

# IENICA

**Interactive European Network for Industrial Crops and their  
Applications**

**Forming Part of the IENICA-INFORM Project**

## **REPORT FROM THE REPUBLIC OF CYPRUS**



INFORM-IENICA is a project funded under the Fifth  
Framework Programme by DG XII of the European  
Commission



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**NICOSIA 2004**

# ACKNOWLEDGEMENT

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This work was funded under the IENICA workstream of the IENICA-*INFORM* project. IENICA is the Interactive European Network for Industrial Crops and Applications. The overall project is funded by the Fifth Framework Programme of the European Commission under the Quality of Life Programme. This project is a development of the FAIR Programme (FP4)-funded IENICA project.

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# METHODOLOGY

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This report was prepared according to the general requirements of the IENICA-INFORM project, in respect of the overall format, the areas for consideration and the information to be gathered and presented about the production and industrial exploitation of non-food crops in Cyprus. To this effect, a review of official documents on policy issues, reports with statistical data, Government budgets, publications on relevant issues and contacts with representatives of the most relevant sectors through interviews and by telephone or e-mail have been made.

Forest trees and the use of plants as biofuels are excluded from IENICA reports.

No concise reports on non-food activities have been identified except for data concerning some activities related to the production and processing of aromatic plants. Researchers, producers and industrial groups have been identified in the process of information gathering.

The main contacts were:

- Department of Statistics
- Department of Agriculture of the Ministry of Agriculture, Natural Resources and Environment
- Sector of Aromatic Plants, Department of Agriculture of the Ministry of Agriculture, Natural Resources and Environment
- Agricultural Research Institute of the Ministry of Agriculture, Natural Resources and Environment
- Forest Department, Ministry of Agriculture, Natural Resources and Environment
- Cooperative Union for the trading of Carobs, Paphos, Ltd.
- Pharmaceutical industry: REMEDICA
- Pharmaceutical industry: MEDOCHEMIE
- Pharmaceutical industry: AEGIS
- Researchers and producers of herbs
- Research Promotion Foundation

Exchange Rate used: 1 C£ = 1.72 Euros (September 2004)

# EXECUTIVE SUMMARY

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Cyprus is situated in the north–eastern part of the Mediterranean, on the crossroads between Europe, Africa and Asia. Despite its small size Cyprus has a diversified crop production and a rich flora, consisting of 1907 species, subspecies and flowering plants, of which 141 are endemic.

The agricultural sector is a vital sector of the Cyprus economy in terms of its contribution to the Gross Domestic Product (GDP) and the employment of the economically active population. Agricultural exports constitute a significant proportion of total domestic exports.

The agricultural sector has expanded significantly in the period 1960 (independence of Cyprus according to the Zurich-London Treaty) – 1974 (Turkish invasion in Cyprus). Turkish military forces have occupied the more productive part of the island since 1974. The displaced farmers moved to the less productive part of the island and were faced with many difficulties caused by the invasion. The new situation seriously affected the broad agricultural sector. Nevertheless, thanks to concerted efforts and heavy investment in land improvement and irrigation, the sector was reactivated and approached the pre-1974 levels of production.

Shortage of water resources has been a major problem affecting all households and the agricultural sector in Cyprus throughout its long history. In order to address this problem, a long term Water Management and Water Development Policy is being implemented since the establishment of the Independent Republic of Cyprus in 1960. In the framework of this policy:

- Dams for water storage and recharge purposes have been constructed and large irrigation projects have been implemented.
- Two factories for the desalination of sea water have been constructed to ensure continuous supply of drinking water to all households.
- The recycling of water is promoted through treatment and reuse of treated domestic effluents and industrial wastes for irrigation purposes.

The development policy of Cyprus aims at restructuring and upgrading the agricultural sector. An integrated plan for restructuring the agricultural sector is implemented by the Department of Agriculture of the Ministry of Agriculture, Natural Resources and Environment.

The plan provides incentives to uproot unproductive fruit trees and plant other more promising crops, including olive trees, herbs, flowers and vegetables. A number of projects including organic farming, integrated production systems etc. aim at promoting suitable and environmentally friendly production methods.

The production and exploitation of industrial crops other than herbs, is small in Cyprus and limited to tobacco and sesame. Currently there is an increasing activity in the production and exploitation of aromatic crops, falling in the sector of crops with special uses. The interest and activity both at the private and the public levels are growing, along with the growing demand for the local and overseas markets.

The other three market sectors of non-food plants, i.e. starch, natural fibres and vegetable oils, are not developed in Cyprus. However, the industrial exploitation of crops falling into these sectors is possible in the future, to the extent that feasibility is ensured under local conditions and in the context of future developments and new trends.

Some of the principal food crops growing in Cyprus, for example cereals (wheat and barley) and potatoes and probably other crops, may have combined exploitation in the future, provided that the cost efficiency in the chain from the production to the market; market demands; future approaches of the Common Agricultural Policy with respect to industrial crops; incentives provided at national and European levels and the flow of relevant information will be adequate to raise the interest of the producers, the industry and the traders.

The same applies to some trees which thrive in Cyprus and which have the potential for industrial exploitation such as carob trees and eucalyptus.

The cultivation of aromatic plants is an increasing activity in Cyprus. The herbs are used as spices and herbal teas and for the production of essential oils, cosmetics and pharmaceuticals.

The local and overseas herb market is growing. There is a growing demand for the export of some aromatic plants, especially fresh plants, and an increasing interest in the production and export of herbs with medicinal properties.

Many aromatic plants are collected from the wild. This situation evokes environmental concerns, which grow along with the growing market for herbs that puts an additional strain on resources. Strengthening the cultivation of these plants and controlling their collection from the wild may address environmental concerns.

The cultivation of herbs is in line with the developmental and environmental policies of Cyprus. The Ministry of Agriculture, Natural Resources and Environment, in its effort to stimulate and contribute to the promotion and development of the cultivation of herbs, provides incentives to the private sector and implements research aiming to improve production practices and know-how.

Incentives are provided to farmers, in the form of subsidisation of interest on loans for the implementation of improved methodologies and techniques in the cultivation, harvesting and processing of aromatic plants.

Besides subsidization in order to increase the interest of the private sector for capital investment, the Ministry of Agriculture, Natural Resources and Environment, is implementing programmes and research, aiming to produce and transfer to the private sector improved knowledge, practices and technology. These programmes are carried out by two of the Departments of the Ministry, namely, the Department of Agriculture and the Agricultural Research Institute (ARI). The production and processing of industrial crops as well as the combined food and non-food use of certain plants, through effective exploitation of new developments in the island (more water availability, reuse of treated waste water etc) and the market demand, may open new opportunities in the future, enabling the addressing of environmental problems and satisfying socio-economic needs.

In the framework of the Research Promotion Foundation and the recently established RISC Project, a set up will be created to disseminate information on research, innovation and technological developments. In this context, they may play an important role in

disseminating information and promoting know-how and networking in the field of industrial exploitation of plants.

The Research Promotion Foundation (RPF) was founded in 1996 by the Government of Cyprus, in order to promote scientific and technological research in the island. The RPF is participating in a number of projects, submitted and selected for funding by the European Commission within the framework of FP5 and FP6. The most important of them is *the RISC Project* (Regional Innovation Strategy for Cyprus).

# INTRODUCTION

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Cyprus is the third largest island in the Mediterranean, with a long history and civilisation of 9000 years. It has an area of 9,251 square kilometres. Its climate is characterised by long, warm and dry summers and by short, mild winters. Thanks to its climate and the diversity of topography, Cyprus has a diversified crop production and a rich flora.

The principal crops in the lowlands are cereals (wheat and barley), a variety of vegetables, potatoes and citrus. Deciduous fruit trees and nuts are grown in the fertile mountain valleys. The olive and carob trees grow widely. The south-west mountain of Troodos is covered with pine, dwarf oak, cypress and cedar. A large area of its southern and western slopes is covered with vineyards.

The most valuable export crops are potatoes, citrus, vegetables and table grapes.

The botanical elements of Cyprus, besides the endemic ones, incorporate plants growing in the surrounding continents of Europe, Asia and Africa. Herbs growing naturally all over the island, thanks to the favourable climatic conditions, constitute a significant part of the Cyprus flora.

The flora of Cyprus includes 1907 species, subspecies and flowering plants, of which 141 are endemic. The most complete study, presented in the two volumes of “The Flora of Cyprus”, has been accomplished by R.D. Meikle of the Herbarium, Royal Botanic Gardens, Kew, U.K. The Kew Herbarium undertook this study with the support and assistance of the Ministry of Agriculture and Natural Resources of Cyprus. The information of the “Flora of Cyprus” is computerised to provide access to investigators and completed by the ARI (“The Cyprus Flora in Checklist Format”, Athina Della, 1999). This list includes both native and cultivated plants.

Floriculture is a relatively new agricultural activity that is rapidly increasing. Flowers are among the most profitable crops per square meter and volume of water that is the limiting factor for the irrigated agriculture in Cyprus (Chimonidou, 2002). Recently, particular

attention was given to the native and endemic species and research is carried out at the ARI (joint projects between Cyprus and Greece), in order to evaluate endemic species from Cyprus flora for potential use in commercial floriculture (Review of ARI 2000-2001).

The scarcity of water resources creates problems affecting the production of crops. Cyprus does not have lakes and rivers with constant water flow. In order to decrease dependency on the annual rainfall, which is highly variable resulting in frequent droughts, a long-term policy has been developed since the independence, aiming at water management and water development. The implementation of various projects in combination with the use of treated wastewater for irrigation purposes, provide new opportunities including opportunities for the cultivation and exploitation of biodegradable, agricultural raw materials.

