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SECTORAL STUDY

Propagation material for ornamentals, vegetables, crops and trees

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10.1. Introduction

Plant propagating material is the basis for cultivation of healthy plants (fruits, vegetables, crops, cut flowers and pot ornamentals) and has a fundamental impact upon the productivity, diversity, quality and security of agricultural output. It is an important aspect of production process that requires extra care not only to ensure the quality and safety of the products but also the health and welfare of the workers and the safety of the environment.

According to the FAO, agricultural production globally will have to almost double by 2050 in order to meet rising global demand for food and feed; most of the increased output will have to come from higher crop yields. So, propagating material of continually improved new plant cultivars is the fundamental input to all agricultural and horticultural production and the key factor to address this challenge successfully.

In Greece the annual turnover of companies that trade seeds is near 170 million Euros (the global annual turn over is more than 5,300 million Dollars) and those of trading planting material (plugs, cuttings, grafts etc) is about 70 million Euros, that is a total of about 240 million Euros with increasing trend. Greece is mainly an importer of propagating material (Anex 2), with annual seed imports of about 90 million Dollars, while its exports are less than 20 million Dollars. There are no exact data concerning the vegetative (clonal) propagating material in Greece and internationally (Emmanouilides, 2013). The main competitor countries of Greece in propagating material are Holland, Germany, Italy, Belgium and Hungary (Anex 2, Table 3).

In the Greek propagating material sector are involved public bodies and private companies. The public bodies are the Ministry of Rural Development and Food with its various sectors involved in the business licensing and quality control of the product. The private companies include producers and trading companies of propagating material and related farm supplies (fertilizers, pesticides, pots, growth substrates, etc), as well as greenhouse, warehouse, growth rooms (etc) and machinery constructors or traders. International organizations involved in propagating material include the “International Seed Testing Association” (I.S.T.A.) and the “International Union for the Protection of New Varieties of Plants” (U.P.O.V. from the French initials).

In Greece in 2013 there were more than 4,000 companies producing or trading propagating material, i.e., 123 seed companies, 841 nurseries for fruit trees and vine, 1.536 nurseries for vegetables, ornamentals and other, and 8 micropropagation (tissue culture) laboratories. From those 187 were wholesalers and 2,115 retailers (a number of the above companies hold more than one type of licence, see below). These companies employed 35,00040,000 employees out of which more than 12,000 were Agronomists (Emmanouilides, 2013). These data concerning employees conflict with a labor force survey conducted by the Greek Statistical Service during the first quarter 2015 (see 10.1.1. below). To a big extend this is due to the fact that a large number of employees work illegally (uninsured). According to the Greek Ministry of Rural Development and Food (personal communication) the number of companies having some type of license for propagating material production and trade has not altered significantly in the last years.

10.1.1. Employment data of labor force in plant propagation

Based on processed data regarding employment in plant propagation, derived from the labor force survey which was conducted by the Greek

Statistical Service during the first quarter 2015: - Total number of employees working in plant propagation was 3,164. It should be pointed out though that this number refers to the employees that work legally in the enterprises, while there is a large number of employees that work without insurance.

- Regarding the pattern of employment, most of the employees work as full time and only about 17% have a part time job (Annex 2, Figure 2.1a).
- Most of the employees (about 60%) are self-employed without staff, while the other part state that are either self-employed with staff or salaried or assistant in family business (Annex 2, Figure 2.1b).
- The highest percentage of employees are from 30 to 59 years old, about 15% are 20-29 years old and only 2% are 60-69 years old (Annex 2, Figure 2.1c).
- Regarding the district of their residence, most of the employees live in Attica or Peloponnese, about 20% in Epirus and even less in Crete and Western Greece (Annex 2, Figure 2.1d). - Regarding their education level, the highest percentage of employees has primary or secondary education and less than 20% of the employees have higher education or possess a Msc or PhD diploma (Annex 2, Figure 2.1e), who logically represent the most qualified staff the companies. Most of the employees have attended general education programs, while only about 6% have studied agriculture or veterinary and about 14% social, economic or legal sciences (Annex 2, Figure 2.1f).

10.2. Methodology

The market data presented in this study were collected by a market research, in order to extract representative data concerning current situation, problems of the sector, produced and imported quantities and value of propagating material, as well as to investigate the possible future development. These data were derived from the Ministry of Rural Development and Food and the National Statistic Service of Greece, as well, as from a larger scale research through a questionnaire and personal interviews addressed to the largest propagating material corporations of Greece; a copy of the questionnaire is found at end of the text, in Annex 1. In addition data concerning the local and international market were extracted by bibliographical research. All data collected during this process were cross referenced and processed in order to formulate the final conclusions.

10.3. Current legislation regarding propagating material

Greek National Law on the production and marketing of propagating material (Law 1564/1985) and on the requirements and the procedure of startup businesses that produce propagating material for cultivated plant species or market such product (Ministerial Decree 1153/16620).

1. The propagating material is divided in the following categories
    - Seeds for arable crops
    - Seeds for vegetables and ornamental plants
    - Tubers, bulbs and rhizomes
    - Seedlings for ornamental plants or vegetables, grafted seedlings and grafts
    - Mixes

All of the above mentioned propagating material is also described as:

- Original material: Material
- Prebasic propagation material
- Basic propagation material
- Certified propagation material
- Marketable propagation material

The Ministry of Rural Development and Food issues the National list of cultivated cultivars, which includes all cultivars accepted for cultivation and marketing. Propagating material can be marketed if the business has a License for Marketing Propagating material that is acquired after a request to the pertinent authority of the Ministry. The pertinent authority of the Ministry is responsible for controlling and certifying the propagating material as to:

- Species and cultivars certification
- Quality control of material
- Appropriate packaging
- Appropriate tagging and labeling
- Production inventories and if all is according then the License is issued and the product is marketable. All marketed propagating material is subjected to controls ensuring that all the above criteria are met after the issuing of the License. All of the above criteria are regulated by Ministerial Decree s. 2. Types of businesses involved in propagating material are defined below (see also Annex 2):
- "Seed production business" - produces "STANDARD" seed (1564/1985) for vegetable production, aromatic or medicinal plants. The business can import material that is essential to its production and sell retail or wholesale only their products domestically or internationally.
- "Plant nursery Type A" - produces and sells propagating material of its own production of shrubs, trees, aromatic or medicinal plants, as well as "STANDARD" vine trees, except vegetables, ornamental plants or flowers. The business can import material that is essential to its production and sell retail or wholesale only their products domestically or internationally.
- "Plant nursery Type B" - produces and sells propagating material for arable crops, vegetables, ornamental plants, flowers including aromatic or medicinal plants. The business can import material that is essential to its production and sell retail or wholesale only their products domestically or internationally.
- "Plant nursery Type C" - produces and sells propagating material obtained from tissue culture. The business can import material that is essential to its production and sell retail or wholesale only their products domestically or internationally.
- "Trading business of propagating material Type A"- imports, exports, standardizes and sells wholesale or retail all plant propagating material. This type of business should be registered in the registry for "Trading business of propagating material Type A", in order to be able to import propagating material from third countries.
- "Trading business of propagating material Type B" - sells wholesale or retail all plant propagating material that is acquired by the local producers, or from "Trading business of propagating material Type A".
- "Trading business of propagating material Type C", that standardizes and sells wholesale or retail all plant material, that is acquired by local producers or from "Trading business of propagation material Type A". Standardized products can only be sold domestically.

3. Starting up the business

Interested parties that want to start up businesses in the propagating material field should file a request to the pertinent authority of the Ministry of Rural Development and Food that includes:

- The type of business as described above
- The business headquarters
- The name of the business
- All the factories or laboratories involved in the business
- All the assets involved in the business
- The name of the qualified agriculturist
- The name of the legal representative of the business The request should be accompanied by:
- Payment receipt for fee (1564/1985)
- Documents that certify that all the above mentioned requirements are met
- Document describing any and all mechanical equipment, building infrastructures current or under construction

Within three months after filing the request, the pertinent authority performs an audit to ensure that all the proper requirements are met and if so the business is registered in the Registry for Propagating Material Businesses and receives a certificate.

4. Obligations pertaining to propagating material businesses:

- Apply all regulations specified by Technical Rules for controlling and certifying and marketing
- Respond to any requests from the Ministry for statistical data concerning their yield etc.
- Keep in a visible space the Certification received from the Ministry (Registered Propagating Material Business)
- Maintain in a healthy state the original propagating material and all other produced propagating material
- Communicate to the Authority all changes in physical or legal state of the business
- Replace the qualified agriculturist within 3 months of his departure Other than the above, Plant nurseries type A, B or C should:
- Prioritize the engraftment of suggested cultivars that are selected by the pertinent authority
- Mark the plants with tags that show the subject and graft plant species and the graft date
- Uproot saplings during the appropriate season so as to minimize damage made to the root system and properly dispose of diseased or underdeveloped trees
- Keep inventory of annual production in quantity and annual product placement, buyers name, quantity, type of material
- Issue proper receipts or invoices for buyers that include the address of the business, name of proprietor, name of buyer, quantity and description of product and date
- Submit annually to the pertinent authority for plant health all data involving the plant material that was sold.

10.4. Phytosanitary requirements for plant propagating material

This document describes EU and Greek National regulations on phytosanitary requirements for plants and plant products that include propagating material (native and vegetative). The aim of these regulations is to protect the EU from introduction or spread of harmful pests and diseases, by submitting to health inspections plants and plant products that are placed on the market, or are an object of intra-Community trade, or are imported from third

countries. All producers and importers are required to register in the National registry that is responsible for implementing the inspections and issuing the adequate certificates such as the Plant Passport and the Phytosanitary certificate. Keywords: Council Directive 2000/29/EC, International Plant Protection Convention, Phytosanitary registry, plant passport, phytosanitary certificate.

EU rules on plant health aim to protect crops, fruits, vegetables, flowers, ornamentals and forests from harmful pests and diseases (harmful organisms) by preventing their introduction into the EU or their spread within the EU. This aim helps to:

- contribute to sustainable agricultural and horticultural production through plant health protection;
- contribute to the protection of public and private green spaces, forests and the natural landscape.

The Council Directive 2000/29/EC that is consolidated in the Greek National law (PD 365/FEK 307A/10-12-2002) provides the basis for this aim. The general principles are based upon provisions laid down in the International Plant Protection Convention (IPPC). The IPPC is an international plant health agreement, established in 1952. The EU participates in the IPPC through the European and Mediterranean Plant Protection Organization (EPPO), a member of which is Greece.

Directive 2000/29/EC is supported by further legislation in the form of a number of Control Directives and Emergency Measures.

In order to meet this aim, the EU:

- regulates the introduction of plants and plant products into the EU from countries outside the EU;
- regulates the movement of plants and plant products within the EU;
- imposes eradication and containment measures in case of outbreaks, and cofinances them;
- places obligations on countries outside the EU which want to export plants or plant products to the EU.

Protection against organisms harmful to plants and plant products

The Council Directive 2000/29/EC lays down measures designed to protect Member States against the introduction of organisms harmful to plants and plant products from other Member States or third countries. This Directive also lays down measures

designed to protect Member States against the spread of harmful organisms within the European Union (EU).

The Directive covers living plants and living parts of plants, including seeds. Living parts of plants are:

- fruit and vegetables that have not been deep-frozen,
- tubers, corms, bulbs, rhizomes,
- cut flowers,
- cut trees and branches with foliage,
- leaves,
- live pollen,
- grafts and any other part of a plant.

Plant products are products of plant origin, unprocessed or having undergone simple preparation, other than the items listed above. Wood as such is also covered in some cases.

"Harmful organisms", as defined by the Directive, means pests of plants or of plant products, which belong to the animal or plant kingdoms, or which are pathogens. This definition covers in particular insects and mites, bacteria, fungi, viruses and parasite plants. Annexes I and II of Directive 2000/29/EC list the harmful organisms banned in the EU, either altogether or when they are on certain plants or plant products. Annex III of Directive 2000/29/EC lists plants and plant products that must not be imported from certain countries.

The protective measures also relate to the means by which plants, plant products and other related items are moved (packaging, vehicles, etc.).The protective measures also cover the movement of plants and plant products between the EU and some of its outermost regions, namely the French overseas departments and the Canary Islands.

Placing on the market and intra-Community trade

This Directive requires certain plants and plant products (Annex V (part A) of Directive 2000/29/EC) to undergo a plant-health inspection. This inspection must take place at least once a year at the place of production, at appropriate times, i.e. during the growth period or just after harvesting. It applies to plants and plant products at the production site and their growing environment.

Producers must be listed on an official register (Phytosanitary registry) held by the national body responsible. According to PD 365, the pertinent authority for plant health in Greece is the Plant Health Inspection Service of the Ministry of Rural Development and Food.

Exemptions may be granted for products for the local market if there is no risk of the harmful organism spreading.

When the check gives satisfactory results, the national body responsible issues a plant passport attesting compliance with Community plant-health rules. This passport is usually in the form of a standard label to be affixed to the product, its packaging or sometimes the vehicle in which it is transported. The passport may be replaced in certain circumstances (change of plant health status, division into batches, etc.) and subject to certain conditions.

Where the results of a check are not satisfactory, the plants, plant products and growing media concerned may be subject to various measures, such as appropriate treatment (if this is successful, the passport is then issued), movement under official control, or destruction. The Member States must also notify the Commission and the other Member States of the presence of harmful organisms or the risk of their entering or spreading on their territory.

In addition to plant-health inspection, Member States are to organize occasional checks, whether at the place where plants or plant products are grown, produced, stored, offered for sale or moved, or at the same time as any other documentary check which is carried out for reasons other than plant health.

Imports from third countries

Certain plants, plant products and other objects (listed in Part B, Annex V - Directive 2000/29/EC) entering the EU must have a phytosanitary certificate guaranteeing that they are:

- properly inspected;
- free from quarantine harmful organisms and practically free from other harmful organisms;
- in line with the plant health regulations of the importing country.

The exporting country's national plant protection authorities issue the certificates. Once in the EU, a plant passport may replace the phytosanitary certificate for imported plants, plant products and other objects which are also listed in Part A of Annex V- Directive 2000/29/EC.

The Directive subjects certain plants and plant products from other countries (Part B of Annex V- Directive 2000/29/EC) to a check on entry into EU territory. This involves a documentary check, an identity check and a plant-health check.

The documentary check consists in checking certificates and documents accompanying the consignment or batch, in particular the plant-health certificate. This is issued by the authority responsible in the country of origin or re-export, using models drawn up by the Commission. It has to certify that the products have undergone appropriate and satisfactory inspections.

The identity check involves checking that the consignment tallies with the plants or plant products covered by the certificate.

The plant-health check involves checking, on the basis of a complete examination or an examination of samples, that the plants or plant products show no signs of contamination by harmful organisms and that they meet the specific requirements defined in this Directive.

The Directive provides for less stringent identity and plant-health checks where certain guarantees are provided.

It also provides for exemptions where there is no risk of harmful organisms spreading, in particular in the following cases:

- where plants of plant products are merely in transit from one point in the EU territory to another via a third country or from a point in one non-EU country to a point in another non-EU country via EU territory.
- where small quantities of plants or plant products are not intended for industrial or commercial purposes or are to be consumed during transport are involved;
- where plants or plant products are intended for trials or scientific purposes and for work on varietal selections;
- where plants or plant products are grown, produced or used in the immediate frontier zone between a Member State and a third country.

Importers of certain plants or plant products (Annex V of Directive 2000/29/EC) must be on their Member State's official register (Phytosanitary registry). Just as in the case of intra-Community trade the pertinent authority in Greece is the Plant Health inspection service of the Ministry of Rural Development and Food (PD 365).

If the results of the checks are satisfactory, instead of a phytosanitary certificate a passport and the rules applicable to intra-Community movement apply. If not, one or more of the following measures may be taken: access to EU territory may be refused,

the consignment may be sent back to a destination outside the EU, the contaminated products may be removed from the consignment, destroyed, placed in quarantine pending further tests, or treated appropriately (this last measure is possible only in exceptional cases and under very precise circumstances). The Member State concerned must also inform the Commission and the other Member States of the situation and what measures have been taken.

Protected zones

The Directive establishes, at the request of one or more Member States, special protected zones to guard against certain harmful organisms. Each zone may cover all or part of the territory of a Member State and must be defined in specific geographic terms and in relation to the harmful organisms concerned.

The reason for this protection is the absence of specified harmful organisms in this zone despite conditions favourable to their development.

The additional protection provided in the protected zones includes:

- an additional list of harmful organisms the introduction and spread of which in the protected zones is prohibited;
- an additional list of plants and plant products the introduction of which into the protected zones is prohibited;
- an additional list of specific requirements to be met by certain crops and crop products when they are introduced into or moved within the EU.

Phytosanitary registry

All Producers and importers, or their unions are required to register to the Phytosanitary Registry, in order to be able to obtain the Plant Passport (in case of placing on the market or intra-Community trade) or Phytosanitary Certificate (in case of imports from third countries). Each member of the Registry is required to:

a. Keep a detailed plan of the site where the plants or plant products are cultivated, produced, stored, kept or used,
b. Keep records of transactions that date at least a year back,
c. Designate a representative responsible for interacting with the pertinent authority,
d. Carry out macroscopic inspections depending on instructions by the pertinent authority,
e. Facilitate access of the pertinent authority to carry out inspections,
f. Cooperate in any way with the pertinent authority,
g. Accept additional regulations regarding plant health and
h. Accept indications regarding the improvement of hygienic state of his business.

In Greece, in order to register, all individuals must submit an application at the Directorate of Agricultural Development at the Prefecture, where their corporation is based. The Prefecture performs inquiries as to ensure that the above requirements are met. If all criteria are met then the applicant is registered and receives his registry number.

The production and marketing of propagating material of trees, ornamentals and vegetables in Greece is regulated by 436690-27-12-94Y, a, (GOV. 21 b/17-1-95), which harmonizes the national laws with the Community (92/34 EEC, 93/65 EEC, EEC 9379). Three categories of certified material: (original) pre-basic, basic and certified and CAC (Conformitas Agraria Communitatis–Minimum Community Standards) material, certified material produced in accordance with accepted practices with regard to the preservation of identity and good phytosanitary condition of material, while the CAC material just meets the minimum requirements of the relevant Community Standards.

Production of propagating material may become, in accordance with these standards, by any legal entity. The Ministry is responsible for checking and possibly certification of propagating material for marketing. The checks referred to include inspections of facilities and production conditions (licenses nurseries, field inspections), supplementary or random checks and plant health laboratory and post checks. The competent supervisory authorities are the KEPPYEL, S.E.A.P.Y. in Aspropyrgos and the I.P.K.F. Sindou, while the Ministry also cooperates with the Benaki Phytopathological Institute for plant protection issues.

The production of certified propagating material in Greece has not progressed. Propagating material, for example for citrus, namely citrus fruit', circulating today is exclusively CAC material. It can also be released propagating intra-Community acquisition; however, import of citrus propagating material from third countries is prohibited.

The Ministry, with the competent authorities, seeking to improve the situation through close cooperation with all conservancy and stakeholders such as:

i. Institutions and private actors on the production of certified protocols Paul/technical material and registration of new hybrids and varieties in the national list.

ii. Nursery gardeners about the statement of their mother trees, in order to facilitate the necessary post checks.

iii. Producers about using propagating material from the legally appropriate nurseries and guaranteed by the label bearing, for the chastisement of illegal trade.

10.5. Propagating material for ornamentals

10.5.1. Legislation regarding ornamentals propagating material

Legislation relating to the control, certification and marketing of ornamentals propagating material is governed by the following laws:

- Common Ministerial Decision No 436691/27-12-1994 (FEK 16 B 1995): Technical Regulation of marketing of ornamental plants propagating material, in compliance with Directive 91/682/EC of European Council and Directives 93/49/EC, 93/63/EC and 93/78/EC of European Committee.
- Common Ministerial Decision No 387966/7-12-1999 (FEK 2246 B): Technical Regulation of marketing of ornamental plants propagating material, in compliance with Directive 98/56/EC of European Council.
- Common Ministerial Decision No 378556/4-7-2000 (FEK 931 B): Technical Regulation of marketing of ornamental plants propagating material, in compliance with Committee Directives 1999/66/EC, 1999/67/EC, 1999/68/EC, 1999/69/EC.

10.5.2. Current status of ornamentals propagating material production in Greece

Ornamentals are plants grown for decorative purposes in gardens and landscape design projects (parks, squares, pavements, green roofs, etc), as house plants (foliage and flowering pot plants), or for cut flower and foliage production. Cut flowers are flowers, often with some stem and leaf (roses, chrysanthemums, carnations, gerberas, lilies, e.t.c.) or leafy stems that have been cut from the plant bearing it and used for indoor decorative purposes. The cultivation of ornamental plants (outdoors or in green houses), called floriculture, forms a major branch of horticulture.

Ornamental plants include thousands of species and varieties (belonging in various families), divided into several groups, such as woody ornamentals (trees and shrubs - leafy and conifer types, evergreens and deciduous plants), climbers, bedding

plants (perennials, biennials, annuals), geophytes (bulbous, tuberous etc), grasses, cacti and succulents, aquatic plants.

Ornamental perennials (geraniums, carnations, chrysanthemums, pyrethrums e.t.c.) are herbaceous plants that live for more than two vegetative periods. This is the richest group of ornamental plants in terms of species, and it includes flowering plants, plants with ornamental leaves, and plants with ornamental fruits. Biennials (e.g. lunaria) are flowering ornamental plants which in the first year of growth develop foliage and in the second year produce stems with flowers and fruits, and maturing, they die. The general term "ornamental annuals" is used for ornamental plants that are raised from seeds in the course of a single growing season. Summer annuals germinate during spring or early summer and mature by autumn of the same year (petunias, cosmos, marigold, e.t.c.). Winter annuals germinate during the autumn and mature during the spring or summer of the following calendar year (snapdragons, calendula, delphinium, e.t.c.). Bulb ornamental plants are of the Liliaceae and Amaryllidaceae families and are cultivated in ornamental gardening or for cut flower production (lilies, tulips, narcissus, hyacinths, freesias, e.t.c.).

Before referring to current status concerning ornamentals propagating material in Greece, it is considered useful to cite some data on the ornamentals cultivation area and quantities of product in Greece, derived from the Greek Ministry of Rural Development and Food, which indirectly show the needs of this sector for propagating material. In 2012 (the most recent data found), total area cultivated with ornamentals was 464.21 ha and represented the 12.7% of the total cultivated agricultural land of Greece, while 39.0% of this area was occupied by cut flowers (180.96 ha), 22.4% by pot plants (104.08 ha) and 38.6% by landscape plants (179.17 ha). In terms of cut flowers, in 2012, carnations and roses were cultivated on larger areas (Annex 3, Table 1) and gave greater quantities of product, 68,170.35 and 34,831.22 cut flower stems, respectively followed by Dahlias (25,583) and secondly Chrysanthemums (7,781) and Gerberas (1,219). Other species with remarkable production were Gladiolus (1,064), Tulips (1,180), Lilies (250), Gipsophila (193) and Solidago (5) (Annex 3, Table 2). During the four year period 2009-2012, a significant reduction in the cultivated area by 36% (Annex 3, Table 1) and production of cut flowers by 47% (Annex 3, Table 2) was observed, most probably as a result of the economical crisis. As regards pot plants, cultivation area and production were also limited during this four year period by 55% (Annex 3, Table 3) and 12% (Annex 4, Table 4), respectively. This reduction in the production of pot plants was significantly greater in the case of foliage perennials (-84.4%) compared to flowering perennials (-12.9%) and annuals (-28.0%) (Annex 4, Table 4). Regarding landscape plants, cultivation area and production were limited too by 39% (Annex 3, Table 5) and 61% (Annex 4, Table 6), respectively. In this case, the production of trees was slightly increased (+11.4%) as opposed to shrubs and herbaceous plants whose production was decreased at 60,9% and 91.9%, respectively (Annex 4, Table 6). Total area cultivated with ornamentals in 2012 represented the 12.7% of the total cultivated agricultural land of Greece

Since the beginning of the economical crisis in Greece (2010), the market of ornamental plants shrank dramatically, as shown above, resulting to the destruction of a big portion of small producers, while larger ones are struggled and indebted, being uncertain if they will be able to recover after the crisis. As a result, the production of ornamental propagating material was limited too. The propagating material for ornamental plants varies depending on the species and can be seeds, cuttings (leafy or hardwood), bulbs, tubers, rhizomes. Nowadays, in Greece, there are about 860 producers of ornamentals registered in the ministry register.

Many of the entrepreneurs of pot plant and landscape ornamentals surveyed produce their own propagating material, by mother plants they maintain. This occurs for about 65-80% of the plants they produce, while they import propagating material from EU, at about 10-20%, or third countries, such as Thailand, Sri Lanka, Vietnam, at about 5-15%. Characteristic is the example of one of the largest Greek companies producing ornamental pot plants, which invested in the production of propagating material during the last decade, and nowadays it imports almost 100% of its propagating material. According to the owner of the company this is due to the preference of Greek producers to buy propagating material from abroad despite the fact that the material offered by his company had the same or lower price and equal quality to the imported one, an attitude attributed to a competitive dispossession. Apart to this, the complexity of Greek legislation and the lack of state support towards promoting exports do not facilitate the export potential of the company, opinion expressed by almost all producers. The lack of a strong cooperative is a problem and the fact that a lot of PM is marketed illegally (no taxation, no quality and sanitary certificates) complicates further the situation and represents an unfair competition.

The majority of ornamentals propagating material is marketed by a few wholesalers, who trade cuttings, seedlings and seeds of flowering plants, indoor plants, outdoor plants (shrubs, herbs and crests), as well as of cut flowers. About 90-95% of the total quantity of the above mentioned propagating material is imported from Germany, Netherlands, Belgium and Italy, while the rest of it is of Greek production, produced in many cases in their own nurseries. There is only one exception, the cuttings of Poinsettia, which are produced in Greece, by a single producer, at more than 90%. Each wholesaler may trade about 1-1.5 millions pieces of propagating material. Over the last two years in Greece, the species that are imported in greater proportion, and have therefore the greatest demand in the Greek market, are cyclamens (~400,000 plants), geraniums, petunias, crests and outdoor (landscape) shrubs. The major proportion of the sales concerns cuttings and seedlings of pot plant species, rather than seeds or propagating material of cut flowers, since the demand for propagating material of cut flowers in Greece is decreasing every year, as a result of their decreasing production.

The production capacity of nursery companies ranges from 150,000 to 1,500,000 plantlets annually, for the low and high production potential enterprises, respectively. Sale prices vary from 0.15 € up to 0.30 €, depending on the species. In most cases small plants are cultivated by companies that produced them and they are sold as final product (pot ornamentals).

It is difficult to identify the ornamental species mostly demanded in Greece, because their demand is a seasonal matter. Generally, species presenting stable high demand are: Carnations, Roses, Chrysanthemums, Gerberas, Lilies, Alstroemerias, Gypsophila, Cymbidium, Phalaenopsis, Tulips as far as cut flowers are concerned, *Chrysanthemum, Phalaenopsis*, *Euphorbia pulcherrima* (*Poinsettia*), *Cyclamen persicum*, *Azalea indica*, *Gardenia jasminoides*, *Hydrangea macrophylla*, *Kalanchoe blossfeldiana, Anthurium, Saintpaulia ionantha, Begonia elatior* from flowering pot plants, *aromatic plants –lavender (Lavender stoechas in particular)*, foliage plants and plants for landscaping. In recent years, there is also increasing demand for native plants both in Greece and worldwide.

Regarding global market of ornamentals, in developed countries there has been a balance or a slight decrease in demand of ornamentals resulting in increasing supply, in contrast to developing countries where there is an increase in demand. From our neighboring countries increased demand for ornamentals present Turkey and countries of the Middle East; thus a company with export profile could focus on them.

Most of surveyed enterprises own at least one type of certification (genetic material, phytosanitary, or both certifications) and follow a production protocol, such as ISO or GLOBAL GAP.

Entrepreneurs reported numerous problems that they faced from the start up of their business until nowadays, such as:

- the increased cost of business establishment (facilities and machinery)
- the legal framework concerning the licensing, operation, disposition, exports, taxation etc., is either inadequate or obsolete - the bureaucracy from the State Authorities
- in several cases, the laws are not applied in practice, there is no control and no offender is punished. As a result, there is unfair competition, since there is illegal trading of propagating material without labeling and purchase receipts
- the false philosophy of producers who do not have export-orientation and do not cooperate
- the small shrinking size of Greek market

When entrepreneurs were asked about the dangers facing replied that once a company has modern facilities, appropriate expertise and tested plants production protocols there is no risk in relation to annual yield. On the contrary, the annual demand forecast, the marketing potential, as well as the selling price of propagating material or/ and final product are severe risks.

All entrepreneurs invested a quite big asset for their company (hundreds of thousand Euros), mainly equity, whereas few of them completed part of their total investment making use of subsidized European programs.

On average, annual requirements for labor employment range from 3 to 12 persons in small enterprises and about 50 persons in larger ones. This number of workers may exhibit seasonal variation, since usually in the spring and summer staffing needs are greater. Specialized staff is considered to be absolutely necessary, especially for management of the parent plants and special breeding techniques, such as tissue culture. A worker costs about 9,000 Euros per year, while those with more experience or qualifications cost 15-25% more.

Facilities and machinery are mandatory for the smooth functioning of the nurseries and include greenhouses, irrigation system, mist system, heating, cooling and shading system, planting machines, mixture preparation machines, laboratory facilities, storage areas, offices etc. Larger companies usually have separate Research and Development (R & D) department with its own development plan and budget, while smaller ones also spend part of their profits in experimentation and study on the use of new chemicals, new production protocols or the inclusion of new, often native species in the production chain.

Many of the big surveyed entrepreneurs collaborate with other firms or private/ public bodies, mainly Universities and Institutes. On the other hand, only few entrepreneurs participate in a cooperative, although most of them feel that this action would be useful and are willing to do so aiming at joint action towards the sector's problems. Some of the entrepreneurs though that are already involved in partnerships are skeptical about their effectiveness.

Data regarding the production of ornamentals propagating material in Greece per species, during the two year period 2013-2014, are shown at Annex 3, Table 7. The species in which reproductive material is produced in greater quantity are roses, geraniums and carnations, in decreasing order, followed by quite smaller quantities of *Euphorbia pulcherrima* (*Poinsettia*), *Hydrangea macrophylla*, *Petunia*, *Begonia, Chrysanthemum, Gardenia jasminoides*, *Ibiscus* and *Bougainvillea*. Moreover, *Cyclamen*

persicum, *Azalea indica*, *Pittosporum, Viburnum, Nerium oleander, Ligustrum* and *Viola tricolor* were produced at even smaller, but remarkable quantities.