# THE AGRICULTURAL SECTOR IN CYPRUS

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The agricultural sector is a vital sector of the Cyprus economy. Agricultural Areas in Cyprus may be grouped into two main categories or zones, i.e. the “Plain” and “Mountainous” Agricultural Zones, each one with its own development targets, capabilities and prospects. Cyprus’ agriculture is irrigated (vegetables, citrus, potatoes, melons, table grapes, deciduous fruit, bananas) or dry land /rain fed agriculture (cereals, fodders, olives, carobs, wine grapes, almonds).

In the period 1960 –1974, between the declaration of the independence of Cyprus (according to the Zurich-London Treaty) and the Turkish invasion in Cyprus, the agricultural sector has expanded significantly. After the Turkish invasion in 1974, the more productive part of the island, which accounted for 46% of crop production, 79% of citrus, 68% of cereals, 100% of tobacco, 86% of carobs, 65% of green fodder and 45% of livestock production, was occupied.

The concentration of displaced farmers in the less productive part of the island, the shortages of fodders and water resources and other difficulties caused by the invasion, incurred blows to the broad agricultural sector. Nevertheless, it was reactivated through concerted efforts and heavy investment in land improvement and irrigation and it has approached the pre-1974 levels of production.

According to the Agricultural Statistics of 2002, the agricultural sector (fishing is no longer part of the agricultural sector according to NACE -Rev.1-classification) exhibited a marginal increase in 2001 compared to the previous years. This is attributed to the favourable weather conditions, which resulted in the increase of the volume of the crop production, mainly for the cereals that increased by 11.3%. The value of livestock production maintained the upward trend of the recent years, with an increase of 3.2% in 2002. The increase of the agricultural sector at constant prices in 2002 resulted in a marginal change of its share to GDP, amounting to 3.8% in 2002.

Employment in the agricultural sector recorded a marginal decrease to 23,000 persons in 2002 compared with 23,400 in 2001. This decrease is attributed to the decreased demand for labour for agricultural activities. The share of employment in agriculture in relation to the total labour force was 6.9% in 2002, compared with 7.1% in 2001, 7.4% in 2000 and 8% in 1998.

Exports of the agricultural products recorded a 15.8% decrease in value terms dropping to £36.9 million (63.47 million Euros) in 2002 compared with £43.8 million (75.34million Euros) in 2001. This is attributed to the great decrease in the value of exports of potatoes. The earnings from potato exports decreased to £11.1 million (19.09 million Euros) in 2002 compared with £17.5 million (30.1 million Euros) in 2001.

Citrus fruit exports increased from £14.7 million (25.28 million Euros) in 2001 to £18.4 million (31.65 million Euros) in 2002. The European Union countries absorbed 76.4% of the agricultural exports in 2002 in comparison with 78.7% in 2001.

On the other hand the exports of processed agricultural products increased, reaching C£24.3 million (41.7 million Euros) from C£24.4 million (41.9 million euros) in 1998. The main exported products in this group, are wines, halloumi cheese (a traditional white cheese) and fruit and vegetable juices.

The total exports of raw and processed agricultural products in 1999, accounted for 17.7% and 12.3% of total domestic exports respectively.

Some statistical information relevant to the production of crops (Agricultural Statistics of 1999 and 2002, Statistical Service of Cyprus) is presented in the tables of Annex 1.

Shortage of water resources is a problem with which Cyprus has always been confronted. This problem has been a constraint for the development of agricultural and other sectors. In order to better manage the scarce water resources, to overcome constraints for the development and to achieve a continuous supply of drinking water to every household, a long-term policy has been developed.

The implementation of this policy has resulted in the following:

- a) A large number of dams for water storage and recharge purposes have been constructed. The construction of dams' has been achieved in the framework of a long-term plan. The current storage capacity of dams and ponds has reached 303 million cubic meters (in the year 2000).
- b) A number of large irrigation projects have been implemented, which include the construction of dams, canals, conveyors, pumping stations, reservoirs, irrigation networks and borehole schemes in various areas.
- c) The recycling of water is promoted by the Government through financing projects and establishing criteria and codes of practice for the reuse of water for irrigation, recharge and amenity purposes. The funds for the tertiary treatment and for the distribution of treated domestic effluents of the towns and large areas are provided by the Government budget, on the condition that they are used for irrigation purposes in the agricultural sector. In the villages, the treatment and reuse are subsidised so that the citizens pay not more than 80 Cyprus pounds per year (137 Euros).
- d) Desalination of seawater has been promoted since 1997 and up to now two sea water desalination units have been installed.

Desalination of seawater became necessary due to the reduction of annual rainfall during the last years, followed by a dramatic reduction in the flow to the dams. This measure is the most recent development aiming to achieve a continuous supply of drinking water to every household. An additional, indirect benefit of desalination to the development of agricultural and other sectors, is the consequent saving of water from the dams and through the savings, more water availability for irrigation purposes.

Two desalination units have been constructed since 1997 and the resulting savings of water from the dams, with a positive though indirect impact on the potentials of irrigated agriculture, accounted for 66.4 million cubic meters.

# OUTLINE OF AGRICULTURAL POLICY

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The development policy of Cyprus aims at restructuring and upgrading the agricultural sector in order:

- (a) To satisfy the needs of harmonisation with the European Union, with the basic reference point being the Common Agricultural Policy,
- (b) To further develop the production of good quality, healthy and safe food at competitive prices in the context of sustainable agriculture,
- (c) To improve production and competitiveness
- (d) To make the best use of the new opportunities and perspectives offered by the European Union and the common market upon accession.

The development policy of Cyprus aims at restructuring and upgrading the agricultural sector.

An integrated plan for restructuring the agricultural sector is implemented by the Department of Agriculture of the Ministry of Agriculture, Natural Resources and Environment. The plan provides incentives to uproot unproductive fruit trees and plant other more promising crops, including olive trees, herbs, flowers, vegetables and others. Suitable and environmentally friendly production methods are promoted through incentives, provided under a number of projects including organic farming, integrated production systems etc.

Systematic measures are implemented, aiming to improve productivity through the introduction of

- New and improved varieties of crops,
- Improved agricultural practices,
- Mechanisation of farming activities,
- Expansion of irrigation and modernisation of irrigation methods and means,
- Plant protection,
- Soil conservation in mountain and hilly areas.

In 1997 a project provided for the subsidisation of interest on loans for capital investment in agriculture, aiming at the modernisation and improvement of production.

# STATE OF THE ART IN GROWING AND EXPLOITING INDUSTRIAL CROPS IN CYPRUS

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The production and exploitation of industrial crops in Cyprus is small, except for the crops with special uses. The three market sectors of non-food plants, i.e. starch, fibres and oils, are not developed in Cyprus. Their production and exploitation is small and limited to tobacco and sesame.

According to the Agricultural Statistics of 2000, only an area of 79 out of a total crop area of 137,336 hectares was cultivated with industrial crops as follows: tobacco 76 and sesame 3 hectares. 374 tonnes of tobacco were produced, worth C£549,780 (944,522 Euros). 1 tonne of sesame was produced, worth C£1,500 (2,577 Euros). An additional area of 280 hectares was cultivated with peanuts in 2000. This is a reduction from 520 hectares in 1999, due to additional restrictions on water used for irrigation purposes during 2000 and also to the import of lower quality but cheaper peanuts from abroad. However, water availability is increasing and thus the level of production will be mainly dependent on the market availability and the competitiveness of the products. Peanuts are recorded as industrial crops although they are used only as food crops. All of these crops are sold to industry and other sectors on the domestic market.

The Ministry of Agriculture, Natural Resources and the Environment is implementing, since 1997, a plan of subsidies to farmers growing Cyprus tobacco (virginia). The subsidy covers a maximum quantity of 350 tonnes of dry tobacco with a maximum fund of 612,000 Cyprus Pounds (1,051,416 Euros) per year. The subsidy is approximately equal to the corresponding subsidy provided by the EU for the same variety of tobacco. It is considered very important for the local industry and for the communities growing this plant.

# 1 Specialist Crops

There is an increasing interest and activity for the production of herbs and other plants, which are used as industrial and /or food crops. This activity concerns both the private and the public sectors. There is also an increasing demand for these crops at home and on overseas markets.

The growing preference of consumers to biopharmaceuticals and bio cosmetics stimulates both the interest of scientists to carry out research into the composition and properties of herbs and the interest of scientists, farmers and industry to invest in this sector.

It is worth mentioning that the plantations of some trees, which grow well in Cyprus, offer environmental and other benefits and also have the potential for industrial exploitation, are decreasing. The potential for their industrial exploitation may become an additional initiative to control their eradication.

The tradition in the use of wild herbs in Cyprus is long, going back to ancient times. Herbs are used for medicinal and culinary purposes by the local population.

Aromatic crops have become increasingly popular in recent years due to their use in international cuisine and their association with better health. During the last decades, people in general and particularly researchers and scientists, have focused their attention on the properties of herbs, enabling their use for medical purposes. Some of these applications have a long history according to references in books of ancient authors.

The agro climatic conditions in Cyprus are ideal for the cultivation of aromatic crops.

## 1.1 Environmental concerns

Many aromatic plants are collected from the wild. The extensive exploitation of many aromatic plants has decreased plant population size to such an extent, that some of them are almost extinct. In addition, experts consider wild collection detrimental to the ecosystem, accelerating soil erosion and reducing biodiversity. The growing market for herbs puts an additional strain on resources.

## 1.2 Herb cultivation

There is increasing activity in the cultivation of herbs for use as spices and herbal teas and for the production of essential oils, cosmetics and pharmaceuticals.

The local herbs market is growing along with the growing demand for the export of some herbs.

The agro climatic conditions of Cyprus are ideal for growing these plants, which in addition have very low requirements in irrigation water.

Both the public and the private sectors are involved in activities relevant to the cultivation and exploitation of aromatic plants.

**Public sector** - The Ministry of Agriculture, Natural Resources and the Environment is implementing a special plan in its effort to increase the cultivation of aromatic and herbal plants. Within this framework:

(a) The Department of Agriculture has established, during the last five years, the necessary infrastructure which consists of: plantations of aromatic and herbal plants, seeds, nurseries, experimental plantations, modern drying installation, distillation installations, installations for ethereal oils analysis, etc. The Section of Aromatic Plants of the Department of Agriculture has been working on the cultivation of aromatic and medicinal plants since 1992, starting with the cultivation of *Origanum*, *Mentha* and *Salvia*.

(b) The Agricultural Research Institute (ARI) is carrying out research for the solution of problems faced in the cultivation of aromatic and herbal plants at the farmer level. Among the primary functions of the ARI, an EU Centre of Excellence, is to conduct research aiming to optimise resource utilisation, improve plant productivity on a sustainable basis and generate and test improved technology for farmers. Research programs in agricultural research represent a combination of theoretical and applied research. The ARI has released a number of improved crop varieties and recommendations on plant protection measures (disease and insect pests), and cultural practices, including soil fertility, fertilisation methods, modern irrigation technology and water management.

It is worth mentioning that the input of the ARI in the Euro-Mediterranean Region and in particular in the Middle East Region is also substantial. Most of the findings of the ARI are accepted and widely used in neighbouring and other countries. Agricultural research can continue to make a significant impact. On this line, the ARI invests its research resources on high priority commodities and production factors with particular focus on critical production constraints. The research priorities are flexible and could be changed according to present and future needs. Within this context, the ARI is implementing research in the field of herbs cultivation:

- The presence of weeds has been a serious problem in the cultivation of herbs. The knowledge about chemical control of weeds in these crops was limited because the cultivation of aromatic plants was a new sector in Cyprus and the relevant literature was limited. In order to address this problem, in 1995, the ARI conducted preliminary weed control field trials in *Origanum* and *Mentha* cultivations, where several herbicides were tested (Annual Review of ARI, 1995).
- Another problem to be addressed was the management and improvement of the local species of oregano (*Origanum dubium*). To this effect, three experiments were initiated in 1996 (Annual Review of ARI, 1996) and were established at three areas of different topography (Zygi, Saittas and Athalassa). Research has been conducted into: Plant population density, effect of cutting height on the yield and selection of local genotypes of oregano.
- Another research priority was to study the effects – in terms of suitability and effectiveness - of the application of several pre- and post-emergence herbicides, in nine aromatic plant species: *Foeniculum vulgare*, *Lavandula hybrida*, *Mentha viridis*, *Origanum dubium*, *Origanum majorana*, *Rosmarinus officinalis*, *Salvia fruticosa*, *Sideritis perfoliata* and *Thymus capitatus*. The experiments have been initiated in 1996.
- The effect of irrigation on the yield and quality of herbs was another research objective of the ARI. The first study in 1996 was carried out with Oreganum and Sage but in the following years new trials have been implemented with other herbs, such as some varieties of Lavender.

The preliminary and the detailed field trials were continued in the next years, while new trials were initiated. (Annual Reviews of ARI, 1997-1999)

- Research activities are also implemented to cover other aspects of cultivation, for example, the application of physical methods. Physical methods include soil mulching with transparent or black plastic during the growing period of the crop and soil covering with straw. Results obtained so far show that soil mulching with black plastic during the growing period of *Ocimum* gave significantly higher yield and better quality.

- Chemical composition and evaluation of essential oils of aromatic and medicinal plants. This work was part of a project aiming to study aromatic and medicinal plants with respect to their cultivation, irrigation, weed control, oil content and chemical composition of essential oils.

Selected genotypes of Oregano (*Origanum dubium*) cultivated on the mountainous area of Saittas were analysed. Its oil content (top 10-15 cm) at the flowering stage varied from 3 to 5% on dry weight basis. The major constituent was carvacrol and irrespective of the location of cultivation it constituted more than 75% of all oil.

Work was carried out on two varieties of sage: *Salvia fruticosa*, which grow in Cyprus, and *Salvia officinalis*. It was found that *S. fruticosa* contains a very low quantity (below 1%), a and b –thujone, which is neurotoxic, whereas *S. officinalis* contains about 30%. Another major constituent of *S. fruticosa* is camphor (over 35%) while *Salvia officinalis* contains only about 20%.

The chemical analysis of lavender (var. Wostok) showed that it contains low quantities (less than 2%) of camphor. It also contains perfumery quality constituents like limonene (2%), cineole (15%) linalool (40%) and linalyl acetate, plus geraniol (combined 15%).

Mineral analysis on the plant material and their tea extracts has been also performed on lavender, sage and oregano. The nutritional status in minerals for humans is insignificant, because very low quantities are used as tea, or as spice (oregano) in food. However, all the major macro- and micro-elements are present both in the dry samples and in the tea extracts. The content in minerals of the latter is about 20 times lower than in the plant material. Iron is

an exception. Its content in tea was 100 times lower than that in the plant material, indicating that iron is not easily soluble in hot water.

**Private sector** – There are increasing activities in the exploitation of herbs. Small businesses are involved in the production, processing and trading of herbs and their products. This sector currently includes:

- 42 producers of aromatic plants
- 7 distillation units
- 6 spices and tea industries
- 1 producer of herbal cosmetics and pharmaceutical products :

## **2 Constraints**

- The main constraints to the further development of the sector are
- The scarce water resources,
- The small farm size and fragmentation, especially in the mountainous zone,
- The lack of adequate post-harvest technology (crop treatment, drying, extraction etc),
- The poor marketing organisation and
- The lack of adequate knowledge and know-how for the industrial crop exploitation.

# OPPORTUNITIES

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## **1 Factors that may influence the developments in the production and exploitation of industrial crops in Cyprus**

- The development of improved and low cost technologies will add value to the cultivation of industrial crops. It will ensure efficiency and improve economical feasibility, thus increasing the interest of producers and industry.
- Market demands, the future approaches of the Common Agricultural Policy in respect of industrial crops and the incentives provided at the national and the European levels, may influence the future development of this sector in Cyprus.
- Potential participation of relevant sectors in Cyprus in European programmes designed to stimulate research and industrial work on new market outlets for industrial crops e.g. European Demonstration Programmes, etc., would increase the interest in non-food activities.
- The development of improved and low cost technologies for the harvest, drying, extraction, handling and other related processes, will add value to the cultivation of herbs. It will ensure efficiency throughout the production chain, improve economical feasibility and increase the interest of producers and industry.
- Further stimulation of the existing cultures of biological herbs would also result in high quality biological products, which would be competitive to high value markets.
- Adding value to crops and moving to high value markets is very important for small countries like Cyprus. The whole value may remain in Cyprus if capacities to carry out all processes from harvest to end products/raw materials are developed.

## **2 Expected benefits from the cultivation and exploitation of industrial crops**

### 2.1 Herbs

Cultivation of herbs rather than collection from the wild is aligned with developmental objectives of Cyprus and should be stimulated in order to address the relevant environmental concerns as well as the increasing market demands. Moreover, cultivation of herbs is thought to enhance the rural environment by increasing sustainability, protecting the endangered species and preventing damage to wildlife habitat, thus preserving biodiversity.

In addition, growing herbs and other plants for industrial or combined uses, may create employment opportunities and new business for Small and Medium Size Enterprises. Cultivation and exploitation of herbs may also strengthen the rural economy and enhance the possibilities for tourist development of some rural areas, which are not near the coastal resorts.

Also, new markets and increased demand is anticipated as a result of new properties identified in the framework of relevant research and as a response to new, increasing trends in the consumption of “green” and “natural products”.

### 2.2 General

Up to now, there is no specific legislation in Cyprus directly relating to the use of crops for industrial purposes. Yet, it is recognised that the use of renewable raw materials is in line with the objectives and complies with the requirements of national and European legislation aiming to protect the environment, to ensure sustainable development and to protect and manage water resources.

In general, cultivation and exploitation of industrial crops (oils, fibres, carbohydrates and speciality) is beneficial to the environment and public health and safer for users. The exploitation of renewable agricultural raw materials presents environmental, health-related and other socio economic advantages.

**Environmental and health benefits:**

- They are readily biodegradable and are not toxic to the environment or human health.
- They are not produced from chemicals or with chemically processed.
- They also:
  - Can be produced with a relatively low use of fertilizers, pesticides and other input requirements.
  - Preserve and enhance biodiversity.
  - Prevent soil erosion.
  - Provide products which are also biodegradable and recyclable.
  - Undergo industrial treatment which is usually more friendly to the environment. (Limiting the use of mineral oils and synthetic chemicals in manufacturing and processing and does not produce persistent toxic pollutants).
  - Consume CO<sub>2</sub> and soil nutrients and to a great extent are CO<sub>2</sub> neutral.