Data regarding the number of produced ornamentals propagating material in Greece per region, during the two year period 2013-2014, are shown at Annex 3, Table 8. The highest numbers of produced ornamentals are observed in the counties of Serron, Thessalonikis and Pellas, followed by Messinias and Trikalon. Data about the production of ornamentals in the county Attiki one of the most important regions for ornamental production are not included in the processed data provided by the Ministry of Rural Development and Food. Moreover, during this two year period (2013-14), the total production of ornamentals propagating material was increased by 5%.

10.5.3. Current status of ornamentals propagating material imports from 3ed countries

There are also data about the ornamentals propagating material that is imported from third countries (mainly propagating material for indoor plants, annuals and herbaceous plants), but not about community acquisition, since propagating material is distributed freely between Member States. Thus, regarding imports from third countries for trading (Annex 3, Table 9), seeds have been mainly imported from the USA, excepting years 2012 and 2013, when they were imported from Israel. In 2009-2010, cuttings were imported exclusively from Israel, but the following years the imported quantities were diminished having imports from various countries, such as India, Kenya, Ethiopia and Australia. As regards bulbs, these were imported from Israel too.

As regards imports from third countries for nursery enterprises (Annex 3, Table 10), cuttings have been imported from Sri Lanka, Israel, Kenya, Guatemala and El Salvador (at greater quantities), as well as from Thailand, Turkey, FYROM and Australia. Bulbs have been imported from Israel, while tissue culture microplants from Sri Lanka.

The market data concerning propagating material of ornamentals provided by the Ministry are not accurate. Producers do not declare, as required by the law, the exact amount of their production and in the case of potted plants propagation material is often confused with the final product.

10.5.4. Perspectives of the market of ornamentals propagating material production

Although the market of propagating material in Greece has great potential due to the geographical location and the climatic conditions of the country, prospects are small due to poor infrastructure, other problems reported in chapter 10.5.2., and big competition from the international market, where huge corporations (production and trading companies) are leading the markets.

Propagation material for high quality ornamental trees and trees of the Greek flora, in pots, for landscape constructions, could be a good idea for an investment in the sector of ornamentals PM.

Native plants could be a way out too. Several institutions (including Agricultural University of Athens) and private companies, are running research programs concerning the assessment and utilization of native plants, and plenty of them have been included in the horticultural production process, such as *Origanum dictamnus*, *Thymus* spp., *Crithmum maritinum*, *Cistus creticus*, *Lavandula stoechas*, *Origanum majorana*, *Melissa officinalis*, *Origanum vulgare* subsp. *hirtum*, *Satureja thymbra*, *Sideritis* spp., *Salvia fruticosa*, *Limoniastrum monopetalum*, *Atriplex halimus, Scabiosa (Lomelosia) hymettia, Asteriscus maritimus, Artemisia absinthium, Helichrysum italicum, Helichrysum orientale, Phlomis fruticosa* etc. These species can be used as pot plants and landscape plants. Being xerophytes are suggested for urban landscaping, particularly for green roofs in urban areas of arid or semi arid regions of the world with Mediterranean climate. Thus there is a new market that should be explored.

An export-oriented company would have good prospects, if it would identify certain lack in the Global market or get the exclusive rights for the production of certain cultivars.

10.6. Propagating material for vegetables

10.6.1. Legislation regarding vegetables propagating material

Legislation relating to the control, certification and marketing of vegetables propagating material is governed by the following laws:

Vegetables

1. Community Ministerial Decree 436692/27-12-1994 (Official Gazette 22 B): Technical regulation for marketing and vegetables propagating material, other than seed for sowing, in compliance with Directives 92/33 / EEC and 93/61 / EEC of Council and 93/62 / EEC of Commission . (Error Correction with Gazette 81 B / 1995).
2. Ministerial Decree 329587/28-1-2000 (Official Gazette 140 B): Technical Control and Certification Regulations for vegetable seeds for sowing, not included in 345331/199-1989 Ministerial decision « Technical Regulation and Certification Control of vegetable seed for sowing » (B' 759).
3. Community Ministerial Decree 236989/12-5-2003 (Official Gazette 705 B): Technical Regulation for Varieties Acceptance and Inspection and Certification of vegetable seed for sowing
4. Ministerial Decree 258624/20-08-2003 (Official Gazette 1228 B): Technical Regulation setting limits for postcontrol of vegetable varieties.
5. Ministerial Decree 313834/10-10-2005 (Official Gazette 1505 B): Technical Regulation to determine the test characteristics when conducting post control for vegetable species.
6. Community Ministerial Decree 244542/19-4-2006 (Official Gazette 672 B):

Amendment and supplement no. 250744/17-6-2003 (Gazette 861/τ. Β΄/2003), 225020/313-2003 (Gazette 492/τ. Β΄2003), 225021/31-3-2003 (Gazette 478/τ. B' /2003), 236989/12-5-2003 (Gazette 705/τ. Β΄/2003) and 225018/31-3-2003 (Gazette 493/τ. Β΄/2003) joint ministerial decisions, in compliance with Directive 2004/117 / EC of 22 December 2004 (L 14, 18-1-2005, p. 18).

7. Ministerial Decree 259304/04-01-2007 (Official Gazette 11 B): Filling in the no. 258 624 / 08.20.2003 Ministerial Decree 'Technical Regulation setting limits post control vegetable varieties "(Official Gazette 1228 B).
8. Community Ministerial Decree 282101/23-5-2007 (Official Gazette 910 B): Amendment and supplement no. 436 692 / 12.27.1994 decision of the Ministers of National Economy and Agriculture "Technical Regulation marketing of vegetable propagating and planting material, other than seed, in compliance with Directives 92/33 / EEC and 93 / 61 / EEC and 93/62 / EEC "(B 22/1995) and no. 236 989 / 05.12.2003 decision of the Ministers of Finance and Agriculture" Technical Regulation Acceptance Variety and Seed Control and Certification Vegetable for Sowing "(B 705) in compliance with Directive 2006/124 / EC of 5 December 2006 (L 399).
9. Community Ministerial Decree 287620/1762/15-7-2010 (Official Gazette 1140 B): Change in number. 250 744 / 06.17.2003, 225 020 / 03.31.2003, 236 989 / 05.12.2003 and 225 021 / 03.31.2003 decision of the Ministers of Finance and Agriculture, as amended and in force, in compliance with Directive 2009/74 / EC of 26 June 2009 (L.166).

10. Community Ministerial Decree 10797/138249/12-11-2013 (Official Gazette 3061 B): Change in number. 236 989 / 05.12.2003 (V705 / 04.06.2003) and 436 692 / 12.27.1994 (B22 / 17.1.1995) decision, as applicable, in compliance with implementing Directive 2013/45 / EU (L 213/20 / 8-8-2013), as regards the botanical names of tomatoes *Potato*

1. Community Ministerial Decree 313394/17-2-1994 (Official Gazette 130 B): Technical Control Regulation and Certification Classes Community potato tubers for planting in category "Basic" ..

2. Community Ministerial Decree 276357/19-7-2002 (Official Gazette 1020 B): Technical regulation control and certification potato tubers for planting.

3. Community Ministerial Decree 243173/28-1-2005 (Official Gazette 129 B): Examined characteristics and limits for Crops post control.

4. Ministerial Decree 2875/110939/13-10-15 (Official Gazette 2269 B): Modify the no. 276 357 / 29.7-2002 decision of the Ministers of Finance and Agriculture "Technical inspection and certification of potato tubers for planting Regulations" (B / 1020 / 5-82002), thou compliance with Executive Directive 2013/63 / EU (L 341/52, 12.18.2013).

5. Ministerial Decree 2874/110922/13-10-2015 (Official Gazette 2408 B΄): Definition of EU classes of basic and certified seed potatoes and the conditions and characteristics that apply to those classes and minimum conditions and EU Classes regarding pre-basic seed potatoes, in compliance with the implementing Directives 2014/20 / EU (L 38/32, 02.07.2014) and 2014/21 / EE (L 38/39, 7.2.2014) the Commission.

10.6.2. Current status of vegetables production in Greece

Vegetables play a central role in human diet as they are a valuable source of energy, proteins, dietary fibers, essential vitamins and nutrients and they also provide variety to the diet. Therefore, vegetable cultivation and production is of high importance for agricultural economy and human societies.

Vegetable crops comprise a large variety of plant species, including 400 plant species in 225 genera and 70 plant families. Vegetables are cultivated for the consumption of diverse plant organs, such as leaves (e.g. spinach, rocket), young stems (e.g. asparagus), stems with leaves (e.g. lettuce, cabbage), immature flower heads (e.g. cauliflower, broccoli), immature or mature fruits (e.g. tomato, melon, pepper, cucumber, snap beans), tubers (e.g. potato, sweet potato), tap roots (e.g. carrot, radish), swollen buds (e.g. Brussels sprouts), rhizomes (e.g. ginger), bulbs (e.g. onion, garlic), etc.

According to F.A.O. (Food and Agriculture Organization of the United Nations) the worldwide production of vegetables for the year 2011 exceeded 1 billion tons, not including the production of underground storage plant organs consumed as vegetables, such as sweet potato, taro and yam whose production reached 750 million tons, as well as those vegetables produced in small farms or urban gardens for domestic consumption (F.A.O. 2013). Therefore, the total global vegetable production cannot be estimated accurately.

The consumption of vegetables is considered to correlate well with the living standard of a certain society. For example, in China during 1975 and 2003 the annual consumption of vegetables increased from 41 to 141 kg per capita, following a respective increase of the average income, whereas, in African countries the daily vegetable consumption per person is far less the recommended quantity of 200 g day^{-1} (Dias and Ryder, 2011).

In Greece, during the last 50 years a huge increase in consumption of vegetables is observed, which coincided with a respective increase in vegetable production. As a result, the average per capita availability of vegetables in Greece in 2003 was 276 kg

(not including potatoes) and was rated first among all European countries. Accordingly, the per capita consumption of vegetables in Greece during the same year exceeded 1 kg per day. In our country, approximately 20% of the total cost for food is spent for vegetables and fruits (Elmadfa et al., 2009).

In Greece, a total of 3.844.500 tons of vegetables (including potatoes) were produced during 2012. Tomato, with 1,039,700 tons accounts for about 1/3 of the total production of vegetables in Greece, followed by potato (829,400 tons), watermelon (620,000 tons), onion (231,000 tons), pepper (205,900 tons), cucumber (151,800 tons), cabbage (187,900 tons), lettuce, chicory and endive (131,700 tons), etc. Most of the vegetables produced in Greece are consumed in domestic markets, a significant part (25%) are processed and only small quantities are exported (mainly watermelons and melons, followed by asparagus, tomatoes, cucumbers and peppers). Similarly, vegetable imports are limited; however, the value of imported vegetables per weight is substantially higher than the respective value of the exports, showing that Greek vegetables are not highly appreciated by foreign markets.

In general, although vegetable production in Greece accounts for a significant part of Greek agricultural economy, providing decent revenues to farmers and great potential for exports of good quality vegetables at fair prices, the last few years shows signs of recession. However, given the grave financial situation of Greece, the vegetable production sector is still active, although not to the level that it should be, taking into account the climatic advantages of Greece for the production of superior quality early open-field (e.g. watermelons and melons) and out-of-season vegetables.

The last two decades a serious change in the habits of the domestic market for fruits and vegetables is observed, including a large increase in fruits and vegetables retail trade by supermarkets and retail chains and a demand by consumers for year-round products (e.g. tomato, cucumber, lettuce, etc.). Those changes are not favorable for traditional small farmers who cannot cope with the increasing demands of the large retailers. Therefore, since 2006 new multimillion investments in the field of greenhouse vegetable production have taken place and a number of medium-sized greenhouses have been built. It must be stressed though, that in the vegetable production sector in Greece, most farmlands are quite fragmented and the average Greek producer possesses a small ownership and is unorganized, therefore the cost of production is high and selling prices from farmers to traders or retailers are low.

10.6.3. Current status of vegetables propagating material production

Due to the diversity of plant species cultivated as vegetables, there are numerous cultivation and propagation techniques suitable for each species. Both sexual and asexual propagation methods are employed in vegetable crops and in many cases a number of different propagation methods, both sexual and asexual, can be used for the cultivation of a certain species.

Regarding vegetable sexual propagation, the use of high-quality seeds in terms of viability and vigor imparts uniform growth, higher yield and better-quality produce. Also, seeds contribute to highly valued genetic material needed for crop improvement, production, and conservation.

Traditionally, the Greek farmer retained seed from one cultivation to the next, and this method continues today for several vegetable crops or minor economic importance. In this way, several local “varieties” (in reality populations, since they are not pure varieties) are propagated (e.g. cherry tomato variety “Santorini”, snap bean varieties “Barbouni” and “Tsaoulia”, onion variety “Vatikiotiko” and eggplant variety

"Tsakoniki"). As those seeds are not produced under an officially certified seed production program, there are no reliable data for the extent of seed saving, but in the case of peas and beans the quantities are significant.

Until 1960, vegetable seeds were produced in Greece using varieties of the Greek Ministry of Agriculture. From 1970, however, vegetable seed imports began and by the end of that decade nearly all the local varieties had been displaced. The cessation of the state monopoly in 1986 and the opening of the seed market as a result of Greek membership of the European Community, allowed vegetable seed production by private enterprise. However, up to date, the implication of domestic seed production companies in producing vegetable seeds in Greece is limited.

On the basis of a law (1564/26-9-85) introduced in 1985, the Ministry of Agriculture initiated a program to restructure the production and marketing of seed in Greece in accordance with the rules of the European Community. In the same year, the first National Catalogue of Varieties of Cultivated Plants was compiled, the second section of which concerns vegetable cultivars, which are grouped into three categories:

- Group 1: Cultivars produced in Greece for sale within the country and abroad. [For hybrids, the parent lines are registered in Group 3].
- Group 2: Cultivars, the seed of which is produced in Greece, but for sale solely in other countries.
- Group 3: Cultivars that are produced in Greece solely for use as parents in the generation of hybrids.

Each accession to the catalogue is listed together with the names of the breeder and maintainer of the cultivar, as well as the year of accession. In the majority of cases the creator (breeder) of a cultivar is also responsible for its maintenance, but this is not obligatory. In Greece, nearly all domestically produced cultivars have resulted from breeding programs of the national research institutes (mainly NAGREF). Vegetables are almost exclusively varieties, many of which are derived from the selection of local populations. Although some of the cultivars have been released to seed producers for commercial exploitation, the number is small and their impact on the seed market limited.

The total quantity and value of vegetable standard seeds traded in Greece, is about 803 tons and 38 million €, respectively (Annex 4, Table 1). The sources of these seeds are:

- Official, controlled Greek seed production.
- Imports from states within and outside the European Union.
- Seed saving by growers
- Uncontrolled Greek seed production.

The first two sources are officially inspected and controlled whereas the other two sources are not. Vegetable species for which significant quantities of uncertified seed are used within Greece include onion, bean and marrow (principally field grown cultivars), and pepper (mainly for processing) (Passam, 2013).

The trade balance of imports/exports in Greece of seeds for sowing is clearly negative, particularly for vegetables. From the total amount of 74 million $ for the imports of seeds for field and vegetable crops in Greece during 2011, 27 million $ spent for the import of 2,195 tons of vegetable seeds, whereas a total amount of 10 million $ was revenue from seed exports, but only 2 million $ for 110 tons of vegetables (Emmanouilides, 2013). As the value of imports reflects the potential of the seed production in a country, the situation in Greece is frustrating, especially on vegetable seeds, given the abovementioned financial and social importance of the vegetable sector in our country. According to ISF (International Seed Federation, 2012) for 2012, among

12 European countries which are comparable in size to Greece or located at the Balkan Peninsula, Greece is listed last regarding the exports of seeds for sowing, for both field and vegetable crops (Annex 4, Table 2).

The cost of hybrid seed is invariably higher than that of varieties, and this is particularly the case for greenhouse cultivars (Annex 4, Table 3). Hybrid seed offers a number of advantages to the grower, including increased vigor, earliness, higher yield and resistance to specific pests and pathogens. For the seed producer, hybrids bring higher profits and increase the difficulty with which competitors can reproduce the cultivar. Seed prices are influenced not only by the cost of seed production, but also by the cost of the initial breeding program and the cost of maintenance of the parent lines. Prices are particularly high in the case of greenhouse cucumber and tomato hybrids (Passam, 2013).

10.6.4. Domestic vegetable seed production

After the cessation of the state monopoly in 1986, the domestic seed production nearly collapsed, due to the inability of the Greek seed production companies to develop, reproduce and trade new Greek varieties or hybrids. On the other hand, all those companies are, in fact, importers and traders of imported seeds, as in most of the cases it is more profitable and safe to sell imported seeds in Greece, than to produce seeds, especially those of high value, such as hybrid vegetable seeds.

However, the last few years, domestic, officially certified seed production is gradually started to re-operate, despite the difficulties and the strong competition from the non-certified domestic production (which is illegal) and the imported seeds. Due to the advantageous soil and climatic conditions, there is a great potential to produce officially certified seeds of high quality in Greece. However, the cost of production is higher than in other countries of the Mediterranean or the Balkan area, as most farmlands are quite fragmented and the labor costs are higher. In addition, Greek bureaucracy certainly hinders any effort for seed production. As a result, some Greek seed companies have started producing seeds for sowing in neighboring countries (e.g. Bulgaria, Romania); however, they produce seeds primarily for field crops such as grains and animal feed crops (alfalfa, vetch etc.), and to a less extent for horticultural crops.

Greek seeds are available only for a few domestic vegetable varieties traditionally cultivated for a certain reason (e.g. the pepper variety "Stavros" which is mainly cultivated in the western Peloponnese for processing), or having particular quality characteristics (e.g. taste, color, appearance, such as the "Florinis" pepper, the "Thrakiotiko" melon or the "Tsakoniki" eggplant, see Table 4). Although in most of the vegetable crops imported seeds cover the needs of propagating material, in okra all the seeds used for this crop are produced in Greece, due to the preference for varieties which produce small-sized pods, instead of the large-fruiting cultivars cultivated in Asia, Africa and America. As a result, in 2013 the quantity of "standard" okra seeds of the "Pylaias" variety officially certified by the KEPPYEL (Centre for Control and Certification of Propagating Material and Control of Fertilizers) of Thessaloniki and Alexandria reached 19463 kg, whereas for varieties of other vegetable crops do not usually exceed some hundreds of kilos (Annex 4, Table 4).

10.6.5. Trade and production of asexual vegetable propagating material

Although some important vegetable species (e.g. artichoke, garlic, green onions) are mainly or exclusively propagated asexually, "potato seed" (i.e. tubers used for propagation) is the most economically important asexual propagating material for vegetables.

Potato in Greece is cultivated in three distinct periods, during summer (accounts for about 40-45%% of total potato cultivation areas in Greece), spring (35-40%) and autumn (about 20%). At an average, 30,000-35,000 ha are cultivated with potato, producing 750,000-950,000 tons per year. The economic importance of potato crop is high as potato constitutes a basic source of energy and proteins for human diet. Likewise, in Greece the economic importance of potato propagating material ("potato seed") is high, as the annual demand for potato seed is about 78,000 tons. In general, for every ha of potato crop 1.8-2.0 tons of potato seed are required.

Those needs are covered by imports, domestic production of certified propagating material and the use by growers of tubers produced for food from a previous crop, as non-certified propagating material. Greece does not export potato seed.

Imported potato seed covers about the 1/3 of total needs in Greece. It is imported from E.U. countries, mainly from Holland (about 64% of total imports) and secondly from France, Germany and Belgium. During 2010 Greece imported 28,000 tons of certified and 500 tons of basic (foundation) potato seed, with a cost of 14,620,000€ (Emmanouilides, 2013; Olympios, 2015).

Certified potato seed must be free from viruses and other pathogens, therefore it can only be produced at isolated areas, virtually free from pests such as aphids which infect potato tubers and transmit viruses. Therefore, domestic, certified production of potato seed is limited to certain, isolated areas in Greece, such as the island of Naxos (produces about 70% of total potato seed in Greece), the region of Apollonia near Thessaloniki and the Tripolis area and accounts for 5,700 tons, which is less than 8% of the total requirements of Greece for potato seed. For that production, about 300 tons of imported basic potato seed is needed.

Another 2,000 tons of non-certified potato seed (about 2.5% of total needs) are produced by potato growers using imported basic seed, following the methods for the production of certified seed. However, more than 55% of total needs for potato seed are covered by using potato tubers which were produced for food from previous crops and are used by growers as non-certified propagating material (Emmanouilides, 2013). Using this method growers seriously reduce the cost of propagating material; however they take the risk of significantly lower yields, due to the increased possibility of using tubers infected by viruses.

10.6.6. Perspectives of the market of vegetables propagating material production

From the aforementioned it is clear that the production of propagating material for vegetables in Greece is either negligible (especially in the case of hybrid seeds) or is constantly reducing (e.g. potato seed). Domestic seed production, which is not economically important, is encountered only for some crops of minor economic importance (e.g. okra, parsley, dill etc.), or when traditional varieties or populations with special characteristics are grown (e.g. "Santorini" cherry tomato, "Tsakoniki" eggplant, "Stavros" or "Florinis" pepper etc.).

In general, in the vegetable crops sector, it is more profitable and safer for seed companies to import and trade than to produce vegetable seeds in Greece. There is a serious lack of incentive by seed traders and, in addition, small seed producers are unable to enter the highly competitive trade of new varieties and hybrids which are produced by the large multinational seed enterprises. The increasing involvement of genetic engineering coupled to gene patenting; virtually exclude small seed producers from the production and trade of modern vegetable varieties and hybrids (Passam, 2013).

Nevertheless, in Greece there is a need for seed production of landraces, populations or traditional varieties of highly consumed vegetables such as tomato,

pepper, cucumber, eggplant, onion etc., as well as of wild edible leafy vegetables (e.g. stamnagkathi, zochos, dandelion etc.) which are getting increasingly popular. In Greece there are also numerous indigenous plant species, often related to cultivated ones, which provide a source of genes for breeding programs. There are also populations of cultivated crops that can be improved and from which new varieties or hybrids may be derived. There should also be an effort to reduce imports of potato seed, as climatic conditions in some areas in Greece (e.g. Messenia) allow the production of potato seeds early in the spring when there are no populations of aphids and the risk of virus infection is considerably low.

However, seed production demands knowledge of production, processing and marketing which include several requirements, such as operational infrastructure, equipment and services (genetic improvement, maintenance of cultivars, seed multiplication, seed production, storage, packaging, market research and advertising, distribution and trading, quality control at all stages of production and marketing, as well as field inspection, testing and certification of the product by state authorities). Therefore, quality, improvement and consistency are needed; hence only companies or individuals with high degree of earnestness together with the assistance of the necessary state services may result in a viable seed production effort.

The last 20 years there is an increasing demand from growers for vegetable transplants from commercial nurseries, due to an increase of the greenhouse crops in Greece, and to the utilization of grafting in many vegetable species. Although grafting is applied mainly to cucurbits (e.g. more than 90% of the cultivated watermelon plants in Greece are grafted onto tolerant rootstocks), nowadays there is a serious demand for grafted plants of solanaceous vegetables and particularly greenhouse tomato. On the other hand, numerous field vegetable crops use transplanting (e.g. solanaceous vegetables and cucurbits, lettuce, cabbage, cauliflower, broccoli, celery etc.), substantially increasing demands for transplants. As a result, 84,520,000 vegetable seedlings were produced during 2010, (24,750,000 of processed tomato, 17,100,000 of lettuce, 13,000,000 of table tomato, 5,870,000 of pepper, 7,100,000 of cabbage 3,110,000 of watermelon etc.), by commercial nurseries (Emmanouilides, 2013). As growers needs for transplants are constantly increasing, small-sized nurseries cannot cope with the increasing demand and the production of grafted seedlings or of "hardened" transplants with special characteristics (e.g. tolerance to low or high temperatures) at low cost. Therefore, most of the production of vegetable seedlings is done in large nurseries-enterprises, which in many cases form part of a group of companies comprising a seed trading company, a nursery and a company trading agrochemicals or fertilizers. Contrasting with the situation of Greek seed production, vegetable nurseries are constantly growing and are expected to grow further, despite the grave economic state of Greece and the unpromising situation of vegetable production sector in our country due to economic recession.

10.7. Propagating material for crops

10.7.1. Legislation regarding crops propagating material

Satisfactory results in agricultural crops cultivation depend to a large extent on the use of high-quality seeds. For this purpose it is necessary to apply certification schemes which are intended by official control to ensure identity, health and quality of seeds and propagating material.

The Hellenic legislation relevant to the propagating material is harmonized with the corresponding EU legislation.

Definitions

For the purposes of this study the following definitions shall apply:

- Propagating material, in relation to a plant of a particular plant variety

Any part or product from which, whether alone or in combination with other parts or products of that plant, another plant with the same essential characteristics can be produced.

- Plant variety

A plant grouping (including a hybrid)

a) that is contained within a single botanical taxon of the lowest known rank,
b) that can be defined by the expression of the characteristics resulting from the genotype of each individual within that plant grouping,
c) that can be distinguished from any other plant grouping by the expression of at least one of those characteristics,
d) that can be considered as a functional unit, suitable for being propagated unchanged.

- Breeder's seed

The initial source of seed that is usually produced by the breeder. It is the source for the production of pre-basic or basic seed.

- Pre-basic seed

The progeny of the breeder seed that is usually produced under the supervision of a breeder or his designated agency. This generation is commonly used for crops that have low multiplication ratios and where large quantities of certified seed are required.

- Basic seed

The progeny of breeder or pre-basic seed that is usually produced under the supervision of a breeder or his designated agency and under the control of a seed quality control agency.

- Certified seed of the first generation

The progeny of basic seed that is produced on contract with selected seed growers under the supervision of the seed enterprise public or private. Certified seed can be used to produce further generations (second or third) of certified seed or can be planted by farmers for grain production.

- Standard seed

Seed which has sufficient varietal identity and varietal purity, which is intended mainly for the production of vegetables.

- Commercial seed

Seed which is identifiable as belonging to a species (in our case aromatic and pharmaceutical plants).

- Landrace

A set of populations or clones of a plant species which are naturally adapted to the environmental conditions of their region.

" Conservation *in situ*

The conservation of genetic material in its natural surroundings and, in the case of cultivated plant species, in the farmed environment where they have developed their distinctive properties.

Current legislation regarding agricultural plant species propagating material

There are four categories of propagating material; the Original material (or breeder's seed), Pre-Basic, Basic & Certified material.

These processes are subject to scrutiny by law as described in the European COUNCIL DIRECTIVE 66/402/EEC, 66/401/EEC, 2002/54/EC, 2002/57/EC and

2002/56/EC on the trading of cereal, fodder, beet, oil and fiber plant seed and seed potatoes respectively.

Below is a summary and explanation of the laws in effect in Greece, from 164A:09/1985, 153A:071995 and 469B:07/1987 describing regulations for seed production of agricultural crops.

I. Official Regulators & Oversight (Greece)

a) The Central Service of the Ministry of Agriculture, which is responsible for quality control and Eligible status of propagation materials.

b) Regional Services of the Ministry of Agriculture, who also have responsibility for quality issues.

II. Pre-requisites for marketing & purchasing of propagation material

Propagation material, produced in the country, can be marketed only if it has been officially certified as "pre-basic material", "basic material" or "certified material " and should be freely marketable within the country once it has been published in the "National Catalogue of Agricultural Plant Species".

A variety is accepted in the National Catalogue only if it is distinct, stable and sufficiently uniform (DUS criteria). The variety must be of satisfactory value for cultivation and use.

A variety shall be regarded as distinct if, whatever the origin, artificial or natural, of the initial variation from which it has resulted, it is clearly distinguishable on one or more important characteristics from any other variety known in the Community.

A variety shall be regarded as stable if, after successive propagation or multiplications or at the end of each cycle (where the breeder has defined a particular cycle of propagation or multiplications) it remains true to the description of its essential characteristics. A variety shall be regarded as sufficiently uniform if, apart from a very few aberrations, the plants of which it is composed are, account being taken of the distinctive features of the reproductive systems of the plants, similar or genetically identical as regards the characteristics, taken as a whole, which are considered for this purpose.

The value of a variety for cultivation or use shall be regarded as satisfactory if, compared to other varieties accepted in the catalogue, its qualities, taken as a whole, offer, at least as far as production in any given region is concerned, a clear improvement either for cultivation or as regards the uses which can be made of the crops or the derived products. This value is based on yield, resistance to harmful organisms, response to the environment and quality characteristics. Where other, superior characteristics are present, individual inferior characteristics may be disregarded. Examination of the value for cultivation and use shall not be required for the acceptance of varieties (inbred lines, hybrids) which are intended solely as components for hybrid varieties.

In order to carry out the examinations for the acceptance of a variety, a large number of uniform criteria and minimum requirements must be laid down according to the Hellenic legislation 433B:4/2000 and 1531B:6/2014.

Specifically, the DUS assessment criteria and value examination uses the following technical procedures:

A. Cereals. Oat 545B:6/1986, rice 304B:3/1995, durum wheat, maize 346B:2/2000, barley, triticale, common wheat 40B:1/2001, sorghum 498B:4/2001.

B. Fodder plants and legumes. Lucerne 710B:7/1986, clovers 546B:6/1986, vetches 545B:6/1986, lentils and beans 940B:12/1986 are some of the most important species.

C. Beet. Sugar beet 454B:3/2003.

D. Oil and fiber plants. Cotton 454B:3/2003, sunflower 93B:2/1987, soya bean 305B:4/1991.
E. Potatoes. Potato 792B:11/1986.
F. Tobacco. Tobacco 423B:4/1995.
G. Aromatic and medicinal plants. Basil, dill, chamomile, thyme, oregano 2266B:8/2014.
The Hellenic National Catalogue of Agricultural Plant Species contains 548 agricultural plant varieties: i.e. 200 cereals, 76 fodder plants and legumes, 57 sugar beet, 161 oil and fiber plants, 34 tobacco and 20 potato varieties.

Certified seed must fulfill the criteria set out in 469B:8/1987 for field production and seed purity, identity and plant health and specific requirements for the marketing categories.