At the same time, from a more global point of view, the above-mentioned benefits of industrial crops contribute to a reduction of global pollution problems such as the greenhouse effect. For this reason, the production and industrial application of renewable raw materials support the overall efforts made in order to comply with the requirements of the international agreements aiming to reduce environmental pollution.

**Socio-economic benefits:**

- They are essential elements of “green chemistry”, which is compatible with sustainable development:
  - They use minimum resources and produce minimum wastes.
  - They make the best possible use of renewable resources and produce more eco-compatible products which are non-toxic and biodegradable.
  - They integrate environmental and consumer objectives with the objectives of the chemical industry, agriculture and the tourist industry (more attractive and safe environment, more resource availability).
- They contribute:
  - To the creation of new markets and new jobs.
  - To the plantation of lands, which cannot otherwise be exploited for various reasons.

- To self- sufficiency.
- To innovation in developments and products.
- They have many potential applications which are highly promising according to current experience and research carried out in Europe, especially oil, fibre and carbohydrate crops, which are currently not (or are minimally) exploited in Cyprus. These promising applications may be realised in the future and include:
  - Oilseed plants in the production of surfactants, bio lubricants, paints, inks and other products.
  - Starch from grains and potatoes to be sold as raw materials for the pulp and paper industry, or, for either trading as raw materials or the production of glues, surfactants, absorbent and other materials.
  - Fibre plants in the textile, construction and paper industry. The cultivation of hemp, canola and other fibre plants offers significant benefits, since they grow on soils which are not suitable for traditional crops, have high lignocellulose content and have moderate input requirements.

### **3 Further exploitation of the medicinal properties of herbs and other plants**

The market demand for prescription-free phytopharmaceutical products has continuously increased during the last decades. Turning to natural remedies for self medication and illness prevention is a preferred choice of many people due to:

- Its convenience
- The absence (or mildness) of side effects and
- The positive impact to the environment from the use of renewable raw materials instead of the synthetic ones

More recently there is an increasing interest in pharmaceutical research related to the potential use of herbs growing in Cyprus, for the treatment of more severe diseases such as the Alzheimer's disease.

More research should be carried out, into the chemical composition and profiling of crops growing in Cyprus, with emphasis on the crops which, according to their traditional use, have medicinal properties.

### 3.1 Going back to the roots

The magnificent and rich flora of Cyprus, its composition and properties, has been studied and utilised in antiquity. Reference and research into the characteristic qualities of a variety of plants has been carried out since ancient times by Aristotle, Strabo, Theophrastos, Dioscurides and others. Concerning the flora of Troodos mountain in Cyprus, Aristotle wrote (Fv. VI. Phys. 266) : “..... many and different herbal species useful in medical art, which if I try to describe separately, time will not be enough”.

It is important to note that people in antiquity were making the best possible and complete utilisation of the available natural sources. They were forced to do it in order to survive and progress, since they were absolutely dependent on their natural habitat. One outlet of this effort was the exploitation of herbs and other plants for food, non-food and combined uses.

The most significant uses of herbs and other plants were based on their nutritional and medicinal qualities. In this way, nutritional, medicinal and other properties were exploited.

Detailed information on the use of herbs and other plants in the production of pharmaceutical preparations is presented in the book “Iatrosoficon” (from the Greek words “medicine” and “wisdom”), written in 1849, by the Cypriot monk Mitrofanis. The monk wrote the book in order to pass on the knowledge and experience, gained from the practice in those days, when the monks were using home made natural preparations, to treat suffering people who were visiting the monastery. He records detailed instructions for the preparation of a variety of natural medicinal formulations and the mode of their use in the treatment of a variety of health problems.

In a recent publication of the book “The therapeutic potency of the medical plants of Cyprus, Kyriaki Zannettou/Panteli, 2000”, the writer describes the remedial qualities of the medical plants and present prescriptions.

In another publication by the same researcher, with the title “The medical plants of Cyprus” (Kyriaki Zannettou/Panteli, 1998), six hundred and twenty three medical plants of Cyprus are listed. The recorded medical plants of Cyprus come up to 131 families.

This list includes besides the indigenous ones, herbs and plants which were imported long ago and acclimatised in the island (e.g. eucalyptus, peonies and certain kinds of acacia). Some of these imported crops became even self-growing (e.g. ailanthus, sorrel and *Sol. Eleagnifolium*). The list also includes plants more recently imported, which are widely grown and used (avocado and kiwi) in Cyprus, or are thought to be promising crops (pineapple, peppino, lotus and others). Some of the plants included in the list are endemic plants of Cyprus (*Acinos troodi*, *Bosea cypria*, *Cyclamen cyprium*, *Nepeta troodi*, *Odontides cypria* etc).

Future developments may influence young scientists to invest in business related to the whole chain of exploitation of medical herbs and other industrial crops. They may also influence the development of plans of pharmaceutical industries towards the expansion of their activities in this area.

### 3.2 New Markets

According to recent research, besides their traditional use, some herbs such as *Origanum*, *Marjoram*, *Ocimum*, *Thymus*, *Salvia* and *Rosmarinus*, have the potential for use in new markets. Sage, Thyme and Rosemary yield high levels of anti-oxidants which can be used in the food and pharmaceutical industries. Research is also carried out into the use of a species of sage in the treatment of Alzheimer’s disease. In addition, it is believed that the essential oils of some herbs can be used as natural pesticides and antibiotics and some others can provide precursors in chemical syntheses, for example, methyl chavicol.

Markets and market potential should be examined not only for dried herbs and herb products but also for other plants growing in Cyprus which have not yet undergone industrial exploitation.

### 3.3 Pharmaceutical Industries

There are several Pharmaceutical Industries in Cyprus with a considerable contribution to the national exports and the employment of scientists and other categories of the economically

active population. Exports of manufactured products constitute the bulk of domestic exports of Cyprus. In 1999 they accounted for C£133million (228.5 million Euros), representing 64.4% of the total domestic exports. Pharmaceutical products were the major products exported from the category of manufactured products, accounting for C£25.1million (43.1 million Euros). Among the major exported manufactured products are cigarettes (tobacco is one of the industrial crops grown in Cyprus) accounting for C£14million (24 million Euros) in 1999. The exports of manufactured products registered a slight decline in 1999 compared to 1998 (C£137.7million, 236.6 million Euros).

Pharmaceutical industries are continuously expanding in products and infrastructure. **These industries are not currently involved in the exploitation of herbs.** Yet, it is worth mentioning that two of the longest established Pharmaceutical industries in Cyprus have been founded on the exploitation of medicinal plants:

- Remedica was founded on the basis of research and development activities, initiated in 1965, relevant to the use of herbs and plant extracts and their trade. One of these herbal preparations was including Lithospasto, (from the words “lithos” = stone and “spazo” = brake) which is included in the extra pharmacopoeia Martindale, 25<sup>th</sup> edition. Remedica is now a well established business with manufacturing and research capacities dedicated to the development, production and sale of a substantial number of high quality pharmaceutical products. The industry has entered foreign markets.

- Medochemie, was founded on the activities of the father of the present Executive Chairman, who started trading in medical herbs. Eventually the business has turned to a manufacturer of generic pharmaceuticals and has grown to a well established global operation. The industry has gained Export Awards in 1983, 1985, 1987, 1990, and 1991 and currently encompasses 3 manufacturing facilities at three manufacturing sites and a Research Institute.

- A more recently established, well established and continuously growing Pharmaceutical Industry, Aegis, is also not involved in the exploitation of medicinal herbs but it's Director General has a PhD in Organic Chemistry, Synthesis of Natural Products with Biological Activity. He is growing and expanding Pharmaceutical industries in Cyprus and has a connection to the exploitation of industrial crops. In addition, they have the potential to carry out research to produce, manufacture and trade herbal medicines.

## **4 Further exploitation of industrial plants in general**

### 4.1 The need to enhance information on the current and future opportunities for the exploitation of industrial crops

The lack of interest in growing industrial crops may be attributed to various reasons, including the lack of adequate information and know-how. Information on the current and future opportunities and know-how for the exploitation of industrial crops may stimulate the interest of growers and the industry.

Adequate information and know-how based on the experience gained from the industrial exploitation of crops, with emphasis on those which are traditionally used as food crops, could result in an increased interest for:

- (a) The combined (food and industrial) or alternative (industrial) use of plants which grow in Cyprus but are used only as food plants
- (b) The production and exploitation of industrial crops, which at the moment are not cultivated or exploited in Cyprus whilst the local conditions are favourable.

For this reason, strengthening the communication of relevant information in combination with an adequate pushing of the benefits of green chemistry and technology to the environment, sustainable development and health would result in an improved awareness of all stakeholders including politicians, environmental and consumer associations.

The role of IENICA and other relevant networks for the collection, evaluation and dissemination of relevant information is significant. At a national level, dissemination of information should be accomplished by the participants in the networks, the Research Promotion Foundation and other bodies.

Improved knowledge may result in stimulating the interest of all involved sectors and putting decision-makers in the picture in order to influence future policies and legislation in favour of growing industrial crops. Dissemination of information and know-how, should cover:

- The potential uses of crops as renewable raw materials.
- The possibilities for combined exploitation by using different parts of several crops for food and feeding purposes and different parts as agricultural raw materials.
- The option for both direct marketing of crops and for processing and marketing value-added products (such as essential oils).
- The option of growing, pre treating and exporting agricultural raw materials to countries with existing related industries, according to market demands.
- The environmental advantages of growing plants for use as renewable and biodegradable raw materials.
- The positive impact to the future of agriculture.
- The potential positive impact to other sectors of national economy.