III. Official sealing, Packaging and Labeling

Seed packages are stamped with the official label or seal by the responsible Official Body (Ministry of Agriculture) or by services under its supervision. The color of the label for seed propagating material shall be a white & purple diagonal line for the prebasic seed, white for basic seed, blue for certified seed of the first generation after basic seed, red for certified seed of subsequent generations after basic seed and brown for commercial seed.

Each delivery of seed propagating material produced in the Hellenic territory should be accompanied by a document from the official service, which shall bear the following indications: plant species, variety, reference number of lot, quantity, germination, country of production and in the case of hybrid varieties: the word 'hybrid'.

IV. Official Controls and Penalties

The genetic identity, phytosanitary condition and quality of the seed propagating material is ensured by official inspections carried out during production and trading of this material. The responsible official bodies shall take all necessary measures for carrying out official controls. If an official inspection of seed propagating material does not meet the requirements for each of the categories of "Pre-basic", "Basic" and "Certified" respectively, will result in the withdrawal of trading authorization and the circulation of such material will be halted.

V. Specific Cases

A. Plant Genetic Resources

The questions of biodiversity and the conservation of plant genetic resources have grown in importance in recent years. In order to ensure *in situ* conservation and the sustainable use of plant genetic resources, landraces and varieties which have been traditionally grown in particular localities and regions and are threatened by genetic erosion, (conservation varieties) should be grown and marketed even where they do not comply with the general requirements as regards the acceptance of varieties and the marketing of seed. In addition to the general aim of protecting plant genetic resources, the particular interest of preserving these varieties lies in the fact that they are apt to be grown under particular climatic, pedological or agro-technical conditions (such as manual care, repeated harvesting).

Landraces and varieties shall be accepted in the common catalogue of Agricultural Plant Species (Hellenic legislation 40A:3/1990, 2038:11/2009, Directive 2008/62/EC). The procedure for official acceptance shall take into account specific quality characteristics and requirements. In particular the results of unofficial tests and knowledge gained from practical experience during cultivation, reproduction and use

and the detailed descriptions of the varieties and their relevant denominations, shall be taken into account and, if sufficient, shall result in exemption from the requirement of official examination. Upon acceptance of such a landrace or variety, it shall be indicated as a conservation variety in the common catalogue.

B. Seeds for Organic Farming

A fundamental principle in organic farming is the use of seeds produced organically. Organic seed (planting material) is seed (planting material) produced by a crop that is planted and raised organically for at least one generation in the case of annual crops, and two generations in the case of biennial and perennial crops. According to EU Regulation 2092/91 for organic farming the organic sector had to close the organic chain using organic propagation material in Europe firstly by December 31, 2000, but it was concluded that there was a general shortage of organic seed for most crops. In order to help farmers and companies to obtain organically produced seed Member states were demanded to establish an online database, where suppliers of seed can register seed and seed potatoes, produced by the organic production method, which they want to put in the market. If there is no seed available of the species which organic farmer wants to grow, or if there is no appropriate variety available, the farmer can ask the inspection body for a derogation to use non-organically produced seed.

10.7.2. Current status of crops propagating material production in Greece

Each year Greece is importing propagation material for arable crops worth of 200 million Euros. Actually, international seed propagation companies cover a great part of the needs while enough of Greek enterprises contribute in the propagation material sector for many major importance crops such as cereals, legumes, rice, cotton, etc. Therefore, it is obvious that there is an adequate space for the further development of this sector as Greece combines many favorable factors in terms of seed-producing activities.

However, there are problems in the establishment and operation of new seed production companies. The illegal seed production becomes much more profitable, unlike the certified seed-production, due to the higher costs arising from inspections, standards and procedures. Another reasonable explanation is that the lack of protection of the certified seed inevitably creates a market distortion.

Actually, the seed production is a perpetual process, responsible, constant, that varies in difficulty depending on the type of propagating material to be produced. The company or the young person, who wants to deal with it professionally, must employ specialized scientist, to ensure the seed production license and establish storage areas. Furthermore, it is essential to have the necessary equipment for harvesting, processing, testing, standardization and storage of the seed. All these require a high initial investment cost which in turn means that there is a high investment risk. The production of propagating material derived from new crops or plant species which are not available from other seed companies could be a way to lower in some extent the high investment risk.

The total cultivated agricultural land in Greece is 3660.27 thousands of hectares (ELSTAT, 2013). Of these, 52.5% of the cultivated area (1920.12 thousands of hectares) is occupied by the arable crops. This high percentage shows the great importance of crops whose cultivated areas (in thousands of acres) are reflected at Annex 5, Table 1. Crops include valuable species both for human consumption and for animal feed. On top of the major crops are three cereal crops, which in order of importance are wheat, rice and corn. Cereals are easier to cultivate with lower production costs and can be used to tackle hunger and rapid growth of population.

Legume crops are grown for the production of grain and plant mass with high content in protein. The fruits (legumes) are used in the diet of human and animals, while plant mass in animal nutrition and for green manure. The most important crops that produce plant mass are alfalfa, clovers and vetch, and the most significant crops that produce fruit are soy, beans, peanuts, peas etc. Mean annual production of legumes is about 33,000-35,000 tons, while consumption is about 90,000-100,000 tons. Beans are the legumes that are cultivated the most in Greece (73% of total greek production of legumes). It is estimated that they are produced annually 20,000-22,000 tons of beans, 2,700- 2,900 tons of chickpeas and 1,000-1,300 tons of lens.

Crops also include very important "industrial plants", such as textile cotton and flax, tobacco, sugar beet, industrial tomato plants as well as oil-giving plants, such as sunflower, rapeseed, sesame, safflower and castor. Their importance lies both in ensuring sufficient income to producers and in their contribution to the development of domestic manufacturing industry.

Greece combines many favorable factors for the development of seed-producing activities. Thousands of isolated islands, fields with physical barriers and a variety of microclimates are essential factors for the development of the propagating material production sector. Nevertheless every year in our country is imported propagating material worth more than 200 million Euros.

In Greece today there are about 120 seed producing companies. Of these 65 are on the seed production mainly of cereals, with seed production of fiber plants approximately 15 and with legumes seed production and protein forage, about 40. Seedling nurseries of the highest productivity, is estimated to be about 60.

The Greek seed producing companies account for almost 100% of the current needs of the country in winter cereals seed sowing (wheat soft-hard, barley, oats, rye, triticale, etc.), approximately 75% of the country's needs in legumes seeds (vetch, alfalfa, lentil, chickpea, pea, beans), about 52% all the country's needs in rice seeds, about 40% of the country's needs in cotton seeds and almost all of the country's needs for tobacco and sugar beet seeds.

With regard to the needs of the country in corn hybrid seeds, sorghum, sunflower and rapeseed are mainly covered by imports (MADF, 2013).

The problem with the certified seed production is that it has higher costs than the common culture. So due to lack of protection of the certified seed a market distortion is created.

Illegal seed production becomes much more lucrative, unlike the certified seed production, which having higher costs, controls, standards, procedures and responsibility becomes sometimes not preferred by the producer. It should also be noted that the competent KEPPYEL (Control and Certification Centres of Propagation Material) have no power to check any trafficker not licensed. But check thoroughly the legitimate, those that have license.

Thus become obvious the reasons why the seed-producing enterprises in the country are reluctant to extend further their investment in certified seed production.

The optimistic side however is that the Ministry of Agricultural Development and Food has recently established a working group for the promotion and protection of certified seed, in an attempt to improve the final quality of the rural products. It is expected that the progress of its work, will produce positive results, as to the consolidation of the seed market.

10.7.2.1. Medicinal and aromatic plants

From the arable crops, medicinal and aromatic plants (MAPs) recently consist an important factor in the rural economy taking into account the added high value of their

products and the increased demand from the international market due to their high qualitative characteristics. Oregano, the most important of MAPs, is cultivated at a small scale, so there is great potential for further development. Furthermore, the MAPs production has an added economic potential in rural community in terms of the "young farmers" involvement in this sector. Particularly, the production of propagating material is an issue of great importance in MAPs sector as there is a great dependency of the Greek producers from the imports of certified propagation material.

Greece is an ideal place for the development of propagation material sector as the MAP flora of our country is internationally one of the richest. Additionally, several MAPs populations have been investigated in recent years and hence promising genotypes have already been selected and preserved on farm by researchers in Greek Universities and research institutes. Taking into account the given existence of MAPs genetic material the engagement of young people give potential opportunities under the assumption that they have to be trained and obtain technical experience in the plant propagation practices. Actually, there are some obvious weaknesses that define this plant propagation sector such as:

- the lack of specialized suppliers in Greece, the reduced demand so far for certified plant material,
- the marketing or importing of Herb propagating material usually served by suppliers of ornamental species
- few propagating materials had been selected by Greek species
- sellers are not interested in the quality of the material that will provide to the producers
- a license from the Ministry of Rural Development and Food is required for the production of propagation material
- varieties of MAPs are not registered so far in the national or in the EU catalogue of varieties of agricultural plant species

The young farmers need to take into consideration that variety rights do not exist and the sales prices vary at an average from 0,15 € up to 0.30 € / plant depending on the species, propagation method and plant size. Additionally, 35.000 plants per ha are needed on average and hence the cost for the growers is approximately 5.250-11.600 €/ha.

According to information derived from the Greek Ministry of Rural Development and Food the following MAPs are considered to possess investment potential for Greek conditions: Aloe (*Aloe vera*), apiganos-rue (*Ruta graveolens* Mill.), rose geranium (*Pelargonium graveolens*), yarrow (*Achillea millefolium*), Valerian (*Valeriana officinalis*), basil (*Ocimum basilicum*), Daphne (*Laurus nobilis*), Rosemary (*Rosmarinus officinalis*), Spearmint (*Mentha viridis*), thymbra (*Satureja thymbra*), Thyme (*Thymus vulgaris*), Lavender (*Lavandula angustifolia*), Verbena (*Verbena officinalis*), Sweet marjoram (*Origanum majorana*), Melissa (*Melissa officinalis*), White Peppermint (*Mentha x piperita officinalis*), Greek Oregano (*Origanum vulgare* spp. *hirtum*), Steeplebush (*Spiraea tomentosa*), Stevia (*Stevia rebaudiana*), Chives (*Allium schoenoprasum*), Ironwort-mountain tea (*Sideritis syriaca*), Sage (*Salvia officinalis*), Dittany of Crete (*Origanum dictamnus*), various aromatics.

Particularly, in 2013 77,990 MAPs were produced generally, either as seedlings or rooted stem cuttings, with missing information for each of the aforementioned species.

In 2014, the number of produced propagation material was significantly increased approaching the number of 598,430 plants. Actually, the number of undefined species was quietly high (473,503), while the recorded produced MAPs (number of seedlings or stem cuttings) per species in reduced rank were the following: basil (*Ocimum basilicum*)

(46,250), aloe (*Aloe vera*) (26,257.), greek oregano (*Origanum vulgare* spp. *hirtum*) (11,502), rosemary (*Rosmarinus officinalis*) (11,498), Thyme (*Thymus vulgaris*) (6,085), Ironwort- mountain tea (*Sideritis syriaca*) (5,000), Stevia (*Stevia rebaudiana*) (2,705), Levander (*Lavandula angustifolia*) (2,379), Sweet marjoram (*Origanum majorana*) (1,852), Sage (*Salvia officinalis*) (1,638), Spearmint (*Mentha viridis*) (1,564), apiganosrue (*Ruta graveolens* Mill.), (1,085) Chives (*Allium schoenoprasum*) (1,000), Verbena (*Verbena officinalis*) (945), Valerian (*Valeriana officinalis*) (843), Thymbra (*Satureja thymbra*) (800), White Peppermint (*Mentha x piperita officinalis*) (800), Rose geranium (*Pelargonium graveolens*) (714), Dittany Of Crete (*Origanum dictamnus*) (575), Melissa (*Melissa officinalis*) (530), Yarrow (*Achillea millefolium*) (500), Daphne (*Laurus nobilis*) (200)

At a regional scale the current situation of the propagation material production in the different propagation centers is presented in annex 5, Table 2.

10.7.3. Structural analysis of the European Union (EU) seed and plant propagating material (PPM) market

In 2012, the value of the EU seed market reached around € 7 billion. The EU market represents 20% of the global market. It ranks n°3 after the United States and China, well ahead of the fourth market (Brazil) (annex 5, Table 3). In an expanding world seeds market (+76%), the EU market grew by +45% between 2005 and 2012.

A group of five Member States (France, Germany, Italy, Spain and the Netherlands) represents two thirds of the EU seed and PRM market, while France is by far the biggest market of the EU. Seed and PPM market of Greece represents only 2% of the EU market; despite its growth by +60% between 2005 and 2010, during the following two years Greek market started to wane (Annex 5, Table 4).

The EU seed and PPM industry is composed of very diverse companies be it in terms of size (turnover, employees), crops portfolio, geographical area covered and activities carried out. They may also be active in one or several stages of the seed industry: plant breeding, seed production, seed conditioning, and seed marketing and distribution.

There is still little information available on the structure of the seed sector in the EU, in particular in terms of the share of micro- or, small and medium-sized enterprises (SMEs) (see Annex 2 for an overview of the criteria used at EU level to define SMEs). Small and medium-sized enterprises still represent a high share of the EU seed sector, while there is a trend towards a reduction in the number of the smaller companies in the total turnover of the sector. Small seed companies are generally active at a more local level.

There are around 7,000 seed companies in the EU, of which 97% are located in ten Member States (Poland, Romania, Hungary, United Kingdom, France, Italy, Germany, Spain, Netherlands, Slovakia). In Poland, Romania and Hungary, more than 90% of seed companies are SMEs. A concentration process is probably taking place in these countries. However, no information is available on their market shares.

Seed companies employ around 50,000 people (80% in those ten Member States). The countries with the highest number of people employed are France, Romania, the Netherlands, Poland, Germany and Italy (in decreasing order). A situation combining a high number of people employed in the sector with a more limited number of seed companies reflects the impacts of a consolidation process.

Seeds Markets remain highly fragmented, by crop and by geographical area, while consolidation levels seem to be lower in the EU than at global level. Other factor limiting competition on the EU seed market is the fact that a single company may own a large number of brands, giving farmers the illusion of having the opportunity to buy from

different companies. Moreover, cross-licensing agreements, in particular for transgenic seed traits have created a network of relationships between seed companies. The number of agreements between companies makes the mapping of the sector extremely difficult.

10.7.4. Perspectives of the market of crops propagating material production

For a young person who wishes to be a producer of propagating material for crops, it is preferable to deal with new or alternative crops, local varieties (landraces) propagation material for organic farming and aromatic, medicinal, culinary and melliferous plants, plants, seed production of which is not already covered by existing seed companies.

From the crops strong growth potential shows the sector of Aromatic and Medicinal Plants. The cultivated areas are still small and thus Aromatic and Medicinal Plants can be a good alternative which will not only contribute to the creation of additional income and will become one of the dynamic rural industries. The potential growth of the sector of Aromatic and Medicinal Plants in Greece, in the food industry and in pharmaceutical and perfumery (in the manufacture of essential oils), is great on the condition of proper planning and comprehensive approach to the issue.

The aforementioned information indicate the deficiency of certified propagation material with the majority of nursery entrepreneurs to produce undefined MAPs with result the lower quality of the final products particularly when the productive direction concerns the production of high added value products such as the essential oils. Thus, the high production MAPs farmers in order to ensure the high standards of the markets' demands purchase their propagating material from certified Institutes or private companies from other countries while, in many cases this propagating material is originated from Greek endemic species. According to the data derived from the Medicinal and Aromatic Union there are just seven registered members who can produce propagating material. Additionally, six companies appear to produce propagation material and only one producer is certified for biological production a sector that has a great potential according to the market demand.

Actually, one of the important issues which create serious obstacles is the absence of registered MAPs varieties in the National Greek Catalog of Varieties. However, the rising trend for the MAPs cultivation in Greece in combination to the increased demand from the worldwide market for certain Greek high quality end-products create prospects for the propagation material sector taking into account the framework, certified genetic material, phytosanitary and trading codes.

We have to take into consideration that a lot of MAP's species are hardly propagate by seed (difficulties in seeding, heterogeneous germination), which leads many producers to propagate MAPs following different techniques, such as cuttings or multiplication by rhizomes (mint). A further inconvenience is that there are no rooting hormone formulations in the market specialized on the MAP's, thus the producers use formulations used for ornamentals plant propagation.

The method of micropropagation even though the high cost for equipment may provide several advantages such as:

a) *in vitro*-derived plants which may be utilized to establish certified "maternal propagation crops" for future use as "source of propagation material",

b) the innovation of a tissue culture laboratory offers the advantages of independence of extended MAPs crops establishment for propagation material,

c) *In vitro* cultures of selected native MAP's clones kept in special nutrient media

and regularly renewed by subculturing or re-installation.

As a result the conservation of certified plant material is provided and the reproductive capacity with a great amount of plants in short time is ensured.

10.7.5. The EU seed and PRM market in a global perspective

The global seed market has been expanding: it has increased by around 2.5 times since 1985. According to the International Seed Federation, the value of the global seed market in 2012 reached around $ 44.9 billion, i.e. € 35 billion (revenues from commercial seed sales; Annex 5, Table 2).

The global seed market is pulled by genetically modified (GM) field crops, which have grown by 22% over the last five years (Annex 5, Figure 1). Since 1996, when commercial GM crops have been grown, the share of GM seeds in the global seeds market has been increasing. Not only GM crops represent an increasing share of acreages in the world, but also GM seeds are generally sold at a higher price than conventional seeds. In 2012 the global GM seed market reached around $ 14.8 billion (€ 11.5 billion), and GM seeds represented one third of the value of the world seed market (from 23% in 2005).

Unlike seed markets in the rest of the world, the EU market has remained a conventional one. As GM cultivation remains marginal in the EU, the GM segment for seed companies on the EU market remains extremely limited. Several EU major seed companies, which do not sell GM seeds in the EU, are increasingly involved in the GM business in third countries producing entirely conventional seed in the EU.

According to industry analysis, the global seed market will continue its growth to over $60 billion in 2020, due to improved seed quality, hybridization and further penetration of GM crops in the world.

It is generally believed that the tendency towards more consolidation in the global seed industry will continue.

The level of investment required, the quality of genetic resources and breeding experience needed represent some of the high barriers to entry in the seed market for new companies.

10.8. Propagating material for fruit-trees

10.8.1. Legislation regarding fruit-trees propagating material

Fruitful propagating materials are seeds, parts of plants and all plant material, including rootstocks, intended for the propagation and production of fruit plants. There are four categories of propagating material; the Original material, Pre-Basic, Basic & Certified material.

- *Original material:*

Material produced by the original creator or species moderator of the plant(s).

- *Pre-basic material:*

Propagating material which has been produced according to generally accepted methods with a view of maintaining the identity of the variety, including the relevant characteristics crucial to identification.

- *Basic material:*

Propagating material which has been vegetatively (asexualy) produced either directly or in a known number of stages from pre-basic material, according to generally accepted methods, with a view to maintaining the identity of the variety. " *Certified material:*

Propagating material and fruit plants which have been vegetatively produced either directly or in a known number of stages from basic material and which, following an

official inspection, have been recognized as satisfying all above-mentioned conditions. "
CAC material (Conformitas Agraria Communitatis):
Plant material graded by standards implemented and recognized internationally, concerning:

- The authenticity of the variety.
- The pathogen-free state of the produced plant from quarantine organisms (diseases or pests).
- The shoot's and root's system growth, reaching an acceptable quality level. - The shoot should consist of plenty living buds, macroscopically clean, without suspicious tans and slits which would conceal the existence of pathogens.
- The root system should be active and macroscopically free from suspicious protuberances concealing the existence of nematodes or soil diseases.

These processes are subject to scrutiny by law as described in the European COUNCIL DIRECTIVE 92/34/EEC of 28 April 1992 on the trading of fruit plant propagating material and fruit plants intended for fruit production.
Below is a summary and explanation of the laws in effect in Greece, from 1952:09/2008 describing regulation for fruit bearing plant propagation.

A. Official Regulators & Oversight (Greece)

i. The Central Service of the Greek Ministry of Rural Development and Food, which is responsible for quality control and Eligible status of propagation materials.

ii. Regional Services of the Greek Ministry of Rural Development and Food, who also have responsibility for quality issues.

B. Pre-requisites for marketing & purchasing of propagation material

Fruit trees propagation material, which is superior of CAC category, produced in the country, can be marketed only if it has been officially certified as "pre-basic material", "basic material" or "certified material", while must also meet one of the following conditions:

a) Be registered in the "National Catalogue of varieties or clone varieties and rootstocks of fruit trees, shrubs and other small fruitful plants".

b) Having legally protected rights as a plant variety in accordance with institutions concerning the protection of new varieties / clones. c) Be commonly / widely recognized and known.

d) Be registered on a list kept by suppliers with its name and a detailed description.

" Exclusion Criteria, applied to all classes of propagation material:

- The presence of harmful organisms to plant health, specified for each plant species, provided by the Government Gazette: FEK 307 / A / 10.2.2002.
- The presence of harmful organisms, which reduce the quality of the propagating material are tolerated only at the lowest possible level.

Propagating material and fruit plants, presenting clear signs or symptoms ascribable to harmful pathogens for which there are no effective treatments, are eliminated.

C. Official sealing, Packaging, & Labeling:

Fruit plant propagating material packages are stamped with the official label or seal by the responsible Official Body (Greek Ministry of Rural Development and Food) or by services under its supervision. The color of the label for fruit plant propagating material must display a white & purple diagonal line for the "pre-basic material", white for "basic material" and blue for "certified material".

Each delivery of fruit plant propagating material produced in the Hellenic territory should be accompanied by a document from the official service, which shall bear the following indications: plant species, variety, clone, rootstock, type of propagation

material, quantity, sender and recipient. The recipient of this material must maintain official labels and the above document for at least four years concerning the "pre-basic" and "basic" material and one year for "certified" material. D. Official Controls and Penalties:

The genetic identity and phytosanitary condition of the fruit plant propagating material is ensured by official inspections carried out during production and trading of this material. The responsible official bodies shall take all necessary measures for carrying out official controls. Specifically:

a. The authorized representatives of nursery companies are obliged to submit to the responsible official department, a phytosanitary certification of their fruit plant propagating material.

b. Holders of their enterprise's license operation, shall mark with tags their cultivars in order to produce fruit plant propagating material.

If an official inspection of propagating material does not meet the requirements for each of the categories of "Pre-basic", "Basic" and "Certified" respectively, will result in the withdrawal of trading authorization and the circulation of such material will be halted (By LAW: GR PC: 1564/1985 (A'/ 164), as amended by l. 2040/1992 (A' /70) and 2325/1995 (A' / 153).

E. Quality Control and requirements for propagation material

In general, the following information applies for all 5 categories of plant trees in Annex 6, Table 1:

- Official annual macroscopic controls are conducted in all crop plants, at the appropriate vegetative stage, and any suspicious plants are laboratory tested. Infected plants must be destroyed. The failure rate of stock nurseries, attributable to other pests (except for viruses and viroids), must not exceed 5%. If the failure can be attributed to other reasons beyond plant phytosanitary factors, then those reasons shall be recorded in the files kept by the holder of the stock nursery.
- Varieties are grafted at least at basic category certification rootstocks or at seedling rootstocks derived from a basic cultivar. The plants are planted at appropriate distances, so there is no contact among them.
- As far as nurseries are concerned, compliance with these requirements is ensured by carrying out official annual macroscopic controls, accompanied if necessary by additional laboratory tests, depending on the type of plant material.

Specifically:

Stock nurseries destined for the production of certified propagating material must obey the following conditions:

A. Malus sp. Mill, Pyrus sp. L. and Cydonia oblonga Mill.

– Must be free from the phytosanitary pathogens presented in Table 6.1., according to periodical official controls, which are based on phytosanitary tests carried out on representative samples, received under a formal procedure:

- Every 3 years for Apple proliferation phytoplasma (APPh) and Pear decline, to every 5, for the rest of the pathogens, which appear to stock nurseries from the third year.

– To be settled in soil, where a similar cultivar has not been planted for at least the past 5 years; additionally, they must be located at least 20 meters away from any orchard or plantation of a lower certification category. B. Prunus spp

– Must be free from the phytosanitary pathogens presented in Table 6.1., according to periodical official controls, which are based on phytosanitary tests carried out on representative samples, received under a formal procedure:

- The 100% of maternal trees destined for seed production, is being tested in annual basis for Prunus necrotic ring spot virus (PNRSV) and Prune dwarf virus (PDV),
- The 10% of maternal trees is being tested every three years for Plum pox virus (PPV), and
- The 10% of maternal trees is being tested every five years for other kind of pests.

The control tests at stock nurseries start at age 3 of plant material.

– Plants should be settled in soil, where a similar cultivar has not been planted for at least the past 5 years; additionally, they must be located at least 100 meters away from any orchard or plantation of a lower certification category.

– Mandatory sample laboratory tests are carried out not only to check the presence of the PPV virus, but are also carried out to fruit trees for the production of which, seedlings have been used, in order to check the presence of Plum pox virus (PPV), PNRSV and PDV viruses.

C. Citrus L, Poncirus Raf., Fortunella Swingle and their hybrids

– Must be free from the phytosanitary pathogens presented in Table 6.1., according to periodical official controls, which are based on phytosanitary tests carried out on representative samples, received under a formal procedure:
- The 100% of maternal trees destined for seed production, is being tested in annual basis for Citrus tristeza virus (CTV),
- The 10% of maternal trees is being tested every three years for Citrus exocortis viroid (CEVd) and Hop stunt viroid (HSVd), tests that begin one year after the establishment of stock nursery, and
- Every five years for other kind of pests, beginning from age 3 at plant material of stock nurseries.

– Plants should be settled in soil, where a similar cultivar has not been planted for at least the past 5 years; additionally, they must be located at least 200 meters away from any orchard or plantation of a lower certification category, if the stock nursery plants are not established under an insect exclusion net house.

- Mandatory sample laboratory tests are conducted to check the presence of the CTV.

D. Olea europaea L and hybrids

- Must be free from the phytosanitary pathogens presented in Table 6.1., according to periodical official controls, which are based on phytosanitary tests carried out on representative samples, received under a formal procedure:

" 10% of maternal trees is being tested every five years, starting from the fifth year of the stock nursery plants.

– Plants should be settled in soil, where a similar cultivar has not been planted for at least the past 5 years; additionally they must be located at least 20 meters away from any plantation of a lower certification category or of common cultivar.

E. Juglans regia L., Castanea sativa Mill. and their hybrids

- Must be free from the phytosanitary pathogens presented in Table 6.1., according to periodical official controls, which are based on phytosanitary tests carried out on representative samples, received under a formal procedure:

" 10% of maternal trees are being tested every five years, starting from the fifth year of the stock nursery plants.

– Plants should be settled in soil, where a similar cultivar has not been planted for at least the past 5 years; additionally they must be located at least 10 meters away from any plantation of a lower certification category.

– Mandatory sample laboratory tests are conducted to check the presence of Cherry leaf roll (CLRV) and the fungus Cryphonectria parasitica, for walnut and chestnut trees, respectively.

10.8.2. Current situation of fruit-trees propagating material production in Greece

The importance of fruit tree crops in our country is significant according to the statistics of the Ministry of Agriculture & Food, comprising 27% of total arable land.

Greece hosts a significant variety of horticultural plants. However, an increased demand is observed in olive, citrus, pome (pear, apple and quince trees) and stone trees (a lot of peach trees, cherry, apricot, plum trees and some sour cherry trees), a few nut trees (especially almond and walnut trees, some chestnut trees and a few hazel and pecan trees). There is also a considerable demand in kiwi, fig trees, pomegranate and lotus, as well as in fruiting bushes, like blueberry, chokeberry, sea-buckthorn and goji berry.

The quality of the end-products reflects the proper implementation of a series of production processes, which is evaluated positively or negatively by consumers, each time they choose which fruit to buy. The ultimate goal of the agro-food sector is to achieve a high quality product, meeting customers' expectations. Therefore, it is necessary to ensure high-quality propagating material.

There are several ways to produce propagating plant material; by sowing, budding or grafting, by the use of leaf cuttings in mist, by the use of hardwood cuttings directly planted in the field or in a bottom heated cold frame and by *in vitro* propagation. The majority of nursery entrepreneurs produce cuttings, grafts and *in vitro* propagated plants of fruit trees. They purchase their propagating material from their own stock nurseries or from certified Institutes or private companies from other countries. Rootstocks are imported (mainly apple and secondarily stone fruit rootstocks), registered varieties for graft and any other plant material to which the country is deficient (e.g. hazel tree).

The production capacity of nursery companies ranges from 200.000 to 1.200.000 plants annually, for the low and high production potential enterprises respectively, while there is one nursery with an annual production of around 8.000.000 rootstocks (mainly stone fruit rootstocks and kiwi). Sales prices vary from 0,10 € up to 5 €, depending on the morphological characteristics of plant material, while in some cases, for difficult to propagate tree species, prices can rise up to 15-20 € per plant (i.e. patented walnut trees).

Entrepreneurs surveyed mentioned that market prospects of propagating material in our country are almost stable with a slight rising trend, but highlighted that under proper management and appropriate legal framework, market prospects can be much better. There is an increased demand in varieties which are worldwide characterized by high productivity, rather than local varieties. Trading of end-products is made either directly from the nursery companies, or online. High production potential enterprises export a considerable percentage (>60%) of their plant material, in contrast with low production potential enterprises which prefer placing their products in the Hellenic market. All enterprises questioned own at least one certification form (genetic material, phytosanitary, or even both certifications).

Some of the most important obstacles faced by entrepreneurs from the beginning of their business activity until nowadays are the lack of certified initial plant material and the bureaucracy from the State Authorities. Moreover, they express their dissatisfaction concerning the institutional framework, pointing out that it needs direct interventions as far as clone ensuring, certification and varieties identification are concerned.

The annual demand forecast is considered to be one of the most significant risks, as well as the value and the performance stability of plant material.

All entrepreneurs invested a huge asset for their company (hundreds of thousand euros), mainly equity, whereas few of them completed part of their total investment making use of an investment program. On average, requirements for labor employment range from 8 to 12 persons annually and specialized staff is considered to be absolutely necessary. Facilities and machinery are mandatory for the smooth functioning of the nurseries and include greenhouses, irrigation system, mist system, laboratory facilities etc. The infrastructure cost is calculated to some hundreds of thousand euros.
Furthermore, a significant proportion of firms include a Research and Development (R & D) department.

All nurseries owners questioned, collaborate with other firms or private / public bodies, mainly Universities and Institutes. Their answer concerning a possible cooperation with big companies of propagating material was mostly positive, but did not hesitate to comment that it would be profitable for them only if large quantities of propagating material would be purchased. Few are those who participate in a collective body, but most of entrepreneurs feel that this action would be useful and are well prepared to be part of it soon, if given the appropriate opportunity.

At Annex 6, Table 2, there is a detailed report concerning the number of produced trees per species and region, at 2014.

10.8.3. Perspectives of the market of fruit-trees propagating material production

The most important forecast for the next three years is the tendency for wider use of high quality and certified propagating material of fruit trees, given the fact that the majority of material traded in Greek market is CAC type. A lot of nursery entrepreneurs' gradually resort to higher category plant material, especially those who trade Citrus species, in order to protect their business activity from the quarantine pathogen "tristeza virus".

A lot of firms are starting to construct net houses for the safest growth of the maternal plant material. Other nurseries, already buy "basic material" with the view to be certified as laboratories of phytosanitary quality control as well, so that they reach independence regarding the Government Authorities.

As far as fruit species are concerned, peach trees will continue to be planted because of the significant demand at the Hellenic market. There is also an upward trend for almond, walnut and pistachio trees due to favorable climatic conditions, lucrative returns and intense use of nuts in confectionery.

Finally, promising seems to be the planting of more hazel nut trees and new Citrus varieties which will cover a wider range of maturation period.

10.9. Propagating material for vine

The problem of phylloxera in our country appeared at the beginning of last century. In Greece the propagating material of vine begins to get organized in the early 1950s.

The leadership of the Greek Ministry of Rural Development and Food decides a "status" state monopoly in the establishment and cultivation of vine rootstocks nurseries (with parents' vines). Therefore, such plantations are established in many locations of Greece: Kopaida, Lesini Aitoloakarnia, Arta, Chrysoupoli, Komotini, Larissa, Rhodes, Crete etc.

The initial establishment mainly includes the rootstocks R110 and 41B.

Small producers and nurseries are supplied by the production of these initial plantations and they take the necessary raw material, which vine growers need. By this way the Greek government controls production of propagating material and ensures

good quality of this material of the nurseries, while the price policy, which is applied by the state, enhances the nurseries entrepreneurs, substantially, and promotes the development of the sector.

This process allows the development of several nurseries, which covers the needs of vine growers, in replanting vineyards, mostly by rooted rootstocks of R110 and 41B.

Few of these units get involved in the production of rooted grafted plants, while the selection of the appropriate rootstock is getting done macroscopically from the producer. Over the time, the state parent plantations are aging and the renewal takes place gradually, but the basic material is not always certified and free from viruses (phytosanitary status). During the years in some of these state parent plantations, the government either loses the control or provides it to the local authorities.

In 1980s the vineyards of Crete were attacked by phylloxera, fact that leads to the establishment of the first cooperative nursery in Greece and to the establishment of a much more modern process in replanting. The cooperative nursery is not limited in the production of the two rootstocks (R 110 and 41B), but its plantations are expanded to other three rootstocks (1103P, 140R, SO4), whereas the initial propagating material is completely certified.

In the rest of Greece the traditional nursery entrepreneurs had to start up in Crete, leading many of them to overcome the stage of small farms and begin to be a modern business.

The interest of foreign large nursery companies stings by the large quantities of imports, for satisfying the high needs. The ideal soil and climate conditions of Greece for the vine culture has as result the start and activity of the first subsidiary foreign interests nursery in Greece.

Furthermore the keep growing needs for the improvement of the quality of wine products pose the general problem of propagating material in the country.

Under the pressure of the new data which were taken place at the end of 1980s, the Greek Ministry of Rural Development and Food began to examine the model of material production of our country. It attempted to adapt this adjustment with the change of legislation, and with giving the permission for the establishment of private parents' plants nurseries.

It means that many illegal plantations had the opportunity to be legal, if they had the necessary prerequisites and in the same time the establishment of new ones began.

Mean while the government's nurseries maintained, with the political will to be reduced or even abandoned, if it will be a response in the field by private agencies to serve likely the needs of the country.

This study was based on the need of ensure the high quality of propagating material in order to produce high quality vine products. It should also be noted that a questionnaire was distributed to selected nurseries, whose answers are taken into consideration in this study.

10.9.1. Current status of vine propagating material production in Greece

The investments of most of Greek nurseries were financed by mainly equity and a small percentage by support through European programs. It seems there is great need for labor employment and specialized scientific staff, particularly in stock nurseries and in the section of tissue culture. The requirements of the permanent or of seasonal labor employment are considered to be absolutely necessary. The number of the staff is proportional to the capacity of each company. The cost of each worker is 30 € / 8 hours or that determined by the collective labor agreement.

In viticulture practice of the country, the nursery entrepreneurs produce rootstocks nurseries owners cuttings in stock nurseries, (which are not enough for the

demands), grafted cuttings (plants) and vine plants in vitro (for scientific purposes). They purchase their propagating material from their own stock nurseries or from certified institutes and private companies from other countries.

In particular, rootstocks and registered grafted grape varieties are imported which, generally, do not satisfy the conditions required in terms of phytosanitary status. Furthermore rooted grafted plants are imported.

Under these circumstances, most of the entrepreneurs of the country provide the necessary propagating material either of rooted grafted cuttings (plants) or rooted rootstocks. It is noticed, also, the rootstock to be certified (usually is imported) and the graft to be unknown health status and often carries high virological load, thus due this rooted grafted cuttings are classified as category standard.

The production of the nursery companies ranges from 50,000 to 2,500,000 plants annually, in correspondence of the capacity of each company and the total production nationwide is: 7-8,000,000 plants (rooted grafted cuttings). Sales prices vary from 1 € up to 1.20 €. It is noted that annual production of rootstocks (parent plants) may reach 10 million cuttings.

At the questionnaire survey the entrepreneurs have indicated that the market of vine propagating material in Greece shows a slightly upward trend (increasing), with the highest demand areas, located in the Peloponnese, N. Greece and Crete.

An upward trend shows at the exports of vine propagating material of high production capacity and properly organized nursery business (up 50%). The rest entrepreneurs prefer placing their propagating material in the Greek market, either directly or through trader - agronomic shops and cooperative organizations.

The demand in table and wine varieties appears almost the same percentage (50%), with a slight lead in Greek wine varieties, recognizable by the consumer and only if they are clonal selection products and genetically identified.

On the world market the demand is, in several occasions, less than the offering. The production cost is high, but sales prices did not increase due to market distortions and unfair competition.

Greece continues to import vine propagating material, due to institutional deficiencies of framework for production of initial and basic material of Greek vine varieties and due to the non-entirely legal status.

It should be noted that the country can become exporting, in short time, with proper management and appropriate legal framework due to favorable climatic conditions.

Some of the nursery companies own production standards (ISO 9001, CLOBAL GAP) and own at least one certification form of genetic material and phytosanitary (official certification from the relevant departments of the State). However, the majority of them disputes the materiality of these or do not own at least one of them.

Some of the most important obstacles faced by the entrepreneurs from the beginning of their business activity until nowadays are:

- The lack of certified initial plant material, namely to ensure the identity and the plant health (clone ensuring, identification of variety, etc.). At the level of a nursery is addressed through the scientific staff of the company, but at the country level is not yet manageable.
- The bureaucracy by State Authorities and the deficiency of state control in the market of vine propagating material.
- The inadequacy and the no contemporary legislative and institutional framework. It is noted that immediate interventions is needed to legislate an implementing protocol of vine clonal selection and as well as the certification and identification of those Greek varieties or clones of them are considered.

- The trafficking propagating material with Royalties or unlabelled, with no invoices or sales receipt (unfair competition problems)
- The failure of effective response to existing problems of unfair competition.

The annual demand forecast is considered to be one of the most significant risks, as well as the value and the performance stability and quality of plant material. Other risks are related to the management of sales, namely pricing policy and method of payment and lack of healthy competition environment in Greece.

A small percentage of nurseries owners collaborate with other companies or private / public firms, mainly universities and institutes, by challenging at the same time, the results of these partnerships.

Few are those who participate in a collective body, but most entrepreneurs believe that the action would be useful and they have the will and feel ready to participate in a body on a new base. They declared, also, their disappointment for such attempts in the past.

Finally it is noted the reluctance of some nurseries owners to answer specific questions for reasons such as disbelief, disappointment, and probably "semi-clandestine" running of their business, under the current muddled legislative framework which, however, it seems improved in comparison to the past.

10.9.2. Perspectives of the market of vine propagating material production

The production of the nursery companies ranges from 50,000 to 2,500,000 plants annually, in correspondence of the capacity of each company and the total production nationwide is: 7-8,000,000 plants (rooted grafted cuttings). Sales prices vary from 1 € up to 1.20 €. It is noted that annual production of rootstocks (parent plants) may reach 10 million cuttings. The market of vine propagating material in Greece shows a slightly upward trend (increasing), with the highest demand areas, located in the Peloponnese, N. Greece and Crete. An upward trend shows at the exports of vine propagating material of high production capacity and properly organized nursery business (up 50%). The rest entrepreneurs prefer placing their propagating material in the Greek market, either directly or through trader - agronomic shops and cooperative organizations.

Greece continues to import vine propagating material, due to institutional deficiencies of framework for production of initial and basic material of Greek vine varieties and due to the non-entirely legal status. It should be noted that the country, due to favorable climatic conditions, can become exporting, in short time, provided proper management and appropriate legal framework.

10.10. Guideline procedures for setting-up businesses in the propagating material sector

10.10.1. Setting-up businesses in the ornamentals propagating material sector

Due to the diversity of plant species used as ornamentals (broadleaf trees, crests, shrubs, climbers, herbaceous plants, ferns, geophytes) all cultivation and propagation techniques are employed. Seedlings, stem cuttings, bulbs/corms/rhizomes and micropropagated plantlets are the most common propagation material for ornamentals, produced in nurseries, greenhouses and tissue culture units. In section 10.11.6 and 10.11.7 we provide guidelines for setting-up a nursery, a greenhouse and a micropropagation laboratory.

10.10.2. Setting-up businesses in the vegetables propagating material sector

Due to the diversity of plant species cultivated as vegetables, there are numerous cultivation and propagation techniques suitable for each species. Both sexual and asexual propagation methods are employed in vegetable crops and in many cases a

number of different propagation methods, both sexual and asexual, can be used for the cultivation of a certain species. Regarding vegetable sexual propagation, the use of high-quality seeds in terms of viability and vigor imparts uniform growth, higher yield and better-quality produce

Although some important vegetable species (e.g. artichoke, garlic, green onions) are mainly or exclusively propagated asexually, "potato seed" (i.e. tubers used for propagation) is the most economically important asexual propagating material for vegetables.

Certified potato seed must be free from viruses and other pathogens, therefore it can only be produced at isolated areas, virtually free from pests such as aphids which infect potato tubers and transmit viruses. Therefore, domestic, certified production of potato seed is limited to certain, isolated areas in Greece, such as the island of Naxos.

The last 20 years there is an increasing demand from growers for vegetable transplants from commercial nurseries, due to an increase of the greenhouse crops in Greece, and to the utilization of grafting in many vegetable species. Although grafting is applied mainly to cucurbits (e.g. more than 90% of the cultivated watermelon plants in Greece are grafted onto tolerant rootstocks), nowadays there is a serious demand for grafted plants of solanaceous vegetables and particularly greenhouse tomato. On the other hand, numerous field vegetable crops use transplanting (e.g. solanaceous vegetables and cucurbits, lettuce, cabbage, cauliflower, broccoli, celery etc.), substantially increasing demands for transplants.

10.10.3. Setting-up businesses in the crops propagating material sector

The seed production is a perpetual process, responsible, constant that varies in difficulty depending on the type to be produced. The undertaking or a young person who wants to deal with it professionally, must have the specific scientist, seed production license and storage areas. You must have the necessary equipment for harvesting, processing, testing, standardization and storage of the seed.

The mechanical equipment, featuring a seed company, usually includes:

- Drying for seed receipt
- Independent horizontal grain warehouses and silos
- Cotton linter removing machinery
- Seed cleaners
- Gravity separators
- Seed coating and pelleting systems
- Automatic bagging system
- Storage of finished products
- Special storage chamber with controlled conditions (cool room)
- Independent special cleaning line alfalfa seed

An equipped laboratory for audits

- Warm germination test
- Cool germination test
- Accelerated seed aging test
- Measurements of humidity, temperature, specific weight
- Measurements of mechanical damage
- FFA Test for oilseeds
- Tetrazolium test
- Conductivity test

- Identify specific seed purity seed

Methods of MAPs propagation material production

Rooted cuttings Requirements:

- The existence of a mother plantation
- Particular equipment (greenhouse, fog system etc)

Seed propagation

- There is no organized seed production in Greece
- Seed availability is rather low. Most of the seed is available mainly from research institutions
- The rather low quantity of seeds in the Greek market comes only from imports
- Problems:
  - Variability of the produced plants o Low seed germination Micropropagation
- It gives a solution in cases where the original material is limited
- Assured phytosanitary
- Mass propagation in short time
- Demands of expensive equipment and scientific support Organic or conventional?
- Medicinal and Aromatic plants can be easily adapted to organic cultivation
- There is an increased demand abroad
- There is a lack of biological plant material in the Greek market

10.10.4. Setting-up businesses in the trees propagating material sector

A nursery propagating deciduous fruit trees needs large fields, where the rootstocks are planted or sown and grown till they reach the desirable state for budding. The cultivation history of these fields should be properly documented, in order to avoid soil-born pathogens. It is estimated that nearly 100000 plants are grown per hectare (depending on the species), waiting to be grafted. The state of the art in the production of deciduous fruit trees nowadays is the growing of trees in pots, in a controlled (in synthesis), sterilized substrate, under net houses, where the possibility of infection is greatly limited. The propagation of fruit trees in pots (or in nursery bags) is not a new technique, since this is the standard way of propagating evergreen trees as well as pistachio and fig. The infrastructure needed is the one allowing the tree to grow "away" from soil, exploiting all the benefits of a synthetic substrate. Such production scheme requires specific irrigation system, delivering water to each individual pot, where the fertilization can be applied though the irrigation system (fertigation) lowering the cost while increasing fertilizer efficiency.

Rootstocks are usually produced either by seed sowing (especially citrus rootstocks and some stone fruit ones) cuttings (mainly in a mist system, when leafy cuttings are used) (especially olive and fig trees and easy to root stone fruit rootstocks and other species) or through micropropagation (*in vitro* culture) (especially stone fruit rootstocks), where specific infrastructure is required (autoclave, laminar flow cabinet, growth chamber, hardening – acclimatization facilities etc).

In Greece the majority of the stone fruit plants are produced by growing the rootstocks in soil. These rootstocks are either purchased from abroad (mainly produced *in vitro*) or by the local market (*in vitro* produced rootstocks too) and grown in soil. Some nurseries produce their own rootstocks by rooting hardwood cuttings directly in soil.

Nonetheless, growing the rootstocks in soil, increases the danger of infections by soil born pathogens.

Apple trees are mainly produced by budding onto rootstocks purchased from abroad, propagated by stool bed. Pear trees on the other hand, are budded onto rootstocks produced mainly in Greece though hardwood cuttings and less onto rootstocks purchased from abroad. Similar is the situation in walnut and chestnut, where seedling rootstocks are used, onto which either imported buds or local ones are budded.

In the citrus industry seedling rootstocks are used onto which the desirable cultivars are budded. The buds are either from imported material or are already present in the country. The most important though for a citrus nursery is to ensure the phytosanitary status of the trees and to protect them from frost. For these reasons the net-house and/or a greenhouse equipped with pest exclusion net are considered necessary.

Olive is usually propagated by cuttings under a mist system and either used as own-rooted plant or is budded with the desired cultivar.

Most of the cultivars grown in Greece are non patented ones, needing thus the nursery no extra money to propagate them. The new cultivars and rootstocks though, are patented, which means that the nursery has to pay in order to get the rights for propagating and distributing the specific cultivar or rootstock. The prices for the cultivar rights depend on the species and the importance of the cultivar, as well as on the policy of the right holder, which is mainly located abroad.

10.10.5. Setting-up businesses in the vine propagating material sector In Greece the usual ways for vine propagation material are:

- By hardwood cuttings
- By the method of grafting
- By *in vitro* propagation

A modern, complete, original nursery, for healthy and certified propagating material of vine includes: stock nursery of american species and hybrids for the production of rootstocks, the vineyard with the desired grape varieties of *Vitis vinifera*, from where scions are chosen, the nursery buildings (for keeping cuttings from all categories) and the necessary land area for the rooting of cuttings, simple or rooted. The existence of a Research and Development Department (R & D) depends of the capacity of the company. In some cases this need is covered by partnerships with Research Centers and Universities.

The facilities and machinery (grafting machines, handling material machines, tractors and accessories, exports machines, agricultural vehicles, lifts, trucks, etc.) are mandatory for the functioning of such company and in addition to the above the facilities include: warehouses, laboratories, stores, packing centers, offices, etc.

The infrastructure cost is estimated in several hundred of thousands Euros. The majority of Greek nurseries do not have at least one or more of the above sections.

10.10.6. Setting-up a nursery (greenhouse including)

- Location

The geographical location, altitude, landscape, inclination, mechanical and chemical composition of the soil, availability of underground water (with suitable pH and EC), are the basic parameters affecting the location of a plant nursery.

The sun radiation (wave length, intensity and duration), temperature, naturally occurring rainfalls, composition of atmosphere (humidity, air pollutants) and the wind, affect the plant cultivation.

Electric power (necessary for the function of various automation systems) and Road connection in the area are also necessary.

- Land reclamation

The main interventions include forming the landscape, installing the irrigation system, forming the road network and delimitating the land. Landscape formation includes: eradication of trees, suppression of weeds, removing any big rocks, rectification of land inclination and installing enclosure around the property.

- Plant nursery structure

Spaces that compose a plant nursery are as follows:

1. Greenhouse (not necessary for all type of nurseries)

A greenhouse should be constructed of polycarbonate panels or plastic sheets (polyethylene film) with supporting framework made of galvanized pipe. The greenhouse should have concrete floor and equipment such as screening installations, heating, cooling, ventilation, fertigation system, mist or fog unit and may be automatically controlled by a computer.

Mother plants in most cases (this does not happened e.g. for vines, or fruit trees) should be kept in the greenhouse for sanitary matters.

Heating system

The heating system of a greenhouse usually consists of two main components: the heat generator and distributor of heat. The two elements commonly used to distribute heat are water and air. As for generating heat, several options are available, generally determined by the nature of the fuel to be used: natural gas, propane, biomass, fuel oil, biodiesel, etc. *Air heating systems or aerotherms:* There are two main methods for the distribution of hot air: by propeller or with polytubes. The main fuels used for unit heaters are propane, natural gas and biodiesel. The main advantage of the air heating system is its more affordable cost, and its ease of use. Furthermore, the initial setup is fast and heat generation is immediate on demand.

Hot water heating system: This system relies on the use of large boilers in which water is heated before being circulated in the greenhouse through metal pipes that distribute heat by radiation. This system is very effective because it distributes heat at plant level, where it is needed, without heating up all the air of the greenhouse. Hot water systems are therefore more energy efficient than air systems. However, the initial investment for this equipment is more substantial and the start-up will take more time than air systems. The heat is also not instantly available. It is recommended to use hot water systems with computerized climate control systems and extensive proactive climate management.

Cooling or fan and pad system

It is targeted to reducing the average temperature during the hot months. In the fan and pad system, aspen or cellulose pads are mounted in one endwall or sidewall of the greenhouse. They are supplied with water from a pipe above the pads and excess water is collected in a gutter at the bottom. Air drawn through the wet pads by fans mounted in the opposite endwall or sidewall is saturated and cools the greenhouse. The pads are sometimes removed for the winter to allow more light to enter the greenhouse.

Irrigation/fertigation system

It consists of a main control system that channels the water, regulates its pressure and automates the procedure. It could be used for fertilizer supply too. The main control system includes filter, pressure regulator, manometer, water valves, check valves and fertilizer injectors and fertilizer spreader (computerized) in case of fertigation.

Benches for cultivation, seeding and rooting of cuttings

The benches should be made of galvanized steel and heated if necessary with a network of ½ inch pipes that circulate hot water below the benches or alternatively with resistors placed at the bottom of the benches. Heating temperatures should be regulated by a thermostat. Seeds and plant cuttings are placed to root either directly on the cultivation substrate in the benches or in individual containers filled with appropriate substrate or in propagation plugs (organic propagation plugs).

Mist/Fog system

The fog system is placed above the cultivation benches and delivers water in the form of small droplets in order to increase relative humidity and reduce leaf temperature. It consists of a water pump, a pressure container, distribution pipes and emitters. The system can be automated by a time switch that controls the water valve.

Covering the cultivation benches

The benches and the fog system can be covered with transparent PE film that is supported by a metal framework. Inside this space the humidity is maintained at a high level and during the cold months, the loss of heat is minimized.

2. Nursery field

It houses propagation material derived from sexual propagation (seedlings) or vegetative propagation (rooted cuttings) of various methods.

The nursery field should be ideally faced south in order to promote improved temperature and light conditions and should be free of any weeds, especially perennials. The following tasks should be carried out before setting up the plant nursery: a) Deep tilth (40-50 cm).

b) Removing of any roots or foreign materials

c) Ground leveling

d) Irrigation trenching

e) Fertilizing

Cultivation at the nursery includes:

a) Irrigation - A flood or drip irrigation system

b) Digging - Digging aims to incorporate fertilizers, suppress weed growth and retain soil water content c) Fertilizing

d) Suppressing pests and weeds - Treatment with appropriate chemicals after correctly diagnosing the pathogen or the weed species.

In addition the following tasks are intended for tree species: a)

Removal of axillary branches

Removing of any branches that grow sideways at a height of 10-20 cm above ground level from treelings derived from cuttings in order to prepare for grafting. b) Grafting the suitable cultivars or varieties

3. Growing seedlings

A seedling propagation chamber is a specially developed chamber with insulation and a system that regulates humidity and temperature. Seeds are carried there right after seeding and remain there in optimum temperature and humidity conditions and for a certain amount of days depending on the plant species. This is a very critical procedure as a great production cost is the loss of seedlings during the first days after seeding if the conditions are not optimum. The temperature in these chambers is regulated electronically.

Seedbeds are facilities that are exclusively purposed to produce seedlings. After the seedlings have reached a certain size they are moved to their final growing position

if they are meant to be transplanted as they are. Otherwise in case they are meant to be used as mother plants or as rootstock or scion they are transported atn the appropriate facility in the plant nursery.

There are three categories of seedbeds: open field, covered cool and hot bed. Open field seedbeds are purposed for arable crops and tree propagation material. Covered cool seedbeds and hot beds are purposed to produce vegetative or ornamental plants propagation material. Covered cool seed beds are used to produce seedlings that are planted in season, or harden off seedlings that are produced in hot beds, or to produce seedlings during the hot months when the soil and air temperature are suitable for their growth.

In general, state of the art facilities use hot beds. Hot beds are specially designed smaller scale constructions (greenhouse) that are covered by glass or plastic film. This protected space is heated by a source such as warm air, warm water, vapor, sun etc.
Inside the hot beds the seeding takes place in benches or individual containers and the seedlings are grown up to a certain growth stage and following they are transplanted into bigger pots and transferred outside after having been hardened off.
Cultivation in seedbed: a)
Irrigation
Irrigation in the seed beds is either delivered manually, through a watering can or in bigger facilities through an automated irrigation system. Irrigation should be regular but not excessive.
b) Hand weeding It's the most expensive task and requires advanced skills in recognizing seedlings from unwanted weeds. c) Digging
Digging aims to incorporate fertilizers, suppress weed growth and retain soil water content.
d) Thinning
Seedling thinning is a necessary task regardless of the seeding method, when the produced number of seedling is dense. e) Shading
Seedlings should be protected from winds and sun in order to increase seeding success rates.
f) Fertilizing *Seeding facility*
The seeding facility includes a variety of equipment such as substrate mixer, tray sanitizer, automatic seeder, seed covering mechanism and irrigation system that are automated. Automation during seeding reduces significantly the seeding time and the work hours.
Storage
The storage room to is meant to store agricultural supplies such as:
Pressurized plant sprayers, pruning shears, hedgers, chainsaw, digging tools, tillage attachments, rakes, shovels, plant containers, substrate ingredients (peat, compost, perlite), irrigation supplies, fertilizers, pesticides, grafting equipment, planting equipment, support supplies (metal and plastic straps, stakes), plant labels and other materials. *Office space*
The office space is purposed to facilitate the tasks regarding the completion of the production such as: selling, advertising, customer and employee service etc

10.10.7. Setting-up a micropropagation business

Micropropagation or *in vitro* propagation is a rapid multiplication technique that produces a large number of progeny plants, using plant tissue culture methods. It is used

commercially for propagating improved cultivars and rootstocks, disease-free plants, rare species and difficult-to-propagate species.

This technique has certain advantages over traditional methods of propagation, such as:

1. The clonal reproduction of mother plants, namely the production of genetically identical progeny of plants, particularly when meristematic explants are used.
2. Increased production of plants in a short time and in small space.
3. The release of production from external environmental conditions and restrictions.
4. The production of healthy propagating material, especially regarding viruses.
5. For some species, micropropagation may be the only propagation method. The main disadvantages of this technique are the followings:

1. It requires a high cost both in equipment and in operating expenses.
2. It requires high proficiency in knowledge, as well as effective supervision and control of all production stages.
3. The cost of plants derived from *in vitro* culture is often considerably higher than that of the conventional methods.

In vitro propagation of plants can be summarized into the following stages:

Stage 0: Preparation of donor plant
Stage I: Initiation stage
Stage II: Multiplication stage
Stage III: Rooting stage
Stage IV: Acclimatization Stage

Some growers specialize in only the micropropagation of plantlets, leaving the growing-on to others, while others are integrating a tissue culture laboratory into their overall operation. Tissue culture companies are distinguished in a number of internationally recognized categories based on the stages of the production process that they cover. These are:

1. Tissue culture laboratory only, that sells plants in stage II and/ or III, not acclimatized, into culture vessels, to the producers.
2. Laboratory with acclimatization unit/ greenhouse, that sells plants up to stage IV, acclimatized, to the producers
3. Laboratory with big greenhouse, that sells grown plants for final consumption
4. Combinations of 1, 2 and 3
5. Service provider laboratory

Proper planning of laboratory operations and proper design of its physical layout so that meets the scope of planned operations is a major undertaking. A well-planned, organized, and properly equipped laboratory supports research activities by increasing operational efficiency and effectiveness, reducing lost time and wasted resources (Wesselschmidt and Schwartz, 2011).

Facilities (Bridgen and Bartok, 1987)

Careful planning is an important first step when considering the size and location of a laboratory. The minimum area required for media preparation, aseptic transfer area and growth room is about 30 m^2. Walls may have to be installed to separate different areas. Larger labs are frequently built as free-standing buildings. Although more expensive to build, the added isolation form adjacent activities will keep the laboratory cleaner. Prefabricated buildings make convenient low cost laboratories. They are readily available in many sizes in most parts of the country.

General laboratory design

Cleanliness is the major consideration when designing a plant tissue culture laboratory. Considering the high value of the product, no losses from contamination are acceptable. Routine cleaning and aseptic procedures can decrease losses to less than 1%.

Laboratories should have easy to wash walls and floors. High efficiency particulate air (HEPA) filters or regular furnace filters can be installed over air intakes to the laboratory or on furnaces. If possible, an enclosed entrance should precede the laboratory. The cleanest rooms or areas are the growth room and the aseptic transfer area and should be enclosed with doors leading to each. Ideally, the media preparation area would lead to the sterilization area, which would lead to the aseptic transfer room and eventually the growth room. An emergency generator should be available to operate essential equipment during power outages.

Glassware washing and storage area

The glassware washing area should be located near the sterilization and media preparation areas. When culture vessels are removed from the growth area, they are often autoclaved to kill contaminants or to soften semi-solid media. The vessels can be easily moved to the washing area if the autoclave is nearby. Locate the glassware storage area close to the wash area to expedite storage; these areas also need to be accessible to the media preparation area. The glassware area should be equipped with two sinks. Adequate work space is required on both sides of the sink; this space will be used for glassware soaking tubs and drainage trays. Plastic netting can be placed on surfaces near the sink to reduce glassware breakage and enhance water drainage. The pipes leading from the sink can be PVC to resist damage from acids and alkalis. Both hot and cold water should be available with water distillation and deionization devices nearby. Mobile drying racks can be stored nearby and lined with cheesecloth to prevent water dripping and loss of small objects. Locate ovens or hot air cabinets (75 °C) close to the glassware washing and storage area. Dust-proof cabinets, low enough to allow easy access, can be used in the storage area.

Media preparation and sterilization area

The water source and glassware storage area should be convenient to the media preparation area. Benches, suitable for comfortable working while standing (86 to 90 cm) and wide enough (60 cm) to hold equipment listed below are essential. Their tops should be made with molded plastic laminate surfaces that can tolerate frequent cleanings.

There is a variety of equipment available for micropropagation laboratories; this equipment is generally located in the media preparation area. All laboratories need the following basics:

1. Refrigerator/freezer-- This is needed to store chemicals and stock solutions.
2. High quality water-- Water purification is crucial in most research laboratories so that cell and tissue culture processes using water are contamination and chemical free. Distillation and deionization devices should be obtained; these would normally be located in the glassware washing area. Deionized water is needed for last rinsing of glassware, while distilled water is needed for growth medium preparation.
3. Chemicals--Various chemical compounds are required for the preparation of media, such as inorganic salts, carbohydrates, amino acids, vitamins, plant growth regulators etc.
4. Glassware--The glassware, particularly the culture vessels, should be made of Pyrex or borosilicate glass or soda glass, which is cheaper. Wide-neck Erlenmeyer flasks (50-, 125-, 250-ml capacity) are also used as culture vessels. Test tubes, petri dishes,

mason jars, baby food jars, and other glassware can be adapted to tissue culture. Other glassware commonly required in a tissue culture facility includes magenta cap vessels, beakers, volumetric flasks, pipettes, graduated cylinders and disposable plastic containers or bags.