#### 4.2 Additional or combined uses of crops which grow successfully in Cyprus and the potential to grow other non-food plants

Although some of the main products of Cyprus may have combined food and non-food uses falling into one of the above categories, their current application is restricted to food and feeding purposes only. The potential for alternative, additional or combined uses (as food and raw materials) of some of the crops, which can grow successfully in Cyprus, should be considered. The potential to grow other non-food plants, for which there is a market demand or other incentives and which may successfully grow under the climatic and topographic conditions of the island, should also be considered. The co-evaluation of all relevant information is vital prior to any decision to invest in growing or further developing the production of non-food plants.

#### 4.3 Increase of water availability in the framework of the Government's water management and water development policy

The combination of projects aiming to decrease dependency on rainfalls, which have been developed and implemented in the framework of a long term policy, have resulted in

increased water availability for both irrigation and drinking purposes. The irrigation projects will be further developed and expanded. The combined measures provide new opportunities for overcoming the constraints posed by the scarcity of water resources and further developing the agricultural sector, including the production of readily biodegradable, renewable and without adverse impact on the environment and health, non-food crops.

#### 4.4 The reuse of treated effluents for irrigation purposes

In addition to the measures which increase water availability, the recycling of water through adequate treatment and reuse for irrigation purposes, recharges and amenity purposes, is promoted as a common objective of the water management and environment policies.

In general, the wastewater reuse for agriculture irrigation has several benefits:

- a) It is an option accepted by farmers and the public under conditions aiming to protect public health, which is crucial due to the scarcity of alternatives for irrigation
- b) It contributes to the conservation of the available water resources and to addressing the increasing urban demand for potable water supplies, exacerbated by the increasing development of the tourist industry
- c) It protects the surface and underground water from pollution, which would occur by discharging untreated wastewater instead of treating and reusing it
- d) It reduces the requirements for synthetic fertilisers
- e) It prevents land erosion and through humus build up contributes to soil conservation
- f) It contributes to forest plantation and to growing non-food plants. These activities improve the environment and create potentials for industrial plants.

According to the established code of practice in Cyprus, the irrigation of industrial crops, fodder crops and forest trees with treated effluents is permitted after secondary treatment and chlorination, after retention in stabilisation lagoons for over thirty days, or after secondary

treatment and storing for over thirty days. The treated effluents of this quality are currently used only for the irrigation of forest trees or fodder crops or are otherwise discharged.

The use of treated wastewater, which conforms to the above requirements for the cultivation of industrial crops and trees with industrial applications, such as eucalyptus, should be promoted as appropriate in order to create new work opportunities.

#### 4.5 Young scientists

Cyprus has one of the highest percentages of scientists in the world and a number of well-qualified scientists turn to new opportunities for work. Going back to the roots is a challenge to them and an important venture aiming to explore and utilise the hidden, forgotten or scattered knowledge of our ancestors to the benefit of the socio-economic, developmental and environmental needs of our modern society.

Going back to the roots, recognising the need to utilise the wisdom hidden in and the wealth of tradition, along with the need to turn to renewable raw materials, may provide such new opportunities, including business in the fields of organic farming and the exploitation of herbs.

#### 4.6 The establishment of producer groups and organisations

An important objective of Government policy is the establishment of producer groups and organisations. It is believed that with their assistance, herb producers will be enabled to improve the production, collection and marketing of their produce according to market demand and to enhance the competitiveness of their farms. Also, through these groups and organisations, application of post-harvest technology and know-how will be practically and economically more feasible.

## **5 Trees with potential for industrial use**

Some trees growing well in Cyprus (such as Carob trees and Eucalyptus) offer environmental and other benefits and have potential for industrial exploitation (other than their potential for

use as biofuels), provided that the relevant procedures are cost effective and the market demands are appealing. The plantations of these trees are currently decreasing, however, due to burning for charcoal production or uprooting for other land uses (see below). Their industrial exploitation may create new opportunities to protect and even increase their plantations, improving the environment and generating jobs at the same time.

## 5.1 Carob trees

Carob trees have been cultivated in Cyprus for many years. In the old times, carobs were called the “black gold of Cyprus” due to the income they provided to farmers. The market demand at the local level and the overseas market, as well as the product price, was high. Their main use was as food and feeding crops. It is estimated that 4,000 hectares in the free areas are planted with 200,000 carob trees, while another 100,000 are spread around. In the past, the main area planted with carob trees was the area of Karpasia which is occupied by the Turks since 1974. The quantity produced, and the value, can be seen in the following table.

**Table 1 Carob Production (tonnes) and value (‘000 C£ and Euros) 1995-2000**

	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>
<b>Production</b>	6,300	8,800	5,100	4,850	5,400	7,300
<b>Value (‘000C£)</b>	964	1,056	566	427	427	686
<b>Value (‘000 Euros)</b>	1,656	1,814	972	734	734	1,179

Of the 7,300 tonnes produced in 2000, 328 tonnes (worth C£187,000, 321,266 Euros) were exported; 200 tonnes (worth C£19,000, 32,642 Euros) were retained for inputs, and 6,772 tonnes (worth C£637,000, 1.1 million Euros) were sales to industry and other sectors.

The production of carobs is subsidised by the Government. The Carob tree is of unique importance for the island not only for its market value. In addition, the carob tree is a beautiful component of the islands ecosystem, favoured by warm climates while resistant to low temperatures. On the other hand it is resistant to drought and grows well on rocky, dry and calcareous soils. Thanks to these properties, they provide potentials to exploit areas which cannot be exploited otherwise, even under adverse climatic conditions. Moreover, the carob tree is environmentally beneficial as it is one of the few trees which is thought to clean the atmosphere by absorbing lead.

The carobs have multiple uses:

- They are used as raw food and for the production of carob honey and of a popular candy – pastelli and pastellaki.
- They are used as a feeding stuff and as a substitute of cacao in the chocolate industry.
- Their kernels also have industrial uses. The carob gum, which is extracted from the kernels, is used in the textile industry, in the production of films and as a food additive.
- The carob honey is traditionally used not only as a food but also as an aid against lung inflammation, against constipation and as an emollient.

Although there is a market demand for both carob powder and the kernels and their production is subsidised, people in some areas set fire to the carob trees and burn them for the production of charcoal, or, they uproot them in order to use the land for residential or tourist purposes.

The purchase, collection, storage, milling, separation from the kernels and marketing of carobs is undertaken by the producers' associations and by a private company.

The carobs and their powder are both locally used and exported, whilst the kernels are entirely exported. The kernels are not currently processed in Cyprus for the extraction of gum, which could be further utilised by the local industrial sector. Future activities in this sector may keep the whole value in the island, create new jobs and provide incentives to protect and further promote the plantations of “the black gold of Cyprus”.

## 5.2 Eucalyptus

Eucalyptus has been growing in Cyprus since about 1880. The first species were grown as ornamental trees in towns and gardens. Subsequently other species were introduced with the aim to drain marshy areas, in an attempt to control malaria.

Several botanical and ecological studies were carried out on the eucalyptus growing in Cyprus during the 1944-1954 decade, followed by species and provenance trials during the 1954-

1964 period. The results of these trials are only indicative since they have not been evaluated statistically.

In recent years, these trees have been uprooted in many inhabited areas and their plantation has declined, because there is a popular belief that they consume large quantities of water. However the reuse of treated waste water, to irrigate plantations of multi purpose and fast growing trees, including Eucalyptus, acacias and pines (all of which grow well in Cyprus), became an attractive option in most of the neighbouring Near East Countries, which also have an arid or semi-arid climate. This option could be as attractive in Cyprus, where plantations of Eucalyptus irrigated with treated waste water may offer environmental benefits and potentials for their industrial exploitation.

Eucalyptus are multi purpose trees. They have potential:

- as sources of industrial wood and fodder,
- for the protection and increase of soil fertility,
- may have industrial use as herbal medicines,
- as herbal medicines.

Eucalyptus essential oil, extracted from the leaves, has been taken by mouth for catarrh and coughs. It is also used as an inhalation. It is used as ingredient of many preparations and in combination with other volatile substances. Eucalyptus oil is also used as a flavouring agent. According to the traditional uses and the opinions/expertise of Cyprus researchers, Eucalyptus has also antiseptic, anti-inflammatory and other medicinal properties. In addition, the timber qualities of certain species have also been tested and the results indicate that the timber is suitable for the manufacture of parquet floorings and particle board.

Despite their ecological significance and their botanical and timber properties, during the last decades there was a decline in the plantations of Eucalyptus trees due to their adverse effect on the underground aquifers and the damage cause by their strong roots, expanding over a large area, to the pavements, streets and the foundations of surrounding buildings. Nowadays, new opportunities emerge for industrial exploitation of these multi-purpose and fast growing trees, due to the potential to raise plantations on suitable areas, irrigated with treated effluents.

## 6. Flowers from Cyprus flora and potential use in commercial floriculture

The introduction of new plants in floriculture is a new trend in countries where horticultural research is well developed. For this reason, native plants are sought and selected for their desirable characteristics. Genetic improvement and hybridization of native plants produces attractive, vigorous and disease resistant plants, which are then introduced into commercial floriculture. The introduction of new plants in the floricultural market has been practiced for some time now in Germany, Denmark, the Netherlands and the United States, where consumers are attracted by new products, thus increasing the market trade. In Greece, recently research has been conducted in Research Centers and Universities where native and endemic species are being tested.

References to the Cyprus flora, and in particular to plants of economic importance, go back as far as Homer. Cyprus plants were mentioned in the works of ancient authors such as Theophrastus, Dioscorides, Plinius and others. At the end of the 18<sup>th</sup> century scientific work was published by many European botanists as a result of scientific explorations of the island. The most complete recent study is the "Flora of Cyprus", by R.D.Meikle of the Herbarium, Royal Botanic Gardens, Kew, U.K. The study was undertaken by the Kew Herbarium with the assistance and support of the Cyprus Government and in particular the Ministry of Agriculture and Natural Resources. The "Flora" was published in two volumes (Meikle, 1977; 1985). However, research on the evaluation of endemic species for the potential use in commercial floriculture is in very early stages.

Recently, particular attention was given to native and endemic species and research is carried out at the Agricultural Research Institute in two joint projects between Cyprus and Greece. A new project funded by the Cyprus Research Promotion Foundations (2002-2005), aims to evaluate six endemic species from Cyprus flora for potential use in commercial floriculture and at the same time to conserve these species since all of them are endemic and two of them are strictly protected by the Bern Convention.

This work is at a preliminary stage and the aim is to study the six selected endemic species from Cyprus flora (*Arabis purpurea*, *Centaurea akamantis*, *Onosma fruticosa*, *Origanum cordifolium*, *Ptilostemon chamaepeuce* and *Euphorbia veneris*), under three environments:

Greenhouse, Screen house and in the open and by application of different irrigation regimes, fertilization, application of growth regulators, cultivation techniques (i.e. pruning, pinching etc.) according to the species, to transform them into flowering pot plants, or cut flowers and use them in commercial Floriculture.

## 1 Description of the species

All of the selected species are endemic of Cyprus and two of them (*Centaurea akamantis* and *Origanum cordifolium*) are strictly protected by Bern Convention.

*Arabis purpurea* (Cruciferae) - Purple Rock-Cress, is a sub shrub or perennial herb up to 30cm high. Stems and leaves with dense stellate hairs. Leaves alternate, simple, silvery to glaucous-green; stem leaves few. Flowers hermaphrodite; inflorescences at first densely corymbose, lengthening gradually into a raceme. Petals pink, purple or rarely white. Flowering from March to April. Locally very common endemic, occurs in crevices of igneous and calcareous rocks at Troodos mountain range between 400-1800 m altitude.

*Centaurea akamantis* (Compositae) - Akamas Centaury, is a sub shrub with hanging or suberect shoots up to 60 cm long, densely white tomentose. Leaves alternate, simple, variable, lobed, pinnatisect or bipinnatisect; lobes linear or oblanceolate, 1-5 mm wide, grayish-green, densely tomentose. Flowers (florets) small, arranged in solitary, terminal capitula; florets purple-mauve, ray-florets ligulate, disk-florets tubular. Flowering from May to November. A very rare endemic, confined to the Akamas peninsula (50-100 m alt.).

*Onosma fruticosa* (Boraginaceae) - Cyprus Golden-Drop, is a much-branched, evergreen shrub, 0.2-0.8 m high, with hairy shoots, which become rather spinose when dried. Leaves alternate, simple, entire, oblong, 7-20x2-4 mm, grey-green, with a mixed indumentum of short hairs and long bristles and with revolute margins. Flowers solitary or 2-3 together, nodding downwards, calyx campanulate, hairy, corolla cylindrical, golden yellow turning into brown-orange with age. Flowering from March to May. Found in areas with garigue vegetation (0-900 m alt.).

*Origanum cordifolium* (Labiatae) - Cordate-leaved Origan, is an aromatic, much-branched sub shrub or shrub up to 60 cm high. Young shoots tetragonal, often purple. Leaves simple,

opposite, sessile, rather regularly spaced; Spikes on branched inflorescences. Flowers hermaphrodite, arranged in an oblong, pendulous spike, 40-70 x 13-25 mm. Bracts suborbicular, glabrous, purple or rosy, sometimes greenish. Flowers appear in June to August. Growing on moist, rocky places along stream sides, on igneous formations (250-900 m alt.).

*Ptilostemon chamaepeuce* (Compositae) var. *cyprum*, is an evergreen shrub up to 1.3 m high. Young branches densely white-tomentose, old branches greyish. Leaves alternate, simple, crowded towards the base of stems and more remote towards apices, entire, linear, 3-19 x 0.1-0.3 cm. Flowers (florets) small, arranged in large capitula, 12-20 mm long; capitula usually solitary, terminal or in loose; florets purple, all tubular. Flowering from May to June. Occurs on rocky slopes on calcareous and igneous formations, very common in the Akamas peninsula (50-1600 m alt.).

*Euphorbia veneris* (Euphorbiaceae) - Euphorbia of Aphrodite, is a perennial, with several simple stems up to 35 cm long arising from woody stock; cauline leaves elliptic, 1-2.5 cm long, 4-9mm wide, shortly acuminate, acute or sub acute and mucronate, entire, coriaceous; ray-leaves elliptic-oblong to obovate; raylet leaves broadly ovate to ovate-sub orbicular, 0.5-1.4 cm long, 0.4-1.6 cm wide. Occurs on rocky mountain slopes at Troodos, up to the snowline, in garigue or *Pinus nigra* woodland; 600-1700 m alt. Flowering in February-June.

## 2 Preliminary results and future prospects

Tests on the germination of these species by seeds at different temperatures, showed that 81% of the seeds of *Arabis purpurea*, germinated at 20°C between the 32<sup>nd</sup> and the 40<sup>th</sup> day and 72-76% of *Ptilostemon chamaepeuce* var. *cyprum*, between 10 and 16 days. A high percentage of *Origanum cordifolium* (82%), germinated at the temperature of 10°C and 79% at 15°C, in both cases after 6 days. For *Centaurea akamantis*, the percentage of seed germination was lower and reached 70% in 14 days at 15°C and 55% in 25 days at 20°C.

Propagation by tissue culture showed that for *Euphorbia veneris*, best results were observed when stem nodes without leaves were used as explants. It is shown that 0,5mg.l<sup>-1</sup> BAP in *Euphorbia veneris* leads to satisfactory bud differentiation and shoot proliferation.

The project within the 3 years, aims to study the reaction of the six plants in control environments (greenhouse and screen house) and in the open and find the optimum conditions for massive production in order to specified species to meet the commercial standards for their introduction in local and international markets. Preliminary results showed that the species *Ptilostemon chamaepeuce* var.cypria (Compositae), *Centaurea akamantis* (Compositae) and *Euphorbia veneris* (Euphorbiaceae) could be potentially pot plants. By the application of different irrigation regimes, fertilization or application of growth regulation according to the species, the project aims to transform the six selected species in to flowering pot plants. At the same time the project aims at the conservation of these species since all of them are endemic and two of them *Centaurea akamantis* and *Origanum cordifolium* are strictly protected by the Bern Convention (Chimonidou et al. 2003).

# **THE POTENTIAL ROLE OF THE RESEARCH PROMOTION FOUNDATION AND THE RISC PROJECT**

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The Research Promotion Foundation and the recently established RISC Project, may play an important role in disseminating information and promoting know-how and networking in the field of industrial exploitation of plants.

The Research Promotion Foundation (RPF) was founded in 1996. The Government of the Republic of Cyprus, recognising the fundamental importance of research in contemporary societies, has established the RPF in order to promote scientific and technological research on the island.

The Foundation is an independent organisation governed by a twelve-member Board of Directors, appointed by the Council of Ministers for a five-year period. Among the objectives and priorities of the Foundation are the following:

- To identify appropriate thematic areas for conducting demand-driven research, taking into consideration the developmental needs of Cyprus.
- To provide funding for the implementation of research projects.
- To promote the participation of Cypriot research organisations in European research programmes.
- To advise the Government on research issues.
- To promote awareness of the Cypriot public for the importance of research in contemporary societies.

Although the Foundation is a newly established organisation it has developed a wide range of activities, including:

- The implementation of annual programs for financing of research projects, covering a wide spectrum of topics in different thematic areas.
- The development and monitoring of a program for the support of young researchers,

- The participation in programs, within the framework of the FP5 and COST, including programs aiming at the promotion of networking between the research community of Cyprus and the European research community,
- The development of databases concerning the research community of Cyprus.

The RPF is participating in a number of projects, submitted and selected for funding by the European Commission within the framework of FP5. The most important of them is the RISC Project (*Regional Innovation Strategy for Cyprus*).

The project was submitted by the Research Promotion Foundation and will have a 32-month duration. The Consortium is made up of the Research Promotion Foundation, TALOS RTD, which is a private initiative with experienced personnel, and two partner regions (Central Macedonia and Kent), which exhibited excellent results on the successful implementation of their RITTS/RIS projects. The RISC project aims to design a Strategy for Technological Development and Innovation in Cyprus. It will strongly rely on the experience of the experts from the Partner Regions and on the consensus and commitment of public and private key-players on RTDI issues.

Based on the evaluation of the strengths and weaknesses of the innovation system in Cyprus, the project will elaborate and promote an Action Plan, aiming at strengthening the innovation support services, upgrading the innovation infrastructure and increasing the competitiveness of the Small and Medium size Enterprises (SME's). These will ultimately lead to the upgrade of the role of innovation in the development process and the creation of an innovation culture in Cyprus.

A set up will be created to evaluate the progress, monitor the impact of the RISC and disseminate information on the innovation and technological development.