5. Balances--High quality balances are essential for a micropropagation laboratory. A triple beam balance is useful for large amounts over 10 grams, but a balance that can measure down to 2 mg is essential. Most laboratories have both a microbalance and a less sensitive top loading balance; the latter can be used more quickly and efficiently for less sensitive quantities.
6. Hot plate/stirrer--At least one hot plate with an automatic stirrer is needed to make solid/semi-solid media.
7. pH meter--This is needed to measure media pH.
8. Aspirator or vacuum pump--Aspirators can be easily attached to a water source and used for filter sterilization of chemicals (particularly those that are sensitive to autoclaving). They are also used to disinfest plant material. Vacuum pumps are faster and more efficient, but also more expensive.
9. Autoclave-- High pressure heat is needed to sterilize media, water, glassware, and utensils. Certain spores from fungi and bacteria will only be killed at a temperature of 121 °C and 15 psi (1,02 atm).
10. Disinfectants-- Methods designed for the disinfection/decontamination of culture waste, work surfaces and equipment represent important means for minimizing the risk of loses. The major disinfectants fall into the following four groups: hypochlorites, phenolics, alcohol and aldehydes.
11. Optional equipment--A variety of non-essential equipment is available for tissue culture laboratories; individual needs and equipment cost will determine what can be purchased. Microwave ovens are convenient for defrosting frozen stocks and heating agar media. Dissecting microscopes are useful to have in the laboratory for meristeming, dissecting floral and shoot apices, and observing plant culture growth. Labwashers, or regular dishwashers, can be useful. Automatic media dispensers are helpful when pipetting large volumes of media. A rotary shaker or a reciprocal shaker is necessary for suspension cultures.

Culture rooms and/or Cabinets

To cultivate the plant cells, culture rooms and/or cabinet-type incubators are essential facilities. Temperature, relative humidity, lighting units, and shelves need to be considered in the culture room. All of these environmental considerations will vary depending on the size of the growth room, its location, and the type of plants grown within it.

Temperature is the primary concern in culture rooms; it affects decisions on lights, relative humidity, and shelving. Typically, the culture room for growth of plant tissue cultures should have a temperature between 15° and 30° C, with a temperature fluctuation of less than ±0.5°C. It is also recommended that the room have an alarm system to indicate when the temperature has reached preset high or low temperature limits, as well as continuous temperature recorder to monitor temperature fluctuations. The temperature should be constant throughout the entire culture room (i.e., no hot or cold spots).

The culture room should have enough fluorescent lighting to reach the 10,000 lux, despite the fact that 3,000-5,000 lux is generally needed for plant tissue culture; the lighting should be adjustable in terms of quantity and photoperiod duration. Both light and temperature should be programmable for a 24-h period. The plant species being micropropagated will determine the intensity used. The developmental stage of the

plants will also help determine if wide spectrum or cool white fluorescent lights are used. Rooting has been shown to increase with far-red light; therefore, wide spectrum lights should be used during stage III and cool-white lights can be used during Stages I and II. Automatic timers are needed to maintain desired photoperiods. Lights are placed under the shelves to illuminate the cultures of the lower shelf. Reflectors can be placed over bulbs to direct their light. Heat generated by the lights may cause condensation and temperature problems. Air spaces, 5 - 10 cm, between the lights and shelves will decrease bottom heat on upper shelves and condensation in culture vessels.

Shelving within primary growth rooms can vary depending upon the situation and the plants grown. Expanded metal provides good air circulation; wire mesh of 1/4 or 1/2 in. A room that is 2.5 m high will accommodate 5 shelves, each 45 cm apart, when the bottom shelf is 5 cm off the floor. The top and bottom shelves may be difficult to work.

Aseptic transfer area

In addition to the growth room, the aseptic transfer area needs to be as clean as possible. It is preferable to have a separate room for aseptic transfer; this decreases spore circulation and allows personnel to leave shoes outside the room. Special laboratory shoes and coats should be worn in this area. Laminar flow cabinets are placed in this room and used for all aseptic work. Ultraviolet (UV) lights are sometimes installed in laminar flow cabinets and transfer areas to disinfect the room; these lights should only be used when people and plant material are not in the room. Safety switches can be installed to shut off the UV lights when regular room lights are turned on. Surfaces inside the aseptic transfer area should be smooth to minimize the amount of dust that settles. Several electric outlets are to be installed to accommodate various electrical devises (flow cabinets, tool sterilizers, microscopes, bacti-cinerators, balances, etc).

Hardening and acclimatization facilities

Tissue culture-derived plantlets must go through a transition phase from the protected environment of the laboratory to the harsh conditions of the greenhouse or field. Survival of microplants during this transition depends on the species, previous culture conditions, and hardening-off environment. Humidity, temperature, and light are key environmental factors that affect plant survival. High humidity is essential to prevent water loss and desiccation of plant tissue. Temperatures around 28°C and adequate light favor rapid root development and plant establishment. Normally, these conditions are provided within a greenhouse modified for *ex vitro* acclimatization, using fogging or misting systems.

The difference between fogging systems and misting systems is in the size of the droplet they produce. High Pressure Fogging produces a droplet so fine (around 10 microns), which is suspended in the air and evaporate before it falls onto the crop. Misting systems that operate at up to 250 psi, produce a droplet size of 10 to 20 times that of a High Pressure Fogging System (i.e. 100 to 200 micron) and these droplets are too heavy to be suspended in the air. The increased droplet size leads to poor evaporation, reduced greenhouse cooling effectiveness and significant wetness in the greenhouse. The wetness on the foliage can cause increased disease and general wetness can pose a safety risk to greenhouse staff.

10.11. Discussion

10.11.1. Summary consideration of capacity and prospects of propagating material (PM) in agriculture and food sector

Plant propagating material (PM) is the key input for cultivation of plants (fruits, vegetables, crops, cut flowers and pot ornamentals) and has a fundamental impact upon the productivity, diversity, quality and security of agricultural output. It is an important aspect of production process that requires extra care not only to ensure the quality and

safety of the products but also the health and welfare of the workers and the safety of the environment.

According to the FAO, agricultural production globally will have to almost double by 2050 in order to meet rising global demand for food and feed; most of the increased output will have to come from higher crop yields. So, PM of continually improved new plant cultivars is the fundamental input to all agricultural and horticultural production and the key factor to address this challenge successfully.

The performance of plant varieties are constantly improved, with regard to yield, resistance to diseases and pests, resource-use efficiency, and product qualities such as taste, appearance, self-life e.t.c.

The commitment to sustainable agricultural production should be maintained by upholding the two pillars of marketing legislation: variety registration and quality requirements for PM, in order to ensure full traceability of PM and offer sufficient guarantees to farmers in terms of identity, performance, quality and health.

Greece is mainly an importer of PM, holding the 16th place in the list of seed importing countries and the 33rd place in the list of seed exporting countries, 2009 data), with annual seed imports of about 90 million Dollars, while its exports are less than 20 million Dollars, while there are no exact data concerning the vegetative (clonal) PM in Greece and internationally (Emmanouilides, 2013).

Greece combines many favorable factors for the development of PM producing activities. Thousands of isolated islands, fields with physical barriers and a variety of microclimates are essential factors for the development of the PM production sector.

However there is strong competition from big international and Greek companies leading the sector of PM, thus a new farmer should find the appropriate type of PM to produce in order to eliminate this competition. Also he should aim not only the Greek market but to exports. It should be pointed out that PM as a product has to be of high quality and its production is governed by strict rules and legislation.

In sections *10.5.3. (ornamentals), 10.6.6. (vegetables), 10.7.4.(crops), 10.8.3. (fruit-trees)* and *10.9.2. (vine)* are presented in detail perspectives of the market for PM production for each PM sector.

For ornamentals PM, the prospects at the moment are not good; the Greek market is shrinking due to the economic crisis, and the competition from the international market is high, as huge corporations (production and trading companies) are leading the markets. The production of PM of native plants of the Greek/Mediterranean frora, mainly xerophytes, including herbs (aromatic and pharmaceutical species), used as indoor and outdoor pot plants and landscape plants, particularly for gardens and green roofs in urban areas of arid or semi arid regions of the world with Mediterranean climate, is a new sector with prospects in the national and international market. PM for high quality ornamental trees, particularly of the Greek flora, for various landscape uses may also be a good investment.

Concerning vegetables PM, growers' needs for transplants are constantly increasing, and the production of vegetable seedlings is done in large nurseriesenterprises, which in many cases form part of a group of companies comprising a seed trading company, a nursery and a company trading agrochemicals or fertilizers. Domestic seed production is encountered only for some crops of minor economic importance (e.g. okra, parsley, dill etc.), or when traditional varieties or populations with special characteristics are grown (e.g. "Santorini" cherry tomato, "Tsakoniki" eggplant, "Stavros" or "Florinis" pepper etc.). Nevertheless, in Greece there is a need for seed production of landraces, populations or traditional varieties of highly consumed vegetables such as tomato, pepper, cucumber, eggplant, onion etc., as well as of wild edible leafy vegetables (e.g. stamnagkathi, zochos, dandelion etc.) which are getting

increasingly popular. In Greece there are also numerous indigenous plant species, often related to cultivated ones, which provide a source of genes for breeding programs. There are also populations of cultivated crops that can be improved and from which new varieties or hybrids may be derived.

Similarly in crops, seeds are produced and traded by big enterprises often international, thus for a new producer opportunities exist to a significant extent for minor plants (new crops), local varieties, propagation material for organic farming and aromatic, medicinal, culinary and melliferous plants, i.e. sectors for whish there is PM demand and limited interest from big companies in the industry. Strongly suggested is the production of PM for herbs (aromatic and pharmaceutical plants), particularly of certain Greek cultivars, with high potential use not only in the food but in the cosmetics and pharmaceuticals industry.

For fruit-trees PM the most important forecast for the next three years is the tendency for wider use of high quality and certified propagating material, given the fact that the majority of material traded in Greek market is CAC type. A lot of firms are starting to construct net houses for the safest growth of the maternal plant material. Other nurseries, already buy "basic material" with the view to be certified as laboratories of phytosanitary quality control as well, so that they reach independence regarding the Government Authorities. As far as fruit species are concerned, peach trees will continue to be planted because of the significant demand at the Hellenic market. There is also an upward trend for almond, walnut and pistachio trees due to favorable climatic conditions, lucrative returns and intense use of nuts in confectionery. Finally, promising seems to be the planting of more hazel nut trees and new Citrus varieties which will cover a wider range of maturation period.

The market of vine propagating material in Greece shows a slightly upward trend (increasing), with the highest demand areas, located in the Peloponnese, N. Greece and Crete. An upward trend shows at the exports of vine propagating material of high production capacity and properly organized nursery business (up 50%). The rest entrepreneurs prefer placing their propagating material in the Greek market, either directly or through trader - agronomic shops and cooperative organizations.

Greece continues to import vine propagating material, due to institutional deficiencies of framework for production of initial and basic material of Greek vine varieties and due to the non-entirely legal status. It should be noted that the country can become exporting, in short time, with proper management and appropriate legal framework due to favorable climatic conditions.

10.11.2. Accessibility and attractiveness as youth employment opportunity

The sector of PM is attractive for a young farmer. Some experience would help but it is not necessary, as it is obligatory to cooperate with an expert agronomist. Accessibility will not be difficult if a new product, with no competition from big producers, will be selected for production, combined with high quality, adequate quantity and price. Also the capital needed for the investment is not big and one could start a small business and expand.

10.11.3. Consumers habits and growth potential, including export potential

Agriculture has good perspectives in Greece and internationally and PM is the key input for cultivation of plants. Consumers are turning to locally produced products and local varieties. Thus having the right product there will be possibilities for expanding in local markets and exports.

10.11.4. Regional considerations

Units for plant PM production (nurseries, greenhouses, tissue culture laboratories) are not of big environmental impact.

10.11.5. Stakeholder analysis

10.11.5.1. Identification

In the sector of plant propagating materials the following stakeholders may be identified, that constitute:

a. the supply side (primary producers, input providers, equipment providers, wholesalers, retailers, banking, consultants and advisory),
b. the demand (wholesalers, retailers, farmers, consumers, collective organizations)
c. the regulation (agricultural authorities, food safety authorities, environmental authorities, labor, social security etc.)

10.11.5.2. Stakeholder description

In Greece in 2013 there were more than 4,000 companies producing or trading propagating material, i.e., 123 seed companies, 841 nurseries for fruit trees and vine, 1,536 nurseries for vegetables, ornamentals and other, and 8 micropropagation (tissue culture) laboratories. From those 187 were wholesalers and 2,115 retailers. These companies employed 35,000-40,000 employees out of which more than 12,000 were agronomists (Emmanouilides, 2013).

As most of the existing propagating material producers are simultaneously producers of final products (pot plants mainly) and thus they produce propagating material for their own needs, there will not be strong competition for new comers in the sector. Propagating material traders will be competing in case the new producers will sell directly their product to clients; though, according to propagating material producers, the farmers prefer to buy from propagating material trading companies and not directly from propagating material producers. Wholesalers who import about 90-95% of the propagating material they trade (cuttings, seedlings and seeds of flowering plants, indoor plants, outdoor plants (shrubs, herbs and crests), as well as of cut flowers) may find the opportunity to take propagating material from the Hellenic market, provided that new companies produce competitive products which are in demand on the market and at low prices. But there is also the possibility to face young entrepreneurs competitively because in many cases, wholesalers produce propagating material themselves.

Input and equipment providers would be positive to the enlargement of propagating material industry because it would increase their sales in supplies and equipment, and hence their profitability.

Retailers could benefit from the engagement of more people with the propagating material, because it would break the monopoly of wholesalers and it is probable that they could buy directly from the producers at better prices.

Regarding banking, it would be difficult to finance a new investment because of unsteadiness and illiquidity of the banking system.

Consultants and advisory would be positively affected by entrepreneurs interested in propagating material, since the latter may approach them in order to design and implement the setup of the business aiming to its sustainability and profitability.

Farmers require good and healthy propagating material in order to ensure the quality and safety of their products but also the health and welfare of the workers and the safety of the environment and so, they would be greatly benefited by new or renovated enterprises that would provide them with certified propagating material.

Consumers demand quality products, especially when those are intended for human consumption. Propagating material is the basis for cultivation of healthy plants and has a fundamental impact upon the productivity, diversity, quality and security of agricultural output.

Collective organizations can reduce the risk of farmer's bankruptcy and generates competences more difficult to be replicated, ensuring competitive advantages to those involved. It is common sense that collective actions seem to play a key role to establish better trading conditions upstream and downstream of the chain, to facilitate the adaptation of this sector to the dynamic environment, and new standards of competitiveness.

The Ministry of Rural Development and Food with its various sectors is involved in the business licensing, phytosanitary requirements for plant propagating material and quality control of the product.

The Hellenic Food Authority (EFET), founded in 1999, is a Governmental Organization supervised by the Ministry of Agricultural Development and Food. Its principal aim is to take all the necessary actions to ensure that food produced, distributed or marketed in Greece meets the standards of food safety and hygiene as described by the national and European legislation. The Hellenic Food Authority also acts as the national contact point of the European Union for the management of the Rapid Alert System of Food (RASFF) and for the Codex Alimentarius as well as the local point of the European Food Safety Authority (EFSA).

The Greek Environmental Network (GEN) is a member of European Network of Environmental Authorities and Managing Authorities (ENEA-MA). Its objectives is the thinking, training, comparison, sharing of experiences and elaboration of proposals of criteria and methodologies related to environmental aspects of EU Structural Funds actions. It is coordinated by the Special Agency of Coordination of Environmental Projects (SACEP).

Labor will be favored because there will be new jobs, both for workers and for specialized scientific personnel as well.

The Greek social security system is a rather complex model of social protection that is promoted through the application of three different techniques: social insurance for persons within the labour market, social assistance for needy uninsured persons and a national health scheme for all persons living in the Greek territory. As far as its administrative structure is concerned, the social insurance system is regulated and supervised by the Ministry of Labor and Social Insurance, while health care and welfare policies are monitored by the Ministry of Health and Social Assistance.

The influence of the involvement of a new entrepreneur in the sector of plant propagating material in the aforementioned stakeholders can be summarized in Annex 7 Table 1.

10.11.5.3. Impacts on the sector

Greece is mainly an importer of propagating material, with annual seed imports of about 90 million Dollars, while its exports are less than 20 million Dollars, which shows that there is space for further development of the sector.

Many of the entrepreneurs of pot plant and landscape ornamentals surveyed produce their own propagating material (this occurs for about 65-80% of the plants they produce), by mother plants they maintain, and occasionally sell propagating material to other farmers or trading companies too. On the other side, wholesalers import the most quantity of the propagating material they trade, but also produce propagating material themselves.

To cover part of the initial investment of a propagation unit, a new farmer can take advantage of the measure for Young Farmers of the new Programming Period 2014 (15) -2020 of the Common Agricultural Policy (CAP) as well as the National Investment Law. Furthermore, young farmers benefit from Pillar I of the new Programming Period, since they can receive an increase of 25% of their annual subsidies for a maximum of five years from their date of entry and until they reach the age of 40 (up to 25 ha)..

Although the advantages of the participation of a producer in a collective organization are plenty, Greek producers hesitate to do so. Some of the entrepreneurs believe that collective bodies would be useful and feel ready to participate, while others are not willing to cooperate with other enterprises of the sector, probably because they are disappointed for such attempts in the past or because they see each other competitively. As a result, Greek products are difficult to be exported, since the production cost is high and products are not competitive in the market. Greek government, in an attempt to encourage the formation of collective organizations, in the new Programming Period 2014 (15) -2020 of the Common Agricultural Policy, in Pillar II, subsidizes the formation of groups and producer organizations in the agriculture and forestry by the total ammount of 25,000,000 Euro.

Regarding the labor, young people that will occupy in the area of propagating material can offer a lot to the sector, such as new production technology and product marketing, export-orientation and formation of producer groups, as young people are generally more positive to changes and adapt more easily to current market requirements compared to elders.

Most of the questioned entrepreneurs reported various problems relevant to legal framework (licensing, operation, disposition, exports, taxation etc.), bureaucracy from the State Authorities and illegal trading of propagating material without labeling and purchase receipts. The Ministry of Rural Development and Food with its various sectors could intervene and adopt laws harmonized with European law in order to ensure the production of certified material, to reduce bureaucracy facilitating a new entrepreneur to deal with the plant propagating material industry, but also to verify that laws are complied in practice and that offenders are punished.

10.11.6. Synergies with other sectors and sectroral studies The PM sector is directly connected with sectoral studies:
AUA studies:
Study 5: Vegetables: Open-Field and Greenhouse Production
Study 7: Olive Oil and Table Olives Study 9:
Organic Products in Greece AFS Studies:
1. Alternative Fruit Crops for Greece
3. Viticulture, Table and Wine Grape Varieties
6. Medicinal and Aromatic Plants

10.11.7. Implications for agro tourism
Not applicable

10.11.8. Implications for e-commerce
The developments in the communication media emerge new methods of shopping (e-shopping), an opportunity for the young farmers who adopt the new technologies. Such an approach will permit the connection of production and commerce among regions in geographical distance giving new opportunities for the local development and facilities to the young farmers in terms of the productive and business procedure.

10.11.9. Analysis of imports and opportunities for Greek-produced substitutes

Greece is mainly an importer of propagating material, with annual seed imports of about 90 million Dollars, while its exports are less than 20 million Dollars. There are no exact data concerning the vegetative (clonal) propagating material in Greece and internationally (Emmanouilides, 2013). The main competitor countries of Greece in propagating material are Holland, Germany, Italy, Belgium and Hungary (Anex 2, Table 3).

A group of five Member States (France, Germany, Italy, Spain and the Netherlands) represents two thirds of the EU seed and PRM market, while France is by far the biggest market of the EU. Seed and PPM market of Greece represents only 2% of the EU market; despite its growth by +60% between 2005 and 2010, during the following two years Greek market started to wane (Annex 5, Table 4).

There are around 7,000 seed companies in the EU, of which 97% are located in ten Member States (Poland, Romania, Hungary, United Kingdom, France, Italy, Germany, Spain, Netherlands, Slovakia). In Poland, Romania and Hungary, more than 90% of seed companies are SMEs. A concentration process is probably taking place in these countries. However, no information is available on their market shares. Seeds Markets remain highly fragmented, by crop and by geographical area, while consolidation levels seem to be lower in the EU than at global level. Other factor limiting competition on the EU seed market is the fact that a single company may own a large number of brands, giving farmers the illusion of having the opportunity to buy from different companies. Moreover, cross-licensing agreements, in particular for transgenic seed traits have created a network of relationships between seed companies. The number of agreements between companies makes the mapping of the sector extremely difficult.

The most important forecast for the next three years is the tendency for wider use of high quality and certified propagating material of fruit trees, given the fact that the majority of material traded in Greek market is CAC type. A lot of nursery entrepreneurs' gradually resort to higher category plant material, especially those who trade Citrus species, in order to protect their business activity from the quarantine pathogen "tristeza virus". A lot of firms are starting to construct net houses for the safest growth of the maternal plant material. Other nurseries, already buy "basic material" with the view to be certified as laboratories of phytosanitary quality control as well, so that they reach independence regarding the Government Authorities.

The production of the vine nursery companies ranges from 50,000 to 2,500,000 plants annually, in correspondence of the capacity of each company and the total production nationwide is: 7-8,000,000 plants (rooted grafted cuttings). Sales prices vary from 1 € up to 1.20 €. It is noted that annual production of rootstocks (parents plants) may reach 10 million cuttings. The market of vine propagating material in Greece shows a slightly upward trend (increasing). An upward trend shows at the exports of vine propagating material of high production capacity and properly organized nursery businesses (up 50%). The rest entrepreneurs prefer placing their propagating material in the Greek market, either directly or through trader - agronomic shops and cooperative organizations. Greece continues to import vine propagating material, due to institutional deficiencies of framework for production of initial and basic material of Greek vine varieties and due to the non-entirely legal status. The country, due to favorable climatic conditions, can become exporting, in short time, providing proper management and appropriate legal framework.

The production of propagating material for vegetables in Greece is either negligible (especially in the case of hybrid seeds) or is constantly reducing (e.g. potato seed). Domestic seed production, which is not economically important, is encountered only for some crops of minor economic importance (e.g. okra, parsley, dill etc.), or when

traditional varieties or populations with special characteristics are grown (e.g. “Santorini” cherry tomato, “Tsakoniki” eggplant, “Stavros” or “Florinis” pepper etc.). In general, in the vegetable crops sector, it is more profitable and safer for seed companies to import and trade than to produce vegetable seeds in Greece. There is a serious lack of incentive by seed traders and, in addition, small seed producers are unable to enter the highly competitive trade of new varieties and hybrids which are produced by the large multinational seed enterprises. The increasing involvement of genetic engineering coupled to gene patenting; virtually exclude small seed producers from the production and trade of modern vegetable varieties and hybrids (Passam, 2013). Nevertheless, in Greece there is a need for seed production of landraces, populations or traditional varieties of highly consumed vegetables such as tomato, pepper, cucumber, eggplant, onion etc., as well as of wild edible leafy vegetables (e.g. stamnagkathi, zochos, dandelion etc.) which are getting increasingly popular. In Greece there are also numerous indigenous plant species, often related to cultivated ones, which provide a source of genes for breeding programs. There are also populations of cultivated crops that can be improved and from which new varieties or hybrids may be derived. There should also be an effort to reduce imports of potato seed, as climatic conditions in some areas in Greece (e.g. Messenia) allow the production of potato seeds early in the spring when there are no populations of aphids and the risk of virus infection is considerably low.

Many of the entrepreneurs of pot plant and landscape ornamentals in Greece produce their own propagating material, by mother plants they maintain. This occurs for about 65-80% of the plants they produce, while they import propagating material from EU, at about 10-20%, or third countries, such as Thailand, Sri Lanka, Vietnam, at about 5-15%. The majority of ornamentals propagating material (for cut flower and plants) is marketed by a few wholesalers, who trade cuttings, seedlings and seeds of flowering plants, indoor plants, outdoor plants (shrubs, herbs and crests), as well as of cut flowers. About 90-95% of the total quantity of the above mentioned propagating material is imported from Germany, Netherlands, Belgium and Italy, while the rest of it is of Greek production, produced in many cases in their own nurseries. There is only one exception, the cuttings of Poinsettia, which are produced in Greece, by a single producer, at more than 90%. Each wholesaler may trade about 1-1.5 millions pieces of propagating material. Over the last two years in Greece, the species that are imported in greater proportion, and have therefore the greatest demand in the Greek market, are cyclamens (~400000 plants), geraniums, petunias, crests and outdoor (landscape) shrubs. The major proportion of the sales concerns cuttings and seedlings of pot plant species, rather than seeds or propagating material of cut flowers, since the demand for propagating material of cut flowers in Greece is decreasing every year, as a result of their decreasing production. Propagation material for high quality ornamental trees and trees of the Greek flora, for landscape constructions, could be a good idea for an investment in the sector of ornamentals PM. Also, native plants of the Greek flora particularly as landscape plants seem to have good prospective in the local and South European market.

10.11.10. Prerequisites to entrepreneurial success

When entrepreneurs were asked about the dangers facing replied that once a company has modern facilities, appropriate expertise and tested plants production protocols there is no risk in relation to annual yield. On the contrary, the annual demand forecast, the marketing potential, as well as the selling price of propagating material or/ and final product are severe risks.

Certification schemes which are intended by official control to ensure identity, health and quality of seeds and propagating material should imply.

Collaboration with other firms or private/ public bodies, mainly Universities and Institutes and partition in a cooperative, would be useful.

The company should be export-oriented to have good prospects.

The performance of plant varieties should be constantly improved, with regard to yield, resistance to diseases and pests, resource-use efficiency, but also product qualities such as taste, appearance, self-life e.t.c., relevant for sustainable agricultural production. Innovation should be at the heart of plant reproduction process.

The commitment to sustainable agricultural production should be maintained by upholding the two pillars of PM marketing legislation: variety registration and quality requirements, in order to ensure full traceability of PM and offer sufficient guarantees to farmers in terms of identity, performance, quality and health.

10.11.11. Recommendations for consideration in the implementation phase

- Conducting workshops, seminars and/or training schools, locally, or/and at the AUA for young farmers, in which the matters presented above will be analyzed and discussed in extend.
- Website providing information on legal and technical matters, current local and international marker status, and possibility for individual answers (personal communication).
- Establishment of Network for farmers, investors, scientist and suppliers.
- Workshops for young agronomist living in rural areas in order to be trained on matters concerning PM, as to become a link between young farmers and the AUA.
- Workshops for agronomist working at the Greek Ministry of Rural Development and Food and its various regional departments.
- Seminars addressed to Prefectures, in order to be able to provide assistance to young farmers/investors.
- Establishment of e-learning on matters concerning propagating material.
- Create of a brochure on propagating material and the legislation governing it.
- Create of audiovisual material on propagating material production process.

10.12. Literature cited

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Useful links:

- International Plant Protection Convention: https://www.ippc.int/en/
- European and Mediterranean Plant Protection Organization: http://www.eppo.int/
- Council Directive 2000/29/EC: http://eur-lex.europa.eu/legal content/EN/TXT/?uri=celex:32000L0029
- Plant Health Inspection Service, Hellenic Ministry of Rural Development and Food: http://www.minagric.gr/index.php/en/farmer-menu-2/plantprotectionmenu/planthealthinpec-menu

ANNEX

Annex 1. Questionnaire addressed to companies that produce propagating material

1. Company Information Year Established:
   Location:
   Facilities:
   Personnel:
2. What propagation material is produced?
   - Seeds
     - Crops
     - Vegetables
     - Ornamentals
     - Aromatic plants
   - Cuttings
     - Fruit Trees
     - Vine
     - Onramantals
     - Aromatic plants
   - Grafted plants
     - Fruit Trees - Vine

- Vegetables

- Seedlings
  - Vegetables
  - Ornamentals
  - Aromatic plants

" *In vitro* plants
  - Fruit Trees
  - Vine
  - Ornamentals
  - Aromatic plants

" Other types of vegetative propagating material (bulbs, tubers, rhizomes etc…) 3. From where do you obtain your original propagating material (mother plants)? Do you import it?

4. What is your annual yield in propagating material (quantities or turnover) and at what price is it available on the market?

Which species are cultivated in Greece and in which regions? Which species or products species show an increased demand?

In your opinion, what is the status of the current world market (supply and demand)?

7. What are the perspectives of propagating material market in Greece?
8. Is there demand for local varieties, native species or new crops and in which regions?
9. Are there opportunities for collaborations with large companies of propagating material?
10. What is your marketing; Market connection. How do you transport/trade your product? do you sell solely to your National market, and/or export a part? Do you use any production protocols; (ISO etc.) 12. Do you have any certification?

Genetic material (variety, clone)?

phytosanitary certificate?

13. Which were the most important problems that you encountered while you were setting up your company? What are your most important problems today? How did/do you deal with these problems?
14. Have you faced particular problems involving legal issues concerning your activities?

15. How do you become aware and how do you deal with dangers? Do the dangers usually concern the annual yield (sufficient amount of product) or the price (will the product reach a satisfactory price)?

16. What kind of investments did you need to do and how where they funded? Were they part of a development program?
17. Is it necessary to employ workers? What kind of demands do you have for work (annually/ seasonally/number of workers)? What is the labor cost today? Is there a need for qualified personnel?
18. What are your annual needs in supplies/ consumables (seeds, pesticides, fertilizers etc.) and how much do they cost?
19. Is it necessary to use machine tools in your production line? What are those and how much did they cost?
20. Do you have a research and development department?
21. Are you in any collaboration with other companies or agencies?
22. Do you participate in any business group or union, and if so how helpful is it? If not would you be willing to join a union and work in association with other producers?