## Agricultural Land 1990-1999 ('000 hectares)

Source: Statistical Service

Land Use	1990		1995		1997		1998		1999	
	Irrigable	Total	Irrigable	Total	Irrigable	Total	Irrigable	Total	Irrigable	Total
<b>CROP AREA</b>	<b>36.1</b>	<b>141.5</b>	<b>35.5</b>	<b>134.4</b>	<b>34.0</b>	<b>133.0</b>	<b>36.2</b>	<b>138.2</b>	<b>36.5</b>	<b>137.2</b>
Temporary crops	20.0	90.6	18.7	92.0	17.5	90.1	19.6	95.5	19.6	95.1
<i>Cereals</i>	2.7	57.5	2.5	60.9	2.1	43.0	3.5	59.1	3.4	58.9
<i>Legumes</i>	1.0	1.4	0.7	1.0	0.7	0.9	0.6	0.9	0.6	0.9
<i>Industrial crops</i>	0.9	0.9	0.5	0.5	0.4	0.4	0.5	0.5	0.6	0.6
<i>Fodder crops</i>	4.0	19.4	1.8	16.4	4.1	35.6	4.5	24.5	4.4	24.1
<i>Vegetables &amp; melons</i>	11.4	11.4	13.2	13.2	10.2	10.2	10.5	10.5	10.6	10.6
Permanent crops	16.1	50.9	16.8	42.4	16.5	42.9	16.6	42.7	16.9	42.1
<i>Vines</i>	2.4	25.2	2.1	19.3	2.3	20.0	2.5	19.9	2.5	19.0
<i>Citrus</i>	7.5	7.5	7.2	7.2	6.9	6.9	6.2	6.2	6.2	6.2
<i>Fresh fruit</i>	3.3	3.3	4.0	4.0	3.6	3.6	3.7	3.7	3.8	3.8
<i>Nuts</i>	1.1	4.6	1.0	3.7	1.2	3.8	1.2	3.9	1.3	4.0
<i>Olives &amp; carobs</i>	1.8	10.3	2.5	8.2	2.5	8.6	3.0	9.0	3.1	9.1
<b>FALLOW LAND</b>	<b>0.3</b>	<b>15.0</b>	<b>2.0</b>	<b>7.1</b>	<b>1.9</b>	<b>8.0</b>	<b>0.6</b>	<b>4.6</b>	<b>0.5</b>	<b>6.0</b>
<b>GRAZING LAND</b>	<b>0.0</b>	<b>4.2</b>	<b>0.0</b>	<b>1.5</b>	<b>0.0</b>	<b>1.1</b>	<b>0.0</b>	<b>1.1</b>	<b>0.0</b>	<b>1.1</b>
<b>UNCULTIVATED LAND</b>	<b>...</b>	<b>40.7</b>	<b>2.5</b>	<b>50.2</b>	<b>2.3</b>	<b>50.3</b>	<b>2.0</b>	<b>48.5</b>	<b>1.9</b>	<b>48.2</b>
<b>SCRUB &amp; DESERTED LAND</b>	<b>0.0</b>	<b>7.2</b>	<b>0.0</b>	<b>7.3</b>	<b>0.0</b>	<b>7.0</b>	<b>0.0</b>	<b>6.9</b>	<b>0.0</b>	<b>6.8</b>
<b>TOTAL</b>	<b>36.4</b>	<b>208.6</b>	<b>40.0</b>	<b>200.5</b>	<b>38.2</b>	<b>199.4</b>	<b>38.8</b>	<b>199.3</b>	<b>38.9</b>	<b>199.3</b>

Agricultural Land 2000-2002 ('000 hectares)

Source: Statistical Service

Land Use	2000		2001		2002	
	Irrigable	Total	Irrigable	Total	Irrigable	Total
<b>CROP AREA</b>	<b>35.8</b>	<b>135.2</b>	<b>35.2</b>	<b>133.6</b>	<b>35.1</b>	<b>132.7</b>
Temporary crops	19.9	93.4	19.2	92.3	19.1	93.3
<i>Cereals</i>	3.0	51.5	4.0	56.0	4.1	59.2
<i>Legumes</i>	0.5	0.8	0.5	1.8	0.6	0.8
<i>Industrial crops</i>	0.4	0.4	0.5	0.5	0.4	0.4
<i>Fodder crops</i>	5.5	30.2	4.5	25.3	4.3	23.2
<i>Vegetables &amp; melons</i>	10.5	10.5	9.7	9.7	9.7	9.7
Permanent crops	15.9	41.8	16.0	41.3	16.0	39.4
<i>Vines</i>	2.5	19.2	2.5	18.2	2.3	15.1
<i>Citrus</i>	5.5	5.5	5.4	5.4	5.5	5.5
<i>Fresh fruit</i>	3.6	3.6	3.6	3.6	3.6	3.6
<i>Nuts</i>	1.2	3.9	1.2	3.9	1.2	4.2
<i>Olives &amp; carobs</i>	3.1	9.6	3.3	10.2	3.4	11.0
<b>FALLOW LAND</b>	<b>1.5</b>	<b>5.0</b>	<b>1.5</b>	<b>5.6</b>	<b>1.7</b>	<b>6.5</b>
<b>GRAZING LAND</b>	<b>0.0</b>	<b>1.1</b>	<b>0.0</b>	<b>1.0</b>	<b>0.0</b>	<b>0.8</b>
<b>UNCULTIVATED LAND</b>	<b>1.9</b>	<b>48.9</b>	<b>1.5</b>	<b>49.5</b>	<b>1.6</b>	<b>48.9</b>
<b>SCRUB &amp; DESERTED LAND</b>	<b>0.0</b>	<b>7.1</b>	<b>0.0</b>	<b>7.0</b>	<b>0.0</b>	<b>7.0</b>
<b>TOTAL</b>	<b>39.2</b>	<b>197.3</b>	<b>38.2</b>	<b>196.7</b>	<b>38.4</b>	<b>195.9</b>



## Crop Areas and Production, 1999

Statistical Service

1 C£ = 1.7180 Euros (June 2002)

Crop	Area (hectares)	Production (tonnes)	Producer's price (C£/tonne)	Value of Production (C£)
<b>I. FIELD CROPS</b>	<b>84,554</b>			<b>29,011,706</b>
Cereals	58,940			16,456,900
<i>Wheat</i>	6,600		146	2,044,000
<i>Barley</i>	52,000	112,700	127	14,312,900
<i>Oats</i>	340	400	250	100,000
Legumes	913			1,921,850
<i>Broadbeans fresh</i>	430	1,000	362	362,000
<i>Broadbeans dry</i>		550	421	231,550
<i>Cowpeas fresh</i>	315	1,900	520	988,000
<i>Cowpeas dry</i>		120	1,950	234,000
<i>Chickpeas</i>	100	130	570	74,100
<i>Lentils</i>	8	4	1,000	4,000
<i>Louvana</i>	60	60	470	28,200
Industrial Crops	597			2,054,160
<i>Tobacco</i>	74	333	1,480	492,840
<i>Sesame</i>	3	1	1,320	1,320
<i>Peanuts</i>	520	2,000	780	1,560,000
Fodder crops	24,105			8,578,796
<i>Vicos</i>	71	60	425	25,500
<i>Vetches</i>	1	1	450	450
<i>Favetta</i>	2	2	400	800
<i>Green Fodder:</i>				
For Grazing	6,530		..	1,451,500
Hay-making	17,500	99,950	..	4,468,246
Straw	..	97,000	..	2,632,300
<b>II. VEGETABLES &amp; MELONS</b>	<b>10,641</b>			<b>63,944,238</b>
Potatoes	6,800	161,500		24,739,218
<i>Food potatoes</i>	6,675	159,214	153	24,359,742
<i>Seed potatoes</i>	125	2,286	166	379,476
Other vegetables	2,891			33,174,120
<i>Carrots</i>	52	1,850	243	449,550
<i>Tomatoes</i>	350	40,000	181	7,240,000
<i>Colocase</i>	105	3,500	398	1,393,000
<i>Cucumbers</i>	190	18,500	274	5,069,000
<i>Haricot beans fresh</i>	265	2,500	588	1,470,000
<i>Haricot beans dry</i>		190	1,415	268,850
<i>Cabbages</i>	155	5,100	180	918,000
<i>Onions</i>	200	7,600	149	1,132,400
<i>Onions sets</i>	8	80	1,000	80,000
<i>Onions fresh (1000 bundles)</i>	60	2,150	94	202,100
<i>Artichokes</i>	165	3,500	261	913,500