Annex 2. General matters

Table 1. Infrastructure, equipment and personnel requirements involved in each type of propagating material enterprises (Based on Ministerial decision 1153/16620)

Requirements for propagating material enterprises							
	Seed production	Plant nursery			Marketing business of propagating material		
		Type A	Type B	Type C	Type A	Type B	Type C
Employ qualified agriculturist	"	"	"	"	"	"	"
Have suitable infrastructure	"						
Have seed analysis laboratory	"				"		"
Have maintenance chamber were original propagation material is kept	"						
Employ qualified technical staff	"						
Establish in an irrigated area		"	"	"			
Have mechanical equipment suitable to its purposes		"	"	"	"		
Occupy an area of at least 3.000 m^2		"					
Occupy an area of at least 1.000 m^2			"				
Have a tissue culture laboratory that includes: laminar flow cabinet, autoclave, pH meter, stereoscope, scale and a device for distilled or deionized water.				"			
Have growth rooms (*not mentioned by Ministerial decision 1153/16620)				"			
Have storage room					"	"	"

Have standardization equipment							"
Have greenhouse (*not mentioned by Ministerial decision 1153/16620)		"	"	"			

Table 2. Definition of small and medium-sized enterprises (as in EU law: EU recommendation 2003/361)

Company category	Employees	Turnover
Medium-sized	< 250	≤ € 50 m
Small	< 50	≤ € 10 m
Micro	< 10	≤ € 2 m

http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/

Table 3. The Main Competitor Countries in Propagating Material in 2014

A/A	Competitor country	Percentage (%) total competition	Progressive sum (%)
1	Holland	33,5%	33,5%
2	Germany	22,0%	55,5%
3	Italy	14,7%	70,2%
4	Belgium	7,8%	78,0%
5	Hungary	6,6%	84,6%
6	FYROM	3,6%	88,2%
7	Kenya	3,3%	91,5%
8	Danmark	2,2%	93,7%
9	Spain	2,1%	95,8%
10	India	1,5%	97,2%
Total			100,0%

Table 4. Geographical distribution of exports of propagation material in 2014(Greek Statistical Service)

Other Live Plants (HS: 0602)

			Exports 2014
County	% (Labels)	%	thousand €
MESSINIAS	0,0%	0,0%	0,3
KILKIS	0,0%	0,0%	1,0
AITOLOAK/NIAS	0,0%	0,0%	1,2
ACHAIAS	0,0%	0,0%	1,8
TRIKALON	0,0%	0,0%	2,0
PIERIAS	0,0%	0,0%	3,0
IRAKLIOU	0,1%	0,1%	5,7
LASITHIOU	0,1%	0,1%	7,5
REST ATTIKIS	0,1%	0,1%	13,9
ARGOLIDAS	0,2%	0,2%	25,2
LAKONIAS	0,3%	0,3%	34,2
CHALKIDIKIS	0,3%	0,3%	36,0
LARISSAS	0,4%	0,4%	44,8
ILIASΣ	0,5%	0,5%	49,4
FTHIOTIDAS	0,7%	0,7%	79,1
PREVEZAS	0,9%	0,9%	101,3
IOANNINON	1,0%	1,0%	107,8
VIOTIASΣ	1,1%	1,1%	125,5
PELLAS	2,5%	2,5%	277,1
KORINTHIAS	2,6%	2,6%	280,3
MAGNISSIAS	5,1%	5,1%	553,3

ΘΕΣΣΑΛΟΝΙΚΗΣ	6,3%	6,3%	683,1
ARTAS	18,1%	18,1%	1.977,0
ATTIKIS	18,9%	18,9%	2.069,8
IMATHIAS	40,7%	40,7%	4.443,9
Total		**100,0%**	**10.924,1**

Table 5. Propagating material (Greek Statistical Service)

Other live plants (HS: 0602 ή ΤΤΔΕ: 29269)

Quantity: Thousand tones

Year	Production	Imports	Exports	Consumption	Self-sufficiency (%)	Exports / Imports	Exports/Production
	(1)	(2)	(3)	(4)=(1)+(2)-(3)	(5)=(1)/(4)		
2000		11,095	2,394		21,58%		
2001		11,888	3,583		30,14%		
2002		15,575	4,194		26,93%		
2003		15,846	3,169		20,00%		
2004		21,488	4,033		18,77%		
2005		14,672	2,591		17,66%		
2006		16,611	2,537		15,27%		
2007		18,896	2,646		14,00%		
2008		22,314	2,031		9,10%		
2009		20,777	2,256		10,86%		
2010		18,023	3,598		19,97%		
2011		16,378	5,861		35,79%		
2012		10,210	5,899		57,78%		
2013		10,030	5,983		59,65%		
2014		10,113	6,117		60,49%		

_			15,594	3,793						27,87%			

Table 5 continuation

Value: million €

Balassa Index	Export price	Import price	Change in imports	Change in exports	Change in exports price	Change in imports price	Year	Production	Imports	Exports	Consumption	Self-sufficiency (%)
(Exp – Imp)/(Exp + Imp)	Value/volume	Value/volume	(Final-Initial)/Initial	(Final-Initial)/Initial	(Final-Initial)/Initial	(Final-Initial)/Initial		(1)	(2)	(3)	(4)=(1)+(2)-(3)	(5)=(1)/(4)
-0,65	1,09	1,86					2000		20,692	2,614		
-0,54	0,91	1,89	7,14%	49,65%	-16,41%	1,38%	2001		22,474	3,270		
-0,58	0,67	1,92	31,0%	17,04%	-26,73%	1,56%	2002		29,904	2,804		
-0,67	0,99	1,67	1,7%	-24,43%	48,37%	-12,84%	2003		26,519	3,144		
-0,68	0,92	1,74	35,6%	27,27%	-6,88%	4,21%	2004		37,473	3,726		
-0,70	1,72	2,02	-31,7%	-35,76%	86,33%	15,61%	2005		29,581	4,460		
-0,74	2,03	1,99	13,2%	-2,11%	17,67%	-1,06%	2006		33,136	5,138		
-0,75	2,10	2,09	13,8%	4,30%	3,70%	4,84%	2007		39,517	5,557		
-0,83	2,71	1,91	18,09%	-23,24%	28,85%	-8,88%	2008		42,521	5,496		
-0,80	1,91	1,91	-6,9%	11,12%	-29,57%	0,34%	2009		39,729	4,301		
-0,80	1,57	1,86	-13,3%	59,47%	-17,82%	-2,74%	2010		33,518	5,637		
-0,67	1,32	1,74	-9,1%	62,88%	-15,80%	-6,39%	2011		28,514	7,731		
-0,27	1,36	2,53	-37,7%	0,65%	3,38%	45,28%	2012		25,824	8,045		
-0,25	1,83	2,21	-1,8%	1,42%	-12,66%	-12,66%	2013		22,157	10,935		

	-0,61	1,53	1,97	1,50%	10,75%	4,31%	1,90%			
	-0,25	1,78	2,16	0,8%	2,24%	-2,11%	-2,11%	2014	21,869	10,880
									30,228	5,583

Table 6. Bulbs & rhizomes (HS: 0601 ή
ΤΤΔΕ: 29261)

Quantity: Thousand tones

Year	Production (1)	Imports (2)	Exports (3)	Consumption (4)=(1)+(2)-(3)	Self-sufficiency (%) (5)=(1)/(4)	Exports/Imports	Exports/Production
2000		1,997	0,067			3,35%	
2001		1,430	0,097			6,76%	
2002		1,398	0,055		3,96%		
2003		1,284	0,164		12,75%		
2004		2,618	0,072		2,74%		
2005		2,560	0,056		2,17%		
2006		2,570	0,043		1,66%		
2007		1,722	0,008		0,44%		
2008		1,978	0,015		0,76%		
2009		1,350	0,000		0,01%		
2010		1,373	0,018		1,34%		
2011		1,214	0,129		10,63%		
2012		1,617	0,037		2,31%		

2013	1,103	0,188	17,06%									
2014	1,159	0,071	6,13%									
	1,692	0,068	4,81%									

Table 6 continuation

Value: million €

Balassa Index	Export price	Import price	Change in imports	Change in exports	Change in exports price	Change in imports price	Year	Production	Imports	Exports	Consumption	Self-sufficiency (%)
(Exp – Imp)/(Exp + Imp)	Value/volume	Value/volume	(Final-Initial)/Initial	(Final-Initial)/Initial	(Final-Initial)/Initial	(Final-Initial)/Initial		(1)	(2)	(3)	(4)=(1)+(2)-(3)	(5)=(1)/(4)
-0,94	2,46	1,79					2000		3,579	0,165		
-0,87	1,99	2,38	-28,41%	44,47%	-19,26%	32,90%	2001		3,405	0,192		
-0,92	1,67	2,14	-2,19%	-42,69%	-15,85%	-10,32%	2002		2,987	0,093		
-0,77	1,22	2,42	-8,16%	195,70%	-27,31%	13,32%	2003		3,108	0,199		
-0,95	1,43	1,53	103,84%	-56,16%	17,65%	-36,98%	2004		3,993	0,103		
-0,96	1,61	1,81	-2,22%	-22,50%	12,31%	18,65%	2005		4,632	0,089		
-0,97	1,47	1,79	0,38%	-23,21%	-8,66%	-1,08%	2006		4,600	0,063		
-0,99	4,06	2,67	-32,99%	-82,08%	176,58%	49,04%	2007		4,594	0,031		
-0,98	2,59	2,62	14,87%	97,43%	-36,14%	-1,96%	2008		5,174	0,039		
-1,00	9,81	3,61	-31,77%	-99,33%	278,35%	37,87%	2009		4,867	0,001		

-0,91	2,39	2,39	0,72%	1349,15 %	54,26%	7,48%			
-0,97	1,24	2,38	1,76%	18006,86 %	-87,35%	-34,12%	2010	3,263	0,023
-0,81	0,60	2,71	-11,57%	599,14%	-51,58%	14,07%	2011	3,291	0,078
-0,95	3,00	2,08	33,18%	-71,09%	399,24%	-23,16%	2012	3,368	0,112
-0,71	0,69	2,83	-31,81%	403,80%	-76,90%	35,74%	2013	3,117	0,130
-0,88	2,07	3,13	5,10%	-62,21%	198,58%	10,75%	2014	3,628	0,147
								3,840	0,098

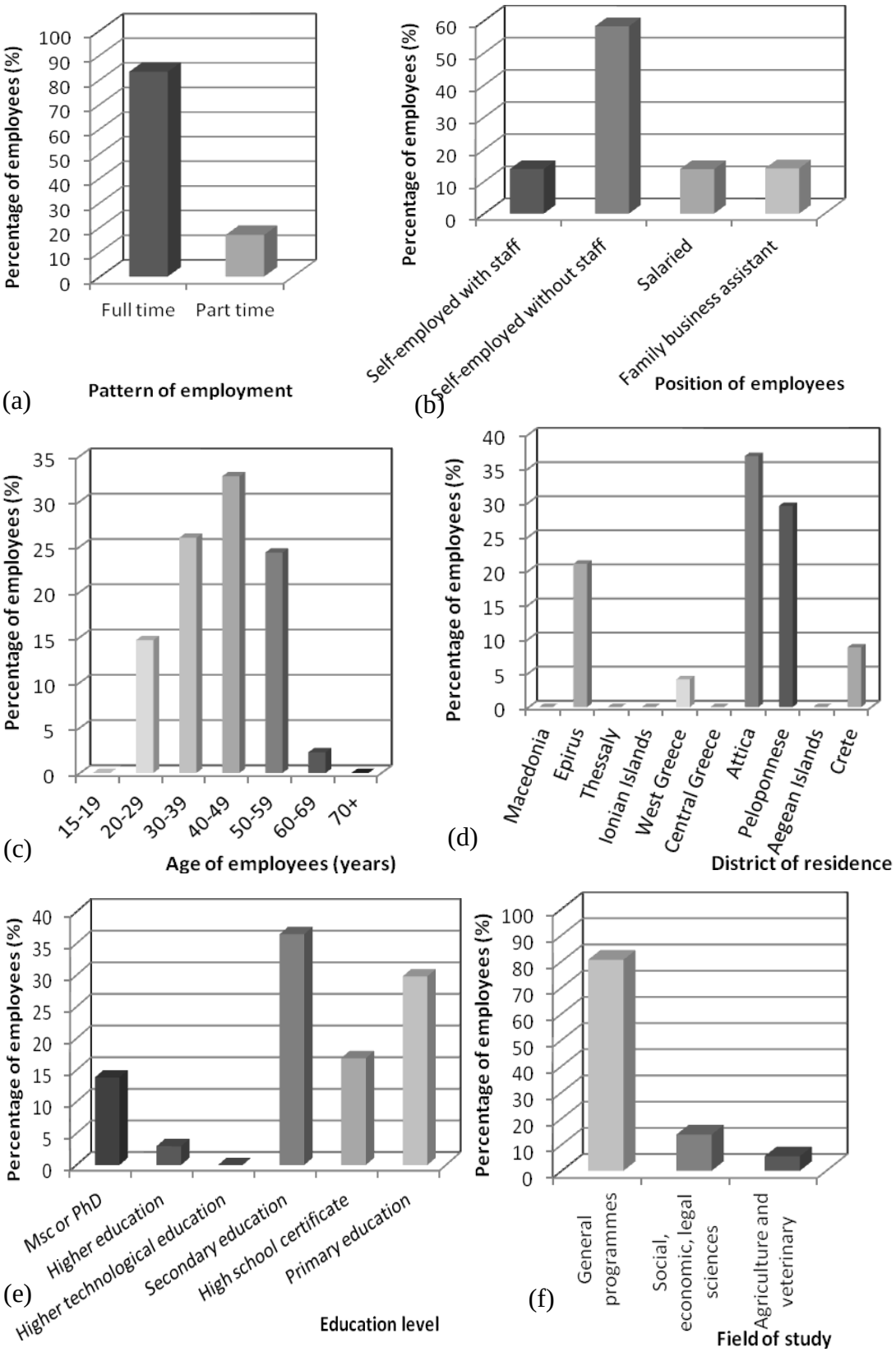


Figure 1. Processed data about employment in nurseries, as derived from the labour force survey (first quarter 2015) of the Greek Statistical Service.

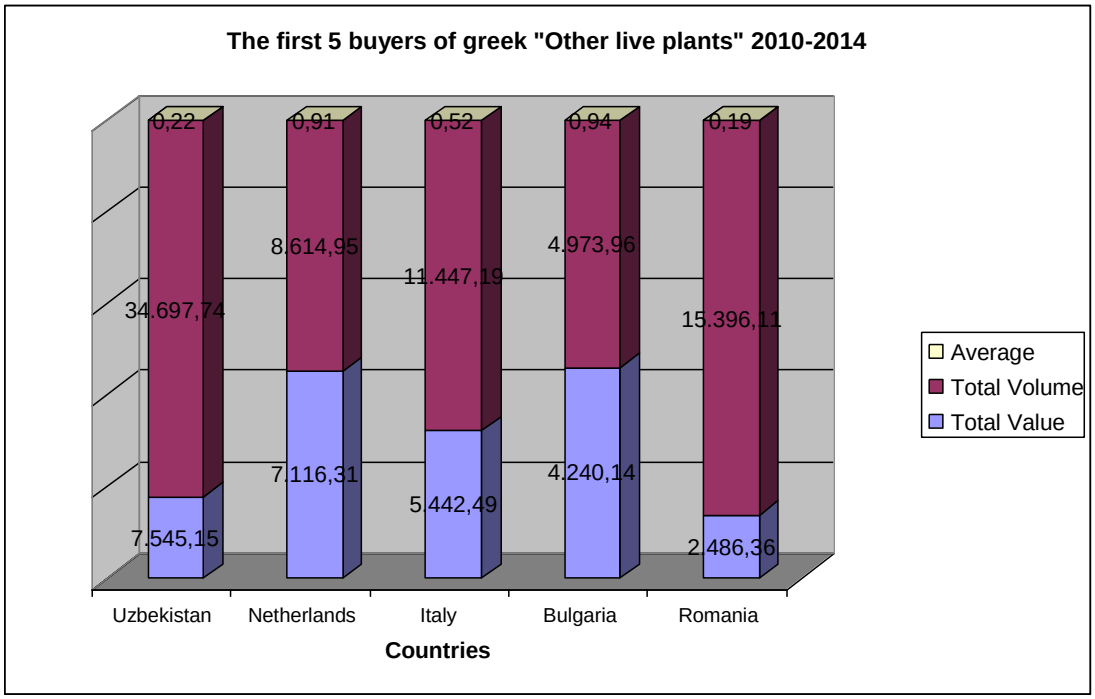


Figure 2. The first 5 buyers of Greek "other live plants" average 2010-2014 (Greek Statistical Service).

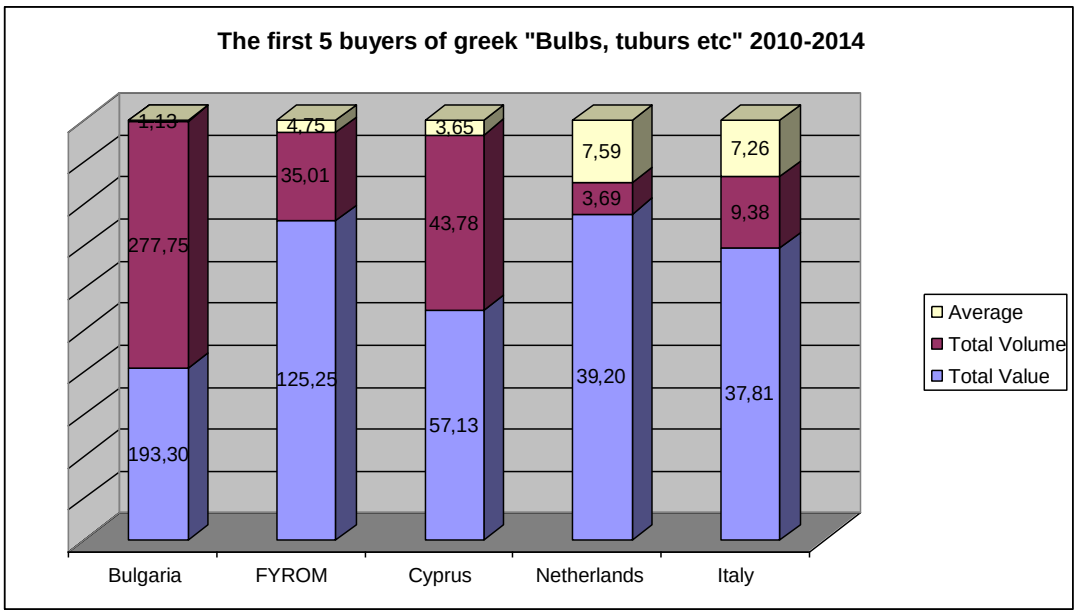


Figure 3. The first 5 buyers of Greek "bulbs, tubers etc" average 2010-2014 (Greek Statistical Service).

Table 2. Production (thousand pieces) of cut flowers in Greece, during the period 2009-2012

Annex 3. Propagating material for ornamentals

Table 1. Area (hectares) cultivated with cut flowers in Greece, during the period 2009-2012

Cut flowers	2009			2010			2011			2012		
	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Tot
Roses	75.19	2.81	78.0	69.3	0.02	69.32	49.46	1.47	50.93	45.07	2.87	47.9
Carnations	53.48	25.71	79.19	49.24	23.55	72.79	40.18	22.50	62.68	24.57	22.70	47.
Gladiolous	0.35	3.07	3.42	0.37	3.05	3.41	0.87	3.05	3.91	0.57	3.55	4
Chrysanthemum	18.87	22.01	40.88	19.31	21.36	40.67	17.93	1.11	19.03	16.14	1.11	17.
Dhalia	0.35	18.95	19.3	0.22	10.00	10.22	3.45	9.15	12.6	2.65	12.50	15
Gerbera	4.35	0.0	4.35	4.43	0.0	4.43	2.85	0.0	2.85	1.98	0.0	1.9
Others	30.18	23.96	54.14	28.14	27.65	55.79	22.7	15.6	38.3	27.08	16.7	43.
Tulips	0.4	2.7	3.1	0.31	1.7	2.01	0.31	1.6	1.91	0.06	1.6	1.
Lilium	0.0	0.0	0.0	0.0	0.0	0.0	0.95	0.0	0.95	0.91	0.0	0.
Lilium oriental	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.1	
Solidago	0.0	0.0	0.0	0.0	0.0	0.0	0.13	0.0	0.13	0.03	0.0	0.
Gypsophila	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.1	1.47	0.67	0.1	0.
Strelitzia	0.77	0.0	0.77	0.77	0.0	0.77	0.0	0.0	0.0	0.0	0.0	0
Total	183.94	99.21	283.145	172.08	87.32	259.40	140.51	54.57	195.75	119.71	61.22	180.9

Source: Processed data from the Ministry of Rural Development and Food of Greece.

Cut flowers	2009	2010	2011	2012

	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor
Roses	70839.5	1268	72107.5	56626.1	3.5	56699.6	35033	1463.3	36496.3	32045.1	2783.5
Carnations	87570	47766	135336	77594.6	43598.4	121193	102099.5	47880.1	149979.6	20489.95	47680.4
Gladiolous	74	718	792	77	626	703	555	726	1281	223	841
Chrysanthemum	16870	25616	42486	16981.7	25180.8	42162.5	10354.5	1070.5	11425	6710.2	1070.8
Dhalia	78.2	10274	10352.2	138.2	4622.2	4760.4	2290	18372	20662	2240.2	23343.2
Gerbera	4571	0	4571	4554	0	4554	1886	0	1886	1219	0
Others	24767	14517	39284	15725	33781	49506	15447	5782	21229	17219.5	5955
Tulips	118	660	778	98	460	558	108	1160	1268	20	1160
Lilium	0	0	0	0	0	0	205	0	205	205	0
Lilium oriental	0	0	0	0	0	0	40	0	40	0	46
Solidago	0	0	0	0	0	0	10	0	10	5	0
Gypsophila	0	0	0	0	0	0	165	28	330	165	28
Strelitzia	90	0	90	90	0	90	0	0	0	0	0
Total	204977.7	100819	305796.7	171884.6	108271.9	280226.5	168193	76481.9	244811.9	80541.95	82907.9

Source: Processed data from the Ministry of Rural Development and Food of Greece.

Table 3. Area (hectares) cultivated with pot plants in Greece, during the period 2009-2012

Pot plants	2009			2010			2011			2012		
	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total

Perennial-flowering	89.25	51.54	140.79	84.52	5.34	89.89	29.37	11.33	40.72	24.88	15.12	40.03
Perennial-foliage	33.42	9.79	43.21	36.16	10.83	47.00	28.12	7.68	35.80	18.80	8.09	26.88
Annual	42.23	4.9	47.19	31.33	6.56	37.88	22.17	7.01	29.18	29.57	7.6	37.17
Total	164.9	66.23	231.19	152.02	22.73	174.77	79.66	26.02	105.70	73.25	30.81	104.08

Source: Processed data from the Ministry of Rural Development and Food of Greece.

Table 4. Production (thousand pieces) of pot plants in Greece, during the period 2009

Pot plants	2009			2010			2011			2012		
	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total
Perennial-flowering	7819.8	3183.5	11003.3	6714.6	310.1	7024.7	5219.2	3063.4	8282.6	5602.75	3981.05	9583.8
Perennial-foliage	4862.2	660.6	5522.8	6495.1	1496	7991.1	4281.9	411.65	4693.55	6790.9	3391.1	10182
Annual	29434	3759	33193	19145.4	1961.5	21106.9	14479	1697.1	16176.1	22256	1640	23896
Total	42116	7603.1	49719.1	32355.1	3767.6	36122.7	23980.1	5172.15	29152.25	34649.6 5	9012.15	43661.8

Source: Processed data from the Ministry of Rural Development and Food of Greece.

Table 5. Area (hectares) cultivated with landscape plants in Greece, during the period 2009-2012

Landscape plants	2009			2010			2011			2012		
	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total
Trees	1.67	56.23	57.9	2.44	158.85	161.29	2.75	37.36	40.11	0.92	38.56	39.48
Shrubs	5.38	180.56	185.94	8.5	158.05	166.55	12.48	121.78	134.26	4.26	127.9	132.16

Herbaceous	2.52	32.01	34.53	2.66	7.83	10.49	3.67	2.655	6.325	2.67	4.855	7.53
Total	9.57	268.8	278.37	13.6	324.73	338.33	18.9	161.80	180.70	7.85	171.32	179.17

Source: Processed data from the Ministry of Rural Development and Food of Greece.

Source: Processed data from the Ministry of Rural Development and Food of Greece.

Table 6. Production (thousand pieces) of landscape plants in Greece, during the period 2009-2012

Landscape plants	2009			2010			2011			2012		
	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total	Greenhouse	Outdoor	Total
Trees	189	4197.5	4386.5	292	12288.4	12580.4	186	3946.15	4132.15	37	4847.8	4884.8
Shrubs	466.8	21200.8	21667.6	3293	10159.6	13452.6	808	8768.65	9576.65	345	8124.2	8469.2
Herbaceous	575	9402.5	9977.5	387	2766.15	3153.15	390	307.9	697.9	515	295.15	810.15
Total	1230.8	34800.8	36031.6	3972	25214.15	29186.15	1384	13022.7	14406.7	897	13267.15	14164.15

Table 7. Production of ornamentals propagating material (pieces) per species

Species	2013	2014
Pittosporum	18894	34524
Azalea	420	11070
Acacias	2150	2320
Alyssum	2250	800
Anthurium	0	400
Pelargonium	1670	7355
Basil	2747	0
Viburnum	8360	21427
Begonia	29624	54416
Bougainvillea	47775	64478
Carnation	167684	165316
Gardinia	9380	88630
Geranium or Pelargonium	412605	391205
Jasmine	330	7248
Gazania	300	6345
Turf grass	7795	10150
Laurel	4100	10592
Various	1815018	1329093
Various annuals	3326867	4262652
Various trees	186482	260529
Various shrubs	424474	502624
Various succulents	0	33175
Various cacti	30290	752
Osteospermum (Dimorphotheca)	1000	7150
Dieffenbachia	0	300
Dracaena	1030	1288
Impatiens	0	6920
Euonymus	4340	5956
Gerbera	0	4150
Hibiscus	33415	42536
Salix	40	205
Kalanchoe	25	1000
Callistemon	80	3360
Camellia	1670	188
Marigold	850	7055
Ivy	160	0
Croton	100	1100
Cyclamen	16300	21640
Lantana	0	4225
Ligustum	1990	29476
Daisy	410	3790

Metrosideros	85	2060
Ficus benjamin	100	2410
Jasminum sambac	300	1750
Mesebrianthemum	120	148
Dahlia	1950	3225
Hortensia	2730	11920
Pansy	300	21750
Petunia	8350	38190
Oleander	1170	23715
Poinsettia	9200	48280
Polygala	70	7040
Primula	3650	26975
Pyracantha	8030	5638
Nerium	6800	8675
Rhododendron	1350	580
Rhyncospermum	35	5510
Sansevieria	0	2000
Schefflera	3060	6695
Snapdragon	0	6875
Surfinia petunia	6580	7160
Thuja	7960	9529
Rose	345492	412200
Ficus	1240	1860
Palm tree	5729	6290
Palms	0	502
Fuchsia	100	1698
Chrysanthemum	31200	33585

Source: Processed data from the Greek Ministry of Rural Development and Food.

Table 8. Production of ornamentals propagating material (pieces) per region and year

NOMOS	2013	2014
N. EBROU (Alexandroupolis)	15170	67693
N. EVIAS (chalcida)	160542	129820
N. ZAKINTHOU (Zakinthos)	52633	22240
N. ILIAS (Pirgos)	-	228432
N. THESPROTIAS (Igoumenitsa)	-	22140
N. THESSALONIKIS (Thessaloniki)	961074	972778
N. IOANNINON (Ioannina)	176300	230200
N. KABALAS (Kabala)	133505	123130
N. KARDITSAS (Karditsa)	-	138100
N. KASTORIAS (Kastoria)	19970	22400
N. KERKYRAS (Kerkyra)	-	119690
N. KEFALLINIAS (Argostoli)	-	22023
N. KILKIS (Kilkis)	38645	58035
N. KOZANIS (Kozani)	68515	98580
N. KORINTHIAS (Kiato)	68160	-
N. KYKLADON (Naxos)	-	20083
N. LAKONIAS (Sparti)	6115	-
N. LARISSAS (Larissa)	97470	147120
N. LEUKADAS (Leukada)	6831	4000
N. MESSINIAS (Kalamata)		672428
N. MYTILINIS (Mytilini)	166270	116810
N. XANTHIS (Xanthi)	301100	-
N. PELLAS (Giannitsa)	810832	825255
N. PIERIAS (Katerini)	123295	101991
N. PREVEZAS (Preveza)	570802	436193
N. RODOPIS (Komotini)	51000	-
N. SERRON (Serres)	1724500	1292300
N. TRIKALON (Trikala)	523500	575100

N. FTHIOTIDAS (Lamia)	320424	351419
N. FOKIDAS (Amfissa)	5120	-
N. CHANION (Chania)	93850	64790
N. CHIOU (Chios)	98900	64005
Total	6594523	6926755

Source: Processed data from the Ministry of Rural Development and Food of Greece.

Table 9. Imports of ornamentals propagating material from third countries for trading.

	2009	2010	2011	2012	2013	2014
USA	38403550 seeds	36450000 seeds	3960000 seeds	-	-	100000 seeds
Israel	12286000 cuttings/ 417000 bulbs	3850000 cuttings/ 170000 bulbs	110000 bulbs	5 kg seeds	307 kg seeds/ 53500 bulbs	-
Australia	-	-	-	12000 seedings/ 1000 cuttings	-	-
India	-	-	136000 cuttings	28000 cuttings	-	-
Kenya	-	-	-	-	-	30000 cuttings
Ethiopia	-	-	-	-	-	5000 cuttings

Source: Processed data from the Ministry of Rural Development and Food of Greece

Table 10. Imports of ornamentals propagating material from third countries for nursery enterprises.

	2009	2010	2011	2012	2013	2014	2015

Sri Lanka	105000 cuttings	190000 cuttings	165000 cuttings	45000 cuttings	18000 micro-plants	14000 micro-plants	36000 micro-plants
Israel	30000 cuttings	-	-	14416 cuttings	17220 cuttings	55000 cuttings / 30000 bulbs	8000 cuttings
Guatemala	-	4900 cuttings	19850 cuttings	14050 cuttings	24000 cuttings	-	-
Australia	-	-	-	1768 microplants	-	-	1600 cuttings /
							2.4 kg seeds
Kenya	146755 cuttings	69445 cuttings	-	-	-	29000 cuttings	9000 cuttings
Thailand	-	-	-	-	6000 cuttings	6700 cuttings	-
FYROM	-	-	-	-	29000 cuttings	-	-
El Salvador	-	-	-	-	-	50000 cuttings	10000 cuttings
Turkey	-	-	40000 cuttings	-	-	13400 cuttings	-

Source: Processed data from the Ministry of Rural Development and Food of Greece

Annex 4. Propagating material for vegetables

Table 1. Quantity and value of "standard" seeds for sowing for the major vegetable crops, which were traded in Greece during 2010 (From: Emmanouilides, 2013)

Crop	Quantity (kg)	Value (million €)
Tomato - greenhouse	400	8.11
- field crop	450	2.49
- industrial crop	500	0.71
- total	3,700	11.31
Pepper (sweet)	- 100	1.65

greenhouse

(sweet) – field crop 620 2.15

- chilli 30 0.05

- industrial crop 50 0.10

- total 800 3.95

Cucumber - greenhouse 850 2.75

- field crop 400 0.53

- industrial crop 60 0.05

- total 1,310 3.33

Zucchini - greenhouse 1,100 0.75

- field crop 7,500 1.10

- total 8,600 1.85

Melon - greenhouse 300 0.66

- field crop 1,100 0.81

- total 1,400 1.47

Watermelon - greenhouse 450 0.40

- field crop	2,250	1.10
- total	2,700	1.54
Eggplant - greenhouse	40	0.25
- field crop	220	1.45
- total	260	1.70
Snap beans - greenhouse	20,000	0.15
- field crop	610,000	2.60
- total	630,000	2.75
Lettuce - greenhouse	30	0.08
- field crop	870	0.97
- total	900	1.05
Cabbage	650	1.28
Cauliflower	260	0.94
Broccoli	100	0.42
Carrot	2,500	1.20
Spinach	105,000	0.90
Onion - for bulbs	40,000	1.62
- for greens	5,000	0.24
-total	45,000	1.86
Other minor vegetables*	-	2.45
Total	803,180	38.00

** e.g. okra, celery, parsley, dill, etc.*

Table 2. List of European (mainly Balkan) countries regarding the value of exports of field and vegetable seeds for sowing (From: ISF, 2013)

Country	Field crops		Vegetable crops		Total Quantity value
	Quantity (metric tones)	Value (million $)	(metric tones)	Value (million $)	(million $)
1. Denmark	121,140	221	7,855	42	263
2. Romania	96,750	217	209	1	218
3. Belgium	18,299	203	675	3	206
4. Austria	57,302	116	45	2	118
5. Slovakia	128,433	94	-	-	94
6. Czech Republic	33,997	42	191	5	196
7. Estonia	51,642	35	-	-	35
8. Bosnia & Herzegovin	25,179	22	-	-	22 a
9. Bulgaria	7,800	15	1,804	4	19
10. Serbia	5,800	14	64	1	15
11. Croatia	7,972	9	24	1	10
12. Greece	6,529	8	100	1	9

Table 3. Estimated quantity and value of seed per stremma* for the cultivation of the major vegetable crops in Greece [data for the year 2003 – From: Vasileiou (2004)]

Crop	Quantity of seed per stremma (g)	Cost of seed per stremma (€)
Asparagus	1,500 plants	540.0
Aubergine - greenhouse	10 (F_1)	21.0
- field crops	10 (F_1)	21.0
Bean - greenhouse	5,000 (F_1)	150.0
- field crop	10,000	50.0
Beetroot	1,500	18.0
Broad bean	8,000	25.6
Cabbage	10 (F_1)	18.3
Carrot	250	5.3
Cauliflower	10	33.5
Celery	500	8.5
Chinese leaves	2,000	20.0
Cucumber - greenhouse	60	582.0
- field crop	20	29.4
- industrial crop	20	1.3
Endive	500	7.5
Leek	500	25.0
Lettuce	30	10.2
Marrow - greenhouse	200 (F_1)	60.0
- field crop	200	40.0
Melon	20 (F_1)	30.0
Okra	1,500	15.0
Onion - fresh	1,000 (F_1)	120.0
- dry	1,000 (F_1)	180.0
Parsley	1,000	6.5
Pea	12,000	25.2
Pepper	20 (F_1)	120.0
Potato - spring	180,000	198.0
- summer/autumn	200,000	165.0
Radish	1,000	10.0
Spinach	2,000	24.0
Tomato - greenhouse	10 (F_1)	240.0
- field crop	10 (F_1)	120.0
- industrial crop	10 (F_1)	30.0
Watermelon - greenhouse	15 (F_1)	24.0
- field crop	15 (F_1)	24.0

*1 stremma = 1,000 m^2

Table 4. Quantity of "standard" seeds for sowing of the main Greek vegetable varieties, certified by the CENTER FOR CERTIFICATION OF PROPAGATING MATERIAL AND CONTROL OF FERTILIZERS of Athens, Thessaloniki and Alexandria (From: Greek Ministry of Agriculture, 2015)

Crop	Variety/year	Harvested seed quantity (kg)	Traded seed quantity (kg)
Pepper	Mytero (2013)	187	173
	P-13 (2013)	113	101
	P-14 (2013)	107	100
	Florinis (2012)	34	30
	Stavros (2013)	11	10
	Kafteri Ierapetras (2013)	23	21
Okra	Pylaias (2013)	19463	17320
Eggplant	Lagada (2013)	26	22
	Tsakoniki (2012)	21	18
Snap beans	Zargana Chrysoupolis (2012)	425	400
Melon	White Amyntaiou (2012)	29	25
	Zakynthou (2011)	12.5	7
	Thrakiotiko (2012)	27	25
Cabbage	Kilkis (2012)	160	150
Zucchini	Kompokolokytho (2011)	35	30

Annex 5. Propagating material for crops

Table 1. Area (thousand hectares) cultivated with crops

Crops	Area (thousands of hectares)
Cereals for grain	**1112.23**
Durum wheat	483.15
Common wheat	183.89
Barley	138.44
Rice	29.18
Maize	212.13
Other cereals	65.44
Edible legumes	**21.99**
beans	9.99
other edible Legumes	12.00
Industrial Plants	**379.79**
Tobacco	19.03
Cotton	272.34
Sunflower	72.21
Sugar beet	7.46
Groundnut	0.67
Other industrial plants	8.08
Aromatic plants	**1.76**
Fodder plants	**374.82**

Source: Greek Statistical Service (2013)

Table 2. The Greek production of MAPs propagation material in 2014 at regional level. The data refer to the number of rooted cuttings or seedlings.

Species	Prefectures										
	Achaia	Serres	Ilia	Zakynthos	Kastoria	Kefalonia	Kilkis	Larissa	Messinia	Chania	Ilia
	Rooted cuttings			*Seedlings*							
Aloe vera	2.200	-	-	-	-	-	-	-	-	24.050	7
Ruta graveolens	1.085	-	-	-	-	-	-	-	-	-	-
Pelargonium graveolens)	150	-	-	-	-	37	-	-	-	-	527
Achillea millefolium	500	-	-	-	-	-	-	-	-	-	-
Valeriana officinalis	800	-	-	-	-	43	-	-	-	-	-
Ocimum basilicum	21.950	-	-	1.800	-	-	-	7.000	-	-	15.500
Laurus nobilis	-	-	-	-	-	200	-	-	-	-	-
Rosmarinus officinalis	8.075	-	3.170	-	-	253	-	-	-	-	-
Mentha viridis	1.250	-	100	-	-	214	-	-	-	-	-
Satureja thymbra	800	-	-	-	-	-	-	-	-	-	-
Thymus vulgaris	2.475	-	3.384	-	-	226	-	-	-	-	-
Lavandula angustifolia	1.000	-	1.130	-	-	249	-	-	-	-	-
Verbena officinalis	275	-	-	-	-	10	-	-	-	-	660
Origanum majorana	1.700	-	-	-	-	52	-	-	-	-	100
Melissa officinalis	500	-	-	-	-	30	-	-	-	-	-
Mentha x piperita officinalis	550	-	-	-	-	150	-	-	-	-	100
Origanum vulgare spp. *hirtum*	10.000	-	150	-	-	1.352	-	-	-	-	-
Salvia	-	-	-	-	-	200	-	-	-	-	-
Spiraea tomentosa	5	-	-	-	-	-	-	-	-	-	-
Stevia rebaudiana	185	-	-	-	-	20	-	-	2.500	-	-
Allium schoenoprasum	1.000	-	-	-	-	-	-	-	-	-	-
Sideritis syriaca)	5.000	-	-	-	-	-	-	-	-	-	-
Salvia officinalis	900	-	672	-	-	66	-	-	-	-	-
Origanum dictamnus	575	-	-	-	-	-	-	-	-	-	-
Undefined MAPs	8.400	40.000	-	673	4.730	1.900	417.200	-	-	600	-

Total (per Prefecture)	*69.375*	*40.000*	*8.606*	*2.473*	*4.730*	*5.002*	*417.200*	*7.000*	*2.500*	*24.650*	*16.894*
Total		***117.981***					*480.449*				

Source: Processed data from the Ministry of Rural Development and Food of Greece.

Table 3. A global perspective: Sizes of domestic seed markets in the world (in € million).

Country	2005	2006	2007	2008	2009	2010	2011	2012	Market Share (2012)
United States	4582	5575	6202	8159	8603	9052	8621	9340	27%
China	2411	3584	2919	4079	4302	7166	6490	7744	22%
EU	4903	4972	5839	5849	6511	6974	6968	7106	20%
Brazil	965	1195	1459	1360	1434	1509	1996	2043	6%
Canada	442	438	401	374	394	415	395	1650	5%
India	482	1035	1094	1020	1075	1509	1437	1557	4%
Japan	2009	1991	1094	816	896	1056	1114	1051	3%
Argentina	748	741	693	501	498	453	542	771	2%
Turkey	137	199	255	255	287	302	287	584	2%
Rest of the world	3148	2870	2752	2599	2709	2619	2888	3121	9%
Total	19827	22600	22711	25012	26710	31054	30626	34967	100%

Source: PolDep B elaboration based on data received from the International Seed Federation. The data includes field crops, vegetable and flower seeds for planting, which are sold to end users. Seed potatoes are not included. Market values were converted from US dollars to Euros using annual exchange rates retrieved from the Eurostat database.

Table 4. A European perspective: Sizes of domestic seed markets in the EU (in € million).

Member states	2005	2006	2007	2008	2009	2010	2011	2012	Share of EU market (2012)
France	1101	1537	1532	2040	2294	2338	2586	2179	31%
Germany	804	796	673	628	811	951	841	911	13%
Italy	522	621	730	510	513	588	514	597	8%
Spain	241	239	328	306	323	339	323	514	7%
Netherlands	241	166	219	204	384	441	420	459	6%
United Kingdom	458	205	292	272	287	302	323	350	5%
Czech Republic	121	159	219	204	215	226	219	237	3%
Hungary	161	159	219	204	215	226	216	233	3%
Poland	322	207	255	238	186	196	187	218	3%
Sweden	161	123	175	163	172	181	180	195	3%
Romania			161	150	158	166	158	171	2%
Denmark	161	135	182	136	118	140	165	170	2%
Greece	**113**	**112**	**175**	**163**	**172**	**181**	**172**	**156**	**2%**
Belgium	104	104	139	129	133	140	133	144	2%
Finland	64	82	117	109	115	121	115	125	2%
Austria	137	135	109	102	108	113	108	113	2%
Bulgaria			88	82	86	91	86	93	1%
Slovakia	72	72	80	75	79	89	79	86	1%
Ireland	48	48	58	54	57	60	57	62	1%
Portugal	48	48	58	54	57	60	57	62	1%
Slovenia	24	24	29	27	29	30	29	31	0%
Total EU	**4903**	**4972**	**5839**	**5849**	**6511**	**6974**	**6968**	**7106**	**100%**

Source: PolDep B elaboration based on data received from the International Seed Federation. The data includes field crops, vegetable and flower seeds for planting, which are sold to end users. Seed potatoes are not included. Market values were converted from US dollars to euros using annual exchange rates retrieved from the Eurostat database.

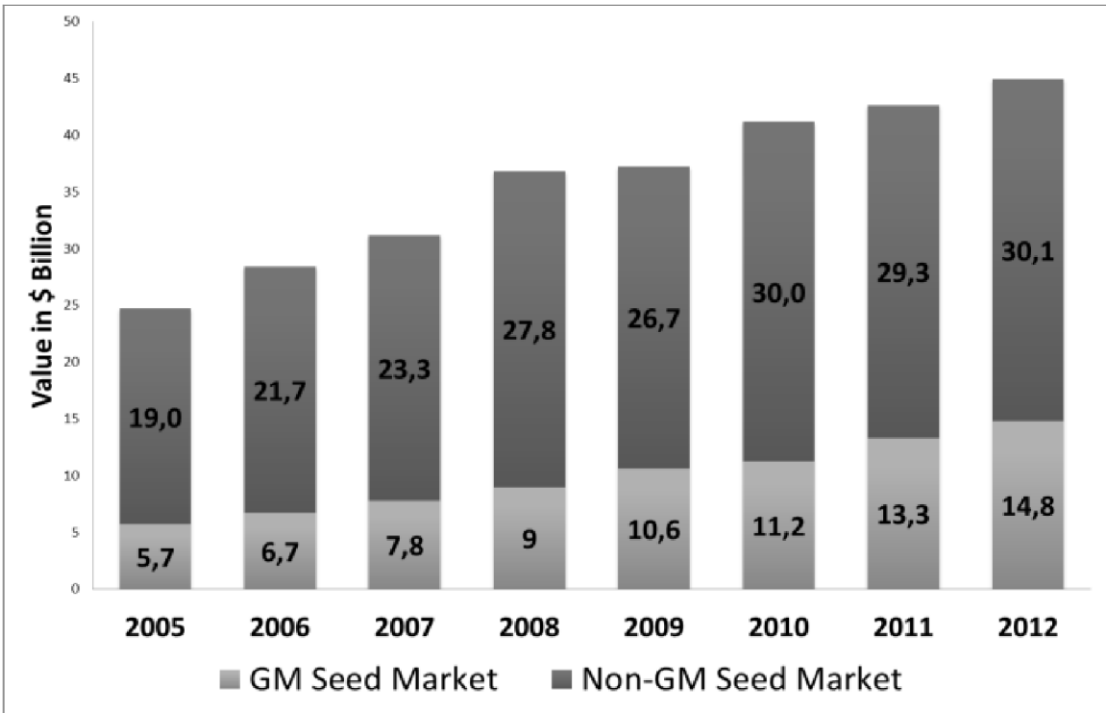


Figure 1. The global seed market ($ billion) regarding genetically modified (GM) and non-GM seeds.

Source: Elaboration by EP PolDep B, based on International Seed Federation data (for total global seed market) and International Service for the Acquisition of Agribiotech Applications (ISAAA) for the GM seed market.

The first 5 buyers of greek beans (SITC: 05423) for the period 2010-2014 (Value in mil. euro, volume in thousand tons, average in euro/ton)*

Country	2010-2014			2014			2013			2012		
	Total Value	Total Volume	Average	Value	Volume	Unit value	Value	Volume	Unit value	Value	Volume	Unit value
Bulgaria	2,39	2,85	0,65	0,48	0,57	0,85	0,04	0,08	0,47	1,66	1,79	0,93
Cyprus	2,03	1,17	1,73	0,62	0,35	1,75	0,55	0,31	1,75	0,30	0,17	1,73
U.S.A.	1,01	0,32	3,18	0,21	0,07	3,04	0,26	0,08	3,37	0,17	0,05	3,38
Germany	0,67	0,29	2,29	0,14	0,06	2,30	0,13	0,06	2,21	0,12	0,06	2,15
Poland	0,14	0,07	2,07	0,06	0,02	2,48	0,00	0,00		0,00	0,00	

* Data for the period 2012-2014 are preliminary

Source: Hellenic Statistical Authority (EL. STAT.) - Data processed by Export Research Centre (KEEM)

Annex 6. Propagating material for trees

Table 1. Phytosanitary pathogens from which trees propagation material must be free

Highly harmful pathogens	Malus Mill, Pyrus L. & Cydonia oblonga Mill	Prunus spp	Citrus L, Poncirus Raf., Fortunella Swingle & hybrids	Olea europaea L. & rootstocks	Juglans regia L., Castanea sativa Mill. & rootstocks
1.	Apple chlorotic leaf spot virus, ACLSV	Plum pox virus, PPV	Citrus tristeza virus, CTV	Arabis mosaic virus, ArMV	Cherry leaf roll, CLRV
2.	Apple mosaic virus, ApMV	Apple chlorotic leaf spot virus, ACLSV	Citrus psorosis virus, CPsV	Cucumber mosaic virus, CMV	
3.	Apple stem grooving virus, ASGV	Prunus necrotic ring spot virus, PNRSV	Citrus concave gum, CCG	Strawberry latent ringspot virus, SLRV	
4.	Apple stem pitting virus, ASPV and pear stony pit, PSP	Prune dwarf virus, PDV	Citrus blind pocket, CBP		
5.	Apple scar skin viroid, ASSVd	Peach latent mosaic viroid, PLMVd	Citrus cristacortis, CC		
6.	Pear blister canker viroid, PBCVd	European stone fruit yellows phytoplasma, ESFY	Citrus impietratura, CI		
7.	Apple proliferation phytoplasma, APPh		Citrus leaf rugose virus, CiLRV		
8.			Citrus exocortis viroid, CEVd		
9.			Hop stunt viroid, HSVd		

10.			Spiroplasma citri		

Table 2. Number of produced trees per species and region

		2014								
		ARTA	LARISSA	MESSOLOGI	KEFALLONIA	ZAKINTHOS	KAVALA	IMATHIA	PELLA	TOTAL
TREE NUTS	Almond	150	45700			85		243150	138903	427988
	Walnut	1000	19100			106		37700	142647	200553
	Chestnut		400					41100	186542	228042
	Pistacio									0
	Hazel								2000	2000
STONE TREES	Vanilla	6								6
	Apricot	700	10325		25	345	50	243650	345241	600336
	Sour Cherry	6	200			30			29100	29336
	Plum	100	100			125	100	259950	334408	594783
	Cherry	650	1325			207	200	585055	707552	1294989
	Nectarine	90	700						298100	298890
	Stone Trees			940						940
	Peach	200	5925		25	90	200	1780880	887035	2674355
	Rootstocks	3771491								3771491
OTHER FRUITFUL TREES	Kiwi	67000						103800	32445	203245
	Lotus	100			25	60		95800	91480	187465
	Pomegranate	506	1650		25	25	50	73200	86196	161652
	Fig	500			100	55		9800	46400	56855

POME TREES	Pear	790	31325		55	253	200	355600	338065	726288
	Asian Pear	10							5800	5810
	Prunus ceracifera					32			33400	33432
	Quince	100	675		25	88	50	31300	56750	88988
	Apple	780	1875		25		200	910400	649789	1563069
	Pome Trees			280						280
	Medlar								34900	34900
CITRUS TREES	Lime	250								250
	Grapefruit			20		45				65
	Citrus Trees				70					70
	Citron	370								370
	Citro-lemon									0
	Kumquat	300		50		15				365
	Lemon	16790		2714	30	390				19924
	Lime									0
	Mandarin	108030		1212	30	380				109652
	Sour orange				120					120
	Bergamot	1650								1650
	Orange	32690		5221	30	485				38426
	Tangelo									0
	Pomelo									0

TROPICAL PLANTS	Avocado									0
OLIVE TREE	Olive	21350	14300	133330	450	1450	7700	21900	39320	239800
OTHER SHRUBS	Goji-berry				30		50		13700	13780
	Aronia						35		4400	4435
	Black Raspberry									0
	Hippophae				15		75		7500	7590
	Cornus									0
	Mulberry								23400	23400
	Blueberry						55		2000	2055
	Rasberry									0
	Gooseberry									0
	Prickly Pear									0
STRAWBERRY	Strawberry				1045					1045
VARIOUS TREES				688				5050	15000	20738
VARIOUS SHRUBS									6000	6000
BARE ROOT FRUIT TREES					300					300

OTHER FRUIT TREES					300					300

Source: Processed data from the Ministry of Rural Development and Food of Greece.

Annex 7. Stakeholders analysis

Table 1. Stakeholders analysis

	Stakeholders	Influence	Interests/ positive impacts	Concerns/ negative impact
Supply side	Primary producers	High	Low	High
	Input providers	High	High	Low
	Equipment providers	High	High	Low
	Wholesalers	Medium	Medium	Medium
	Retailers	High	Low	High
	Banking	Medium	Medium	Medium
	Consultants	High	High	Low
	Advisory	High	High	Low
Demand	Wholesalers	High	High	Low
	Retailers	High	High	Low
	Farmers	High	High	Low
	Consumers	High	High	Low
	Collective organizations	High	High	Low
Regulation	Agriculture authorities	High	High	Low
	Food safety authorities	High	High	Low
	Environmental authorities	High	High	Low
	Labor	High	High	Low
	Social security	High	High	Low

BUSINESS PLAN

Background information

1. Business name: microHERB
2. Location: Attica
3. Economic Sector: Nursery
4. Activities: Micropropagation of Oregano (*Origanum vulgare* spp. *hirtum*), Felty germander (*Teucrium polium*) and Dittany of Crete (*Origanum dictamnus)*
5. Establishment Year: 2016.
6. Type of ownership: family-owned agricultural business

Executive Summary

The company and the product microHERB is a micropropagation business that produces three native herbs grown in Greece, namely Oregano, Dittany of Crete and Felty germander. The business consists of a micropropagation laboratory that is housed in a prefabricated building of about 70 m^2 and a greenhouse of 480 m^2. The company utilizes a total of 0.15 hectares of land. microHERB utilizes owner labor as well as two permanent workers in the production process.

Competitive advantages

1. Efficient Production portfolio
2. Location of the company
3. Micropropagation technique
4. The production of diversified, Greek clones of herbs

The Market

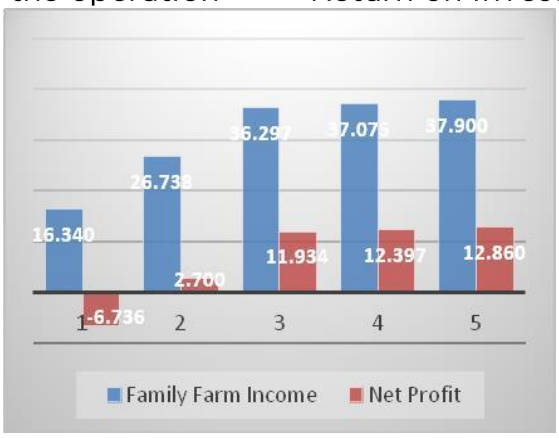
During the first year of operation, the company targets solely to the domestic market. After the first year of its operation, the company increases its volume of production and expands its sales to the domestic and foreign markets.

Financial plan

The start-up budget for the investment is about 170,000 €. Half of this investment cost will be covered by a bank loan, another 25% will be subsidized by the National Development Law. The remaining 25% will be self-financed.

At the first year of operation, microHERB presents negative Net Profits, but positive Family Farm Income, an important index in agricultural economics. After the first year, Net Profits turn positive. In addition, the Return on Equity index is positive and attractive from the first year of operation, while the Return on Investment index is negative only in the first year of the company's operation. Moreover, the level of breakeven price for Oregano that is the main product of the company is easily achievable according to the plan, and therefore the microHERB, can produce significant profits. Finally, the Net Present Value of the investment also denotes the attractiveness of the project

Forecasts of Net Profits and Family Farm Income of the operation



Forecasts of Return on Equity and Return on Investment ratios

1. Company Summary

microHERB is a micropropagation business located in the municipality of Markopoulo, Attika. The business produces mainly three herbs of the Greek flora, namely Oregano, Felty germander and Dittany of Crete. These three herbs have many uses in the food & drink and the pharmaceutical & cosmetic industry, but are also used in landscaping. The company targets both the domestic and the international market and can easily produce other species according to the market needs. The main advantage of the microHERB company is the ability to produce disease-free and identical plants, with the desired characteristics.

The company sells acclimatized plants, since it owns a specially designed greenhouse where plants produced in the laboratory remain for about three months. Plants are mainly sold directly to domestic growers. After the second year of its operation the company also promotes part of its production abroad.

The annual production of the micropropagation unit is about 450,000 plants. The production has two seasonal peaks, according to the planting seasons, which are in early spring (March-April) and late autumn (October-November).

The production process in the micropropagation laboratory lasts about two months. The laboratory is placed in a small prefabricated building of about 70m^2 that includes the glassware washing and storage area, the media preparation and sterilization area, the transfer area, the culture room as well as a small office for the manager.

Mission

The mission of the Herb-Tissue company is the production of high-quality, disease free acclimatized, nursery herb plants of the Greek flora. The production specializes in specific species of three Greek herbs, namely Oregano, Felty germander and Dittany of Crete that hold unique characteristics. The industry requires specific characteristics for its raw material and as a result growers demand disease free and genetically identical herb plants. The mission of Herb-Tissue lies in this high demand for propagation material that is still not met.

Objectives

The company aims to establish a modern and fully equipped micropropagation unit of a capacity of 450,000 nursery plants. This production level will be reach gradually over the first three years of the company's operation. The majority of the production will be distributed to domestic growers. The company will specialize in the production of a specific cultivar of Oregano, but will also produce Felty germander and Dittany of Crete. During the first year the total production of the company will be 300,000 plants and it will be promoted exclusively to the domestic market. After the first year, the production will increase and foreign markets will also be targeted.

2. Company targets

During the first year of operation the company will produce 300,000 plants, which accounts for about 70% of its maximum production. During this year the production will be promoted to domestic growers. Oregano plants account for over 70% of this production (220,000 plants). The company will also produce equivalent amounts of Felty germander and Dittany of Crete plants. The company targets to increase its production to 400,000 plants by the second year of its operation and to promote the additional 100,000 plants to nurseries abroad. During this second year a total of

290,000 Oregano plants, 55,000 Felty germander plants and 55,000 Dittany of Crete plants will be produced.

Finally, during its third year of operation the company will reach its maximum production level of 450,000 plants. Specifically, 320,000 Oregano plants, 65,000 Felty germander plants and 65,000 Dittany of Crete plants will be produced. The company targets to promote one third of its total production to neighborhood countries (e.g. Cyprus, Bulgaria, Turkey).

The above production plan will allow the company to yield a positive net profit by the second year of its operation. Also the gradual increase of the production level will allow the company to set well in the domestic market and make connections with foreign markets before reaching its maximum production.

3. Start-up Finance

The initial investment for the establishment of microHERB involves a 70 m^2 prefabricated building that houses the laboratory, all the necessary laboratory equipment and a 480 m^2 fully equipped greenhouse for the acclimatization of the plants (see section 8.1). In total, the company occupies 0.15 hectares of land. The total cost of the investment is estimates at about 170,000. This investment cost will be 25% selffinanced. Another 25% will be financed by the inclusion of the investment in the National Development Law, while the remaining 50% of the start-up cost will be covered by a long-term bank loan, with 8.25% interest rate. Finally, the company will receive a yearly short-term loan to ensure its cash-flow. This loan corresponds to 50% of the variable costs, with an interest rate of 8.25%.

4. Key to success

There are four main competitive advantages of the microHERB company that promote its success: 1. Production portfolio

The portfolio of the production is characterized by low market risk and can provide a significant income to the owner. The production of the company involves mainly Oregano plants. The cultivation of Oregano in Greece is well established, compared to other herbs and there is an increasing demand for certified propagation material. Additionally, the owner of the microHERB company has already come into contact with domestic growers interested in Felty germander and Dittany of Crete plants. Finally, the production schedule of microHERB is designed to satisfy the high seasonal demands of autumn and spring, when most plantations are established.

2. Location of the company

The location of the company is carefully selected so that it can ensure the production of disease free plants and minimize production and distribution costs. Specifically, the location is in the prefecture of Attica, in a non-agricultural area and close to the city of Athens. The location ensures that the production can easily be distributed throughout the country, while the climatic conditions minimize the energy costs for heating.

3. Micropropagation technique This technique has important advantages relative to the “traditional” ways of nursing. The most important advantages of the technique

are summarized in the production of a large number, disease free and uniform plants all year round.

4. The production of diversified, Greek cultivars of herbs

The company will focus on the production of Greek cultivars with unique characteristics as desired by the food & drink as well as the cosmetic & pharmaceutical industry. Therefore, the company will efficiently promote its product and will not face direct competition from other nurseries.

5. Market Analysis

5.1 Market segmentation

microHERB targets initially the Greek domestic market. During its first year of operation, its production will be exclusively promoted directly to domestic growers. During the second and third year the manager will seek to expand the company's production and promote it to neighbourhood countries. The manager has already come in contact with producers interested in the cultivation of the tree herbs, and the company is planning to supply them with the necessary propagation material. Additionally, there are about 1,000 hectares cultivated with Oregano in Greece which corresponds with 3040 millions of plants. The maximum oregano production of the company is 320,000 plants annually, which corresponds to 10 hectares. Approximately, two thirds of this maximum production will be promoted in the domestic market. This is a realistic target since the cultivation of Oregano is characterized by an increasing trend.

After the first year of its operation, the company will promote part of its production to nurseries in neighbourhood countries like Turkey, Bulgaria, Italy and Cyprus. These countries are important herb producers. Therefore, the company expects that its production will easily be absorbed by their market.

5.2 Location of the farm

The location of the farm is in the Municipality of Markopoulo in the prefecture of Attica. The location of the farm is isolated and selected to ensure the production of disease free plants. Furthermore, the location is near the national road that connects Athens to Thessaloniki and other parts of Northern Greece where Oregano cultivations are mainly located. Finally, the favourable climatic conditions ensure low energy costs for heating.

5.3 Competition

There are approximately 40 nurseries that produce herbs in Greece, 7 of which are located within the prefecture of Attica. However, the company will focus on the production of specific species using a specialized technique so it does not face direct competition. For the selection of the desired genotype the company will invest resources to analyze the active ingredient concentration of selective domestic genotypes.

5.4 Market structure

It is estimated that 1000 hectares are cultivated with Oregano in Greece, while in total, 3300 hectares are occupied with herb cultivations. The market has undergone significant changes during the last few years, mainly due to the appearance of many Greek food and drink as well as pharmaceutical and cosmetic industries that use herbs and aim to collaborate with Greek growers. One of the main problems herb growers have to face is the lack of certified propagation material, while on the other hand the industry requires herbs with specific characteristics. It is estimated that about 40 propagation units are involved but not specialized in the production of herbs. Furthermore, the lack of domestic certified propagation material often leads to imports. Therefore, the microHERB company can become an important and necessary link in the production chain of herbs.

Suppliers Power:

In the area of Attica, there are plenty of stores, where the company can purchase the necessary inputs for the tissue culture. As for the maternal plants used in micropropagation the owner will collect various plants and will test their concentration in essential oils and other active ingredients. He will then select the genotype with the optimum characteristics (e.g. concentration of carvacrol in oregano).

Buyers Power:

The number of herb growers in Greece is still small and the total herb cultivated land is limited. Furthermore, growers can propagate plants for the expansion of their cultivations. Therefore, the company will also aim to promote its production to foreign markets.

5.5 SWOT ANALYSIS

Strengths • The micropropagation technique leads to the production of a large number, disease free and genetically identical plants in a small space • The production of the plants is not subject to climatic and other environmental conditions • The location leads to low shipping and production costs. • The efficient production portfolio lowers risk and ensures a significant income. • The selection and reproduction of specific genotypes and species of herbs that can easily be promoted to the domestic and foreign market • The ability to effectively respond to market demands regarding the quantity and quality of the produced plants	Weaknesses • The production is capital intensive. The start-up investment cost and the annual production costs are very high and therefore the company needs to raise finance to meet the capital needs • The technique requires expertise and constant supervision throughout the production process
Opportunities • The rising market for herbs in the food and drink as well as the pharmaceutical and cosmetic industry • The opportunity to export disease free nursery plants • The rising demand for certified nursery plants by the industry and growers who practice contract farming	Threats The market is highly competitive due to: • Imports of propagation material from countries like Bulgaria • The ability to propagate herbs with other techniques like cuttings Farmers can also use their own propagation material to expand

6. Products and production process

6.1 Product description

microHERB produces three different herbs (Oregano, Dittany and Felty germander). However, after its establishment in the market, the company will seek to invest in the tissue culture of new herbs. The majority of the company's production involves Oregano. Oregano is a well-known, native herb. It is a perennial plant located mainly in open or mountainous habitats. It is used mainly in the food industry but also in pharmaceuticals. The Greek oregano (*Origanum vulgare* and *Origanum onites*) is considered as top quality worldwide. Felty germander (*Teucrium polium* and *Teucrium capitatum*) is a herb native to Mediterranean region. Its leaves are used in the pharmaceutical industry. Dittany of Crete (Cretan dittany, *Origanum dictamnus*) is a species native to Crete, used in food and pharmaceutical industry. In addition, all these herbs are used in addition as ornamental plant in gardens and urban greenroofs in areas with Mediterranean climate.

The company will produce Oregano, Felty germander and Dittany acclimatized plants that it will promote primarily to Greek individual producers and after the second year of its operation to nurseries in neighborhood countries.

The amount of plants produced annually can be seen in Table 1. It should be noted that average losses, are estimated at 25%.

Table 1. Herb-Tissue expected production (number of plants).

	1	*2*	*3*	*4*	*5*
Oregano	220,000	290,000	320,000	320,000	320,000
Felty germander	40,000	55,000	65,000	65,000	65,000
Dittany	40,000	55,000	65,000	65,000	65,000
TOTAL	300,000	400,000	450,000	450,000	450,000

6.2. Description of the production process and the equipment needed

Micropropagation is a multiplication technique that can produce a large number of plants using plant tissue from one donor plant. The technique consists of four or five stages. The first stage involves the preparation of the donor plant, the second stage is the initiation stage, the third stage is the multiplication stage and the fourth stage is the rooting stage. The fifth stage involves the acclimatization of the plants and it is optional since some growers choose to acclimatize their plants, while others sell them into culture vessels after they root and leave the acclimatization up to the producers.

microHERB owns a laboratory for the multiplication of the plants and a greenhouse for the acclimatization, so in this case plants are sold acclimatized and all five production stages are taking place in microHERB.

The laboratory is housed in a prefabricated building that covers 70 m^2. The walls are painted with an easy to wash acrylic paint and the floor is covered by tiles. As seen in Figure 1 the laboratory consists of four areas. The first area is the glassware washing and storage area. In this area glassware like culture vessels are washed after they are autoclaved and before they are stored. The washing area is equipped with two sinks. Also water distillation and deionization devices are required as well as cupboards for

the storage of glassware. The media preparation and sterilization area is located near the washing area. The media preparation area has work benches with plastic laminate surface.

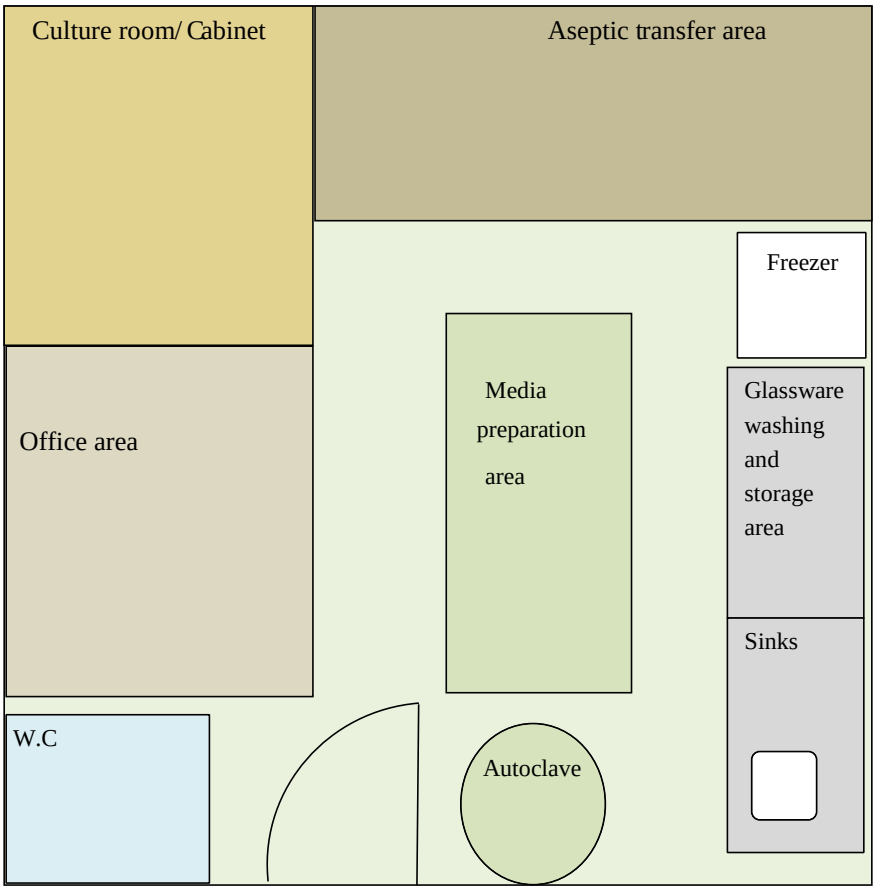
The majority of the laboratory equipment (see list below) is placed in the media preparation area. The laboratory has a walk-in culture roomwhere plants grow. Temperature, light and humidity control systems are installed and metal shelves are used. The size of the growth room is about 10 $m^2$and the available shelf area is 50 m^2. The aseptic transfer area is isolated from the rest of the laboratory so that contamination problems are minimized. The area requires extra electric outlets and switches and smooth, easy to clean surfaces. Finally, the laboratory has a small office space, where the manager can keep his computer equipment.

Additionally, the laboratory has the following equipment:

- Refrigerator/freezer
- Water Distillation and deionization devices
- Glassware including culture vessels like test tubes, petri dishes, mason jars, baby food jars magenta cap vessels and other glassware like pipettes, graduated cylinders, volumetric flasks, and beakers.
- A micro balance and a top loading balance
- A hot plate/stirrer
- A pH meter
- An autoclave
- A dishwasher
- A rotary shaker

As for the heated greenhouse used for the acclimatization of the plants it is estimated that the required space is 480 m^2. At the first stage of acclimatization, the young plants stay for one week on heated benches (about 20° C) with fog system. After that, the plants are removed from the heated benches and stay for one more week in controlled temperature inside the greenhouse. At the final stage, the plants are moved outside the heated greenhouse for 2,5 months, in a plastic unheated tunnel greenhouse.

Figure 1. Laboratory plan.



6.3 Personnel

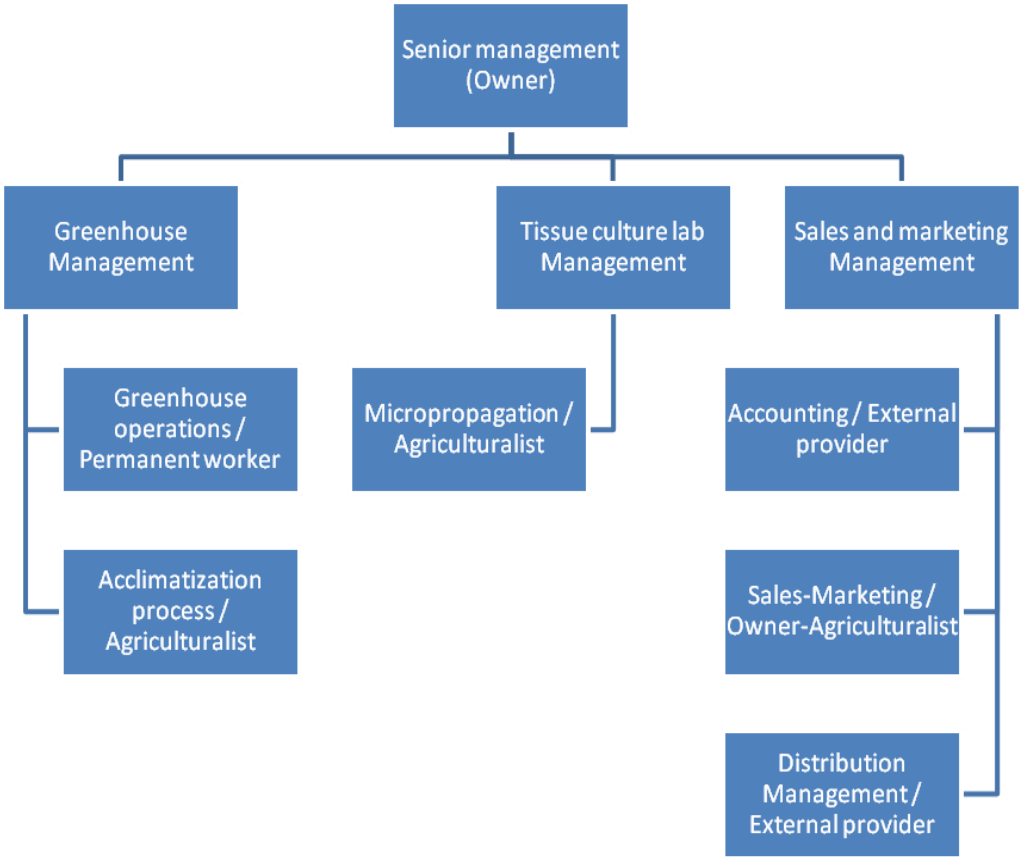
The business will offer full time employment, not only to the owner but also two permanent workers. The micropropagation technique requires expertise so that production can be maximized and potential problems can be spotted and treated early. Thus, one of the permanent workers should be an agriculturalist. One more full-time worker is required to assist in the greenhouse operation (Table 2).

Table 2. Annual personnel cost of the farm (€)

Year	*1*	*2*	*3*	*4*	*5*
Manager (Owner)	16,000	16,000	16,000	16,000	16,000
Agriculturalist	10,710	14,280	14,280	14,280	14,280
Greenhouse worker	8,190	10,920	10,920	10,920	10,920
TOTAL	34,900	41,200	41,200	41,200	41,200

6.4 Organizational plan

The owner of the company is responsible for the senior management. Primarily the owner is responsible for the marketing and sales strategy of the company but also works in the laboratory, together with the agriculturalist. The manager also oversees greenhouse operations. The agriculturalist works primarily in the laboratory but also monitors greenhouse activities and assists in the sales and marketing management. The permanent worker is responsible for greenhouse operations, like maintenance. Finally, the company collaborates with an external accounting provider.



7. Marketing strategy according to the marketing mix

7.1 Sales strategy

The company will promote its products primarily to the domestic market. Plants will be distributed directly to producers. After its first year of operation, the company will promote part of its production to nurseries in neighborhood countries, like Bulgaria, Turkey, Italy and Cyprus.

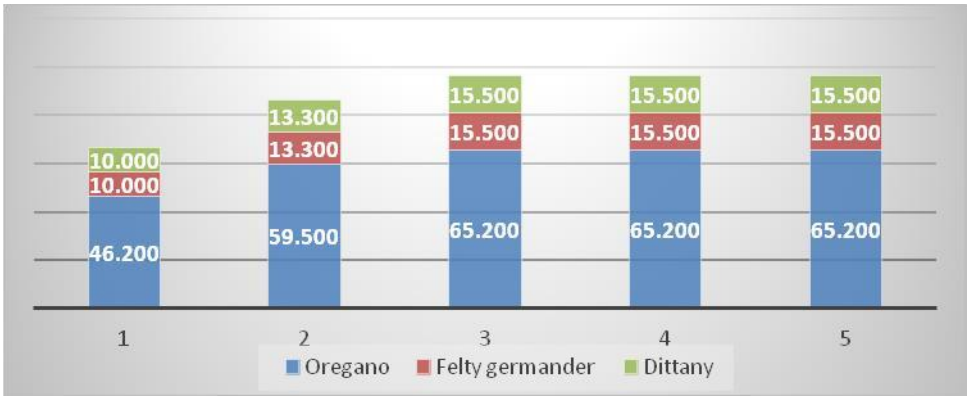
The company offers competitive prices, to gain a market share from the first year of operation. According to experts in the field, the price of certified planting material, produced with micropropagation ranges from 0.25 to 0.35 €/plant. In the case of Oregano, the company offers a low price as its main target is to set in the market. As far as the other two herbs are concerned, their price is formed at the minimum of the above range (0.25 €/plant). The company also uses price differentiation as a mean to promote its production to nurseries abroad. Specifically, the company distributes plants to foreign markets at 0.22 €/plant in the case of Dittany and Felty germander and 0.19 €/plant in the case of Oregano. The expected average prices for Oregano, Felty germander and Dittany, are presented in Table 3.

Table 3. Herb-Tissue expected prices.

	Price (€/plant) (Domestic producers)	Price (€/plant) (foreign nurseries)
Oregano	0.21	0.19
Dittany	0.25	0.22
Felty germander	0.25	0.22

Given the producer prices and the expected production (see also Table 3), the sales forecast is presented in Figure 2.

Figure 2. Sales forecast



7.2 Distribution strategy

Plants will be distributed throughout the country at the expense of the buyers. However, a partnership with a shipping company will ensure a lower shipping cost.

7.3 Marketing Strategy

The marketing strategy of the company relies on personal communication with domestic herb producers' organizations and agricultural associations. The manager has already come in contact with producers interested to invest in the production of Felty germander and Dittany. The manager will also come in contact with domestic food, cosmetic and pharmaceutical industries to promote the collaboration between all links of the production chain. After the company sets in the domestic market, the company will seek for collaborations with nurseries abroad. In order to follow this marketing strategy, the company will cover an annual cost for the promotion of its products, but also an extra promotion cost during the first year of its operation. This cost is estimated at 20,000 and it covers the following:

- the development of the corporate identity (e.g. design of the company's logo),
- the development of the company's website,
- travel expenses for the owner, particularly since many growers are located in Northern Greece,
- registration of the company in professional yellow pages and other professional guidelines
- advertising in newspapers and other agricultural related magazines.
- radio advertising, particularly in local radio stations
- participation in related domestic and foreign expos

The development of a website available in Greek but also in English is particularly important, so that the company can promote and offer information on its unique products. It is estimated that, after the first year of operation, promotion will be cut down to 3,000 €.

8. Financial Plan

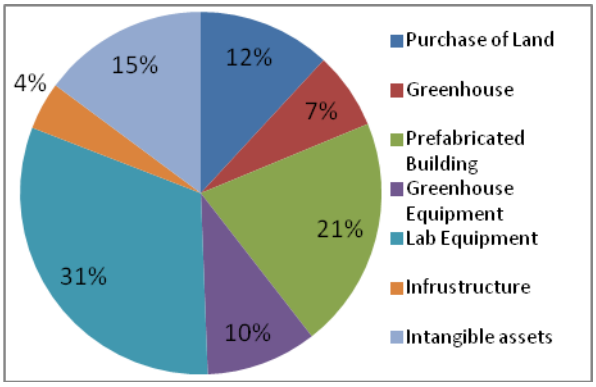
8.1. Start-up investments

Table 4 presents the start-up budget for the investment, which is about 170,000€. The main part of the budget regards the laboratory, and specifically the Lab equipment and the construction of the prefabricated building (31% and 21%, respectively). Intangible assets regard the cost of licensing as well as the start-up promotion costs.

Table 4. Start-up budget (€)

Figure 2. Start-up budget breakdown

Investments	*Value*
Purchase of Land	20,000
Greenhouse	11,600
Prefabricated Building	35,000
Greenhouse Equipment	16,668
Lab Equipment	53,130
Infrustructure	7,200
Intangible assets	25,000
TOTAL	**168,598**



8.2. Annual production costs

Table 5 presents the annual production costs for the first five years of operation. The company will receive a yearly short-term loan to ensure its cash-flow that corresponds to 50% of the variable costs, with an interest rate of 8.25%. According to Figure 4, the main part of the annual costs regards the labor costs (48%), while variable and non-variable capital cost regard 28 and 24% of the annual costs, respectively. Energy costs (heating cost for the greenhouse and electricity cost for the tissue culture lab) are, by far, the main element of the variable costs, followed by general expenses (Figure 5).

Finally, Figure 6 depicts annual costs per year of operation. Until the third year of operation, when the company reaches its production target, the annual costs are increasing. During the next two years, the annual cost is slightly decreasing, due to the slight decrease of the annual capital costs. It is important to emphasize that the contribution of each cost item to the annual costs is almost stable.

Table 5. Annual costs

Year	*1*	*2*	*3*	*4*	*5*
Land	450	450	450	450	450
Labor	34,900	41,200	41,200	41,200	41,200

Permanent	18,900	25,200	25,200	25,200		25,200
Owner	16,000	16,000	16,000	16,000		16,000
Capital Costs	38,546	43,030	44,056	43,593		43,130
Variable costs						
Energy Costs	17,866	22,381		23,817	23,817	
Fertilizers-Plant	11,768	15,417		16,420	16,420	
protection	107	142	160	160		160
Pallets	960	1,280	1,440	1,440		1,440
Packaging-Shipping	960	1,280	1,440	1,440		1,440
Other direct costs	571	762	857	857		857
General expenses	3,500	3,500	3,500	3,500		3,500
Non-Variable Capital Costs	20,679	20,649		19,776	19,313	
Depreciation	5,179	5,179		5,179	5,179	
Insurance	991	957	923	888		854
Maintenance	2,517	2,430	2,343	2,256		2,169
Interests	11,992	12,083		11,452	11,111	
TOTAL	72,936	83,400		**83,803**	**83,340**	

Figure 4. Annual cost breakdown (after the third year of operation

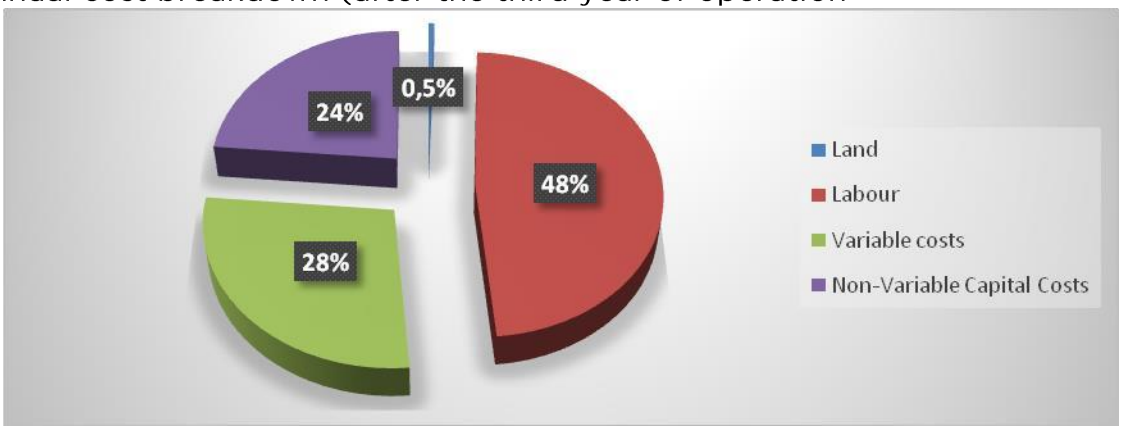


Figure 5. Breakdown of variable costs (after the third year of operation)

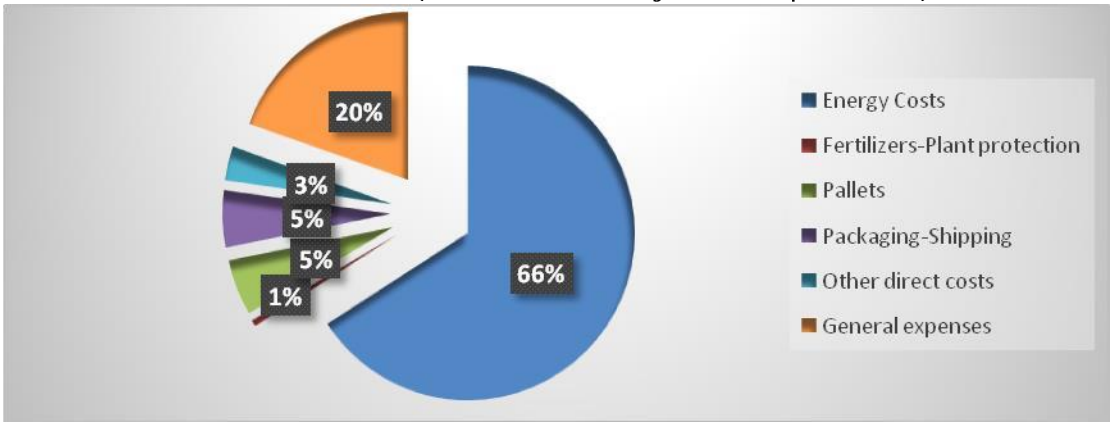
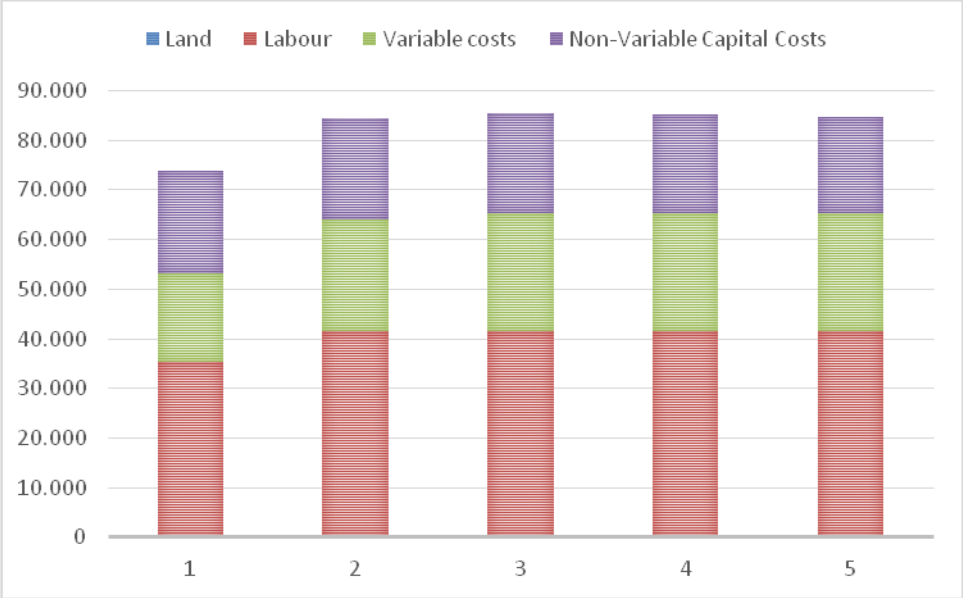


Figure 6. Annual costs for the first five year of the investments.



8.3. Economic results

Table 6 presents the economic indices for the company. microHerb presents positive Net Profits from, the second year of operation (and profit margin). However, the family farm income is positive, even form the first year of operation. Net profits increase during the next year, as well as the Family Farm Income.
Finally, the returns on equity are positive and increasing form the first year of operation. On the other hand, the return in investment ration is negative only in the first year of operation (see also Figure 8).

Table 6. Economic indices per year

Year	1	2	3	4	5
Revenues	66,200	86,100	96,200	96,200	96,200
Variable costs	17,604	21,971	23,300	23,300	23,300
Non-Variable costs	55,332	61,429	60,966	60,503	60,039
Explicit	43,690	53,074	53,649	52,905	52,115
Implicit	29,246	30,326	30,617	30,898	31,225
Total costs	72,936	83,400	84,266	83,803	83,340
Gross Profit	48,596	64,129	72,900	72,900	72,900
Profit (excl. tax, interests & depreciation)	10,435	19,962	28,907	29,028	29,150
Family Farm Income	16,340	26,890	36,450	37,228	38,052
Net Profit	-6,736	2,700	11,934	12,397	12,860
Profit Margin	-10.17%	3.14%	12.41 %	12.89 %	13.37 %
Return on Investment	3.95%	10.86 %	17.76 %	18.40 %	19.10 %
Return on Equity	4.96%	33.90 %	63.01 %	67.34 %	72.10 %

Figure 7. Net Profits and Family Farm Income of the operation

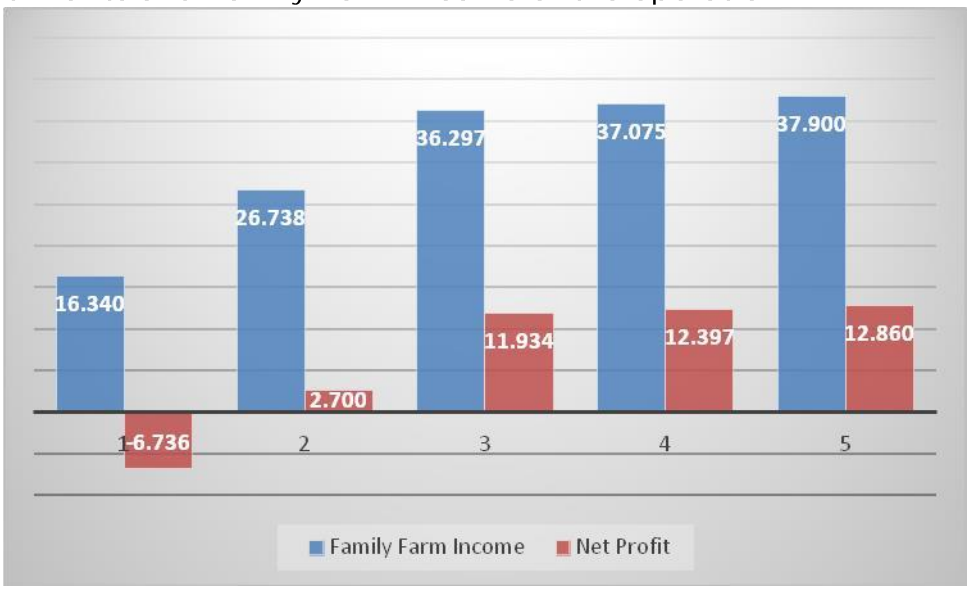
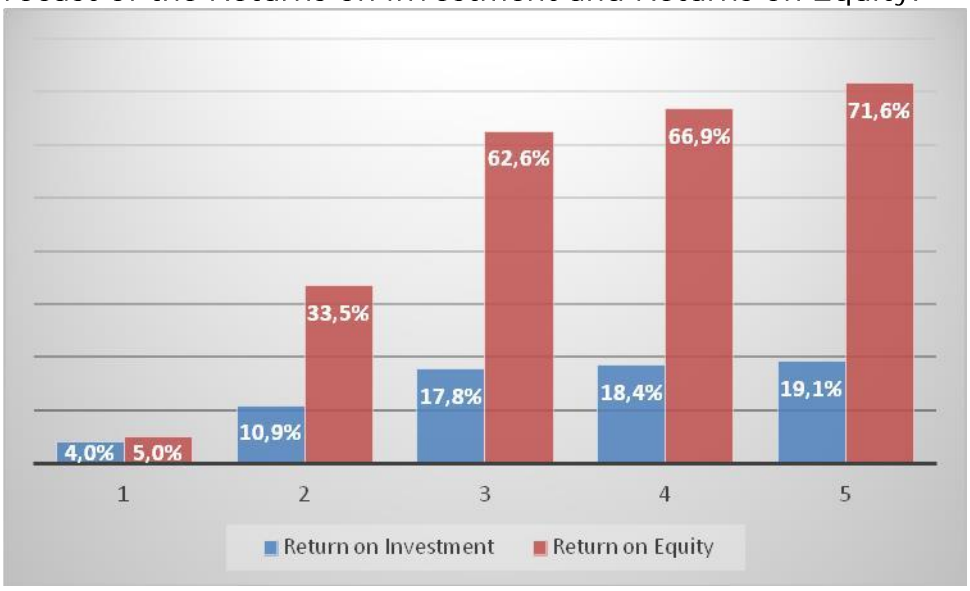


Figure 8. Forecast of the Returns on Investment and Returns on Equity.



8.4. Break-even analysis

The results of the break-even analysis, are presented in Table 7. Break-even price reflects the minimum price that the company needs to achieve in order to cover the variable cost of production. In the case of the microHerb company, the analysis focuses only in the break-even price of Oregano, as the other two herbs hold a small production share. The results are presented in Table 8 apart from the first year of operation, the break-even price is significantly lower than the price of Oregano.

Table 7. Break-even Analysis per year for Oregano production

	1	*2*	*3*	*4*	*5*

Oregano sold to farmers in the domestic market	0.237	0.194	.	0.148	0.146	0.144	.
Oregano sold to foreign nurseries Abroad	-	0.140	0.054			0.050	0.046

8.5. Net Present Value of the investment

The Net Present Value of the investment is estimated at 24,032 € (assuming 10% rate of return) which highlights the attractiveness of the investment. The high level of the NPV is partly the result of the fact that 25% of the investment is state financed (National Development Law).

9. Conclusions

microHerb is a newly developed micropropagation business that focuses on the production of three native herbs, namely Oregano, Felty germander and Dittany of Crete. The company owns a small micropropagation laboratory and a greenhouse for the acclimatization of the plants. The total utilized area is 0.15 hectares. Half of the initial investment cost is covered by a bank loan, another 25% of the cost is subsidized and the remaining 25% is self-financed. As the business plan demonstrates, the proposed investment is attractive, since it produces positive profits and income. The profitability this investment is also reflected by the level of other indices such as returns on equity and returns on investment. The Net Present Value of the investment also denotes the attractiveness of the investment. An extra advantage of this company is that it can easily expand to other herbs (or even ornamentals or fruit trees) according to the market demand.