<i>Cauliflower</i>	92	2,400	272	652,800
<i>Marrows</i>	162	4,600	270	1,242,000
<i>Egg-plants</i>	65	3,000	250	750,000
<i>Beetroots</i>	70	2,700	215	580,500
<i>Celery (1000 bundles)</i>	53	2,600	148	384,800
<i>Okhra</i>	73	1,500	713	1,069,500
<i>Pepper</i>	63	1,900	407	773,300
<i>Peas fresh</i>	80	700	459	321,300
<i>Mushrooms</i>	..	2,000	1,774	3,548,000
<i>Other vegetables</i>	683	..	..	4,715,520
Melons	950	..	..	6,030,900
<i>Water melons</i>	710	40,500	105	4,252,500
<i>Sweet melons</i>	240	10,400	171	1,778,400
<b>III. FRUITS AND TREE CROPS</b>	<b>42,050</b>			<b>63,855,670</b>
Grapes	18,995			16,017,300
<i>Wine Grapes (1*)</i>	17,226	84,600	147	12,436,200
<i>Table Grapes (2*)</i>	1,769	20,700	173	3,581,100
Citrus	6,210			17,140,300
<i>Oranges</i>	2,100	52,800	113	5,966,400
<i>Lemons</i>	1,100	22,100	134	2,961,400
<i>Grapefruit</i>	1,340	44,200	72	3,182,400
<i>Mandarines</i>	1,630	24,300	207	5,030,100
<i>Bitter Oranges</i>	40	..	..	..
Fresh Fruit	3,795			19,862,970
<i>Apples</i>	1,200	11,500	437	5,025,500
<i>Pears</i>	160	1,100	667	733,700
<i>Quinces</i>	13	80	363	29,040
<i>Peaches</i>	480	2,900	508	1,473,200
<i>Apricots and Kaisha</i>	260	2,200	638	1,403,600
<i>Cherries</i>	270	1,100	1,035	1,138,500
<i>Plums</i>	200	1,100	661	727,100
<i>Pomegranates</i>	170	800	315	252,000
<i>Strawberries</i>	95	1,800	934	1,681,200
<i>Figs</i>	330	3,900	745	2,905,500
<i>Bananas (3*)</i>	320	13,500	241	3,253,500
<i>Loquats</i>	60	380	515	195,700
<i>Avocato</i>	110	1,000	640	640,000
<i>Kiwi</i>	46	390	564	219,96
<i>Other tropical fruits</i>	81	..	..	184,470
Nuts	3,950			1,560,500
<i>Almonds</i>	3,250	1,100	505	555,500
<i>Walnuts</i>	410	270	3,400	918,000
<i>Hazelnuts</i>	100	50	750	37,500
<i>Pistachio</i>	190	18	2,750	49,500
Other Tree Crops	9,100			9,274,600
<i>Olives</i>	6,700	14,000	632	8,848,000
<i>Carobs</i>	2,400	5,400	79	426,600
<b>IV. FLOWERS AND PLANTS</b>	<b>121</b>			<b>18,808,200</b>
<i>Flowers</i>	51	..	..	9,308,200
<i>Nurseries' products (seedlings)</i>	70	..	..	9,500,000

*and ornamental plants)*

<b>TOTAL CROP PRODUCTION</b>	<b>137,366</b>	<b>..</b>	<b>..</b>	<b>175,619,814</b>
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Notes:

(1\*) 8,209 tons of wine grapes valued at £1,118,887 were delivered to scrap heaps

(2\*) 3,416 tons of table grapes valued at £387,374 were delivered to scrap heaps

(3\*) 1,480 tons of bananas valued at £118,400 were delivered to scrap heaps

## Crop Areas and Production, 2002

Statistical Service

1 C£ = 1.72 (September 2004)

Crop	Area (hectares)	Production (tonnes)	Producer's price (C£/tonne)	Value of Production (C£)
<b>I. FIELD CROPS</b>	<b>83,685</b>			<b>30,367,288</b>
Cereals	59,200			19,145,400
<i>Wheat</i>	5,900	12,900	153	1,973,700
<i>Barley</i>	52,900	128,400	133	17,077,200
<i>Oats</i>	400	450	210	94,500
Legumes	847			1,899,050
<i>Broadbeans fresh</i>	430	1,000	350	350,000
<i>Broadbeans dry</i>		340	375	127,500
<i>Cowpeas fresh</i>	265	1,700	600	1,020,000
<i>Cowpeas dry</i>		150	2,020	303,000
<i>Chickpeas</i>	85	105	630	66,150
<i>Lentils</i>	7	3	1,000	3,000
<i>Louvana</i>	60	60	490	29,400
Industrial Crops	405			1,652,588
<i>Tobacco</i>	77	357	1,384	494,088
<i>Sesame</i>	3	1	1,500	1,500
<i>Peanuts</i>	325	1,300	890	1,157,000
Fodder crops	23,233			4,645,250
<i>Vicos</i>	70	45	400	18,000
<i>Vetches</i>	1	1	450	450
<i>Favetta</i>	2	2	400	800
<i>Green Fodder:</i>				
For Grazing	4,560		..	850,200
Hay-making	18,600	95,000		3,775,800
Straw	..	121,000		3,025,000
<b>II. VEGETABLES &amp; MELONS</b>	<b>9,687</b>			<b>70,447,800</b>
Potatoes	5,715	148,500		25,865,950
<i>Food potatoes</i> <sup>2</sup>	5,600	144,650	174	25,169,100
<i>Seed potatoes</i>	115	3,850	181	696,850
Other vegetables	3,007			36,324,850
<i>Carrots</i>	55	1,850	280	518,000
<i>Tomatoes</i>	460	37,000	270	9,990,000
<i>Colocase</i>	95	2,600	650	1,690,000
<i>Cucumbers</i>	265	16,400	330	5,412,000
<i>Haricot beans fresh</i>	260	2,300	800	1,840,000
<i>Haricot beans dry</i>		190	1,425	270,750
<i>Cabbages</i>	140	4,700	220	1,034,000
<i>Onions</i>	185	7,100	200	1,420,000
<i>Onions sets</i>	8	80	1,000	80,000
<i>Onions fresh (1000 bundles)</i>	60	2,100	100	210,000
<i>Artichokes</i>	155	3,000	250	750,000
<i>Cauliflower</i>	90	2,400	320	768,000
<i>Marrows</i>	160	4,100	350	1,435,000
<i>Egg-plants</i>	62	2,900	280	812,000

<i>Beetroots</i> <sup>2</sup>	70	2,500	205	512,500
<i>Celery (1000 bundles)</i>	48	2,400	225	540,000
<i>Okhra</i>	73	1,800	785	1,413,000
<i>Pepper</i>	60	1,850	400	740,000
<i>Peas fresh</i>	80	900	520	468,000
<i>Mushrooms</i>	..	1,270	1,800	2,286,000
<i>Other vegetables</i>	681	..	..	4,135,600
Melons	965	..	..	8,257,000
<i>Water melons</i>	730	39,500	150	5,925,000
<i>Sweet melons</i>	235	10,600	220	2,332,000
<b>III. FRUITS AND TREE CROPS</b>	<b>38,318</b>			<b>71,572,180</b>
Grapes <sup>1</sup>	15,055			10,172,800
<i>Wine Grapes</i>	13,915	49,000	151	7,399,000
<i>Table Grapes</i>	1,140	13,400	207	2,773,800
Citrus	5,495			20,375,000
<i>Oranges</i>	1,930	45,500	130	5,915,000
<i>Lemons</i>	1,050	22,000	125	2,750,000
<i>Grapefruit</i>	815	29,300	110	3,223,000
<i>Mandarines</i>	1,660	41,000	207	8,487,000
<i>Bitter Oranges</i>	40	..	..	..
Fresh Fruit	3,638			24,781,580
<i>Apples</i> <sup>2</sup>	1,130	10,800	610	6,588,000
<i>Pears</i> <sup>2</sup>	130	1,100	836	919,600
<i>Quinces</i>	13	70	350	24,500
<i>Peaches</i> <sup>2</sup>	420	4,000	672	2,688,000
<i>Apricots and Kaisha</i>	230	2,000	750	1,500,000
<i>Cherries</i>	265	600	1,750	1,050,000
<i>Plums</i>	260	1,100	900	990,000
<i>Pomegranates</i>	172	750	400	300,000
<i>Strawberries</i>	95	1,750	985	1,723,750
<i>Figs</i>	335	3,900	800	3,120,000
<i>Bananas</i>	290	10,500	430	4,515,000
<i>Loquats</i>	60	400	800	320,000
<i>Avocado</i>	125	1,030	600	618,000
<i>Kiwi</i> <sup>2</sup>	32	290	662	191,980
<i>Other tropical fruits</i>	81	..	..	232,750
Nuts	4,180			2,120,500
<i>Almonds</i>	3,600	2,000	515	1,030,000
<i>Walnuts</i>	410	300	3,400	1,020,000
<i>Hazelnuts</i>	50	30	1,100	33,000
<i>Pistachio</i>	120	15	2,500	37,500
Other Tree Crops	10,950			14,122,300
<i>Olives</i>	8,600	27,500	485	13,337,500
<i>Carobs</i>	2,350	7,200	109	784,800
<b>IV. FLOWERS AND PLANTS</b>	<b>117</b>			<b>12,845,750</b>
<i>Flowers</i>	47	..	..	4,885,750
<i>Nurseries' products (seedlings and ornamental plants)</i>	70	..	..	7,960,000
<b>TOTAL CROP PRODUCTION</b>	<b>132,807</b>	<b>..</b>	<b>..</b>	<b>185,233,018</b>

Notes:

- (1) Includes 8,620 tons of grapes valued at £1,735,045, which were gathered green.  
This value is not included in the gross input.
- (2) These values include subsidies as follow:
  - a) £10,080,000 for potatoes
  - b) £967,300 for apples
  - c) £359,100 for peaches
  - d) £94,900 for pears
  - e) £3,600 for kiwi
  - f) £197,200 for beetroots

## ANNEX 1

## Production of Main Crops 1994-1999

Source: Statistical Service

Crop	1994		1995		1996		1997		1998		1999	
	Q/ty (tonnes)	Value (C£000's)	Q/ty (tonnes)	Value (C£000's)	Q/ty (tonnes)	Value (C£000's)	Q/ty (tonnes)	Value (C£000's)	Q/ty (tonnes)	Value (C£000's)	Q/ty (tonnes)	Value (C£000's)
<b>CEREALS</b>												
<i>Wheat</i>	8,000	1,088	11,000	1,551	13,000	1,846	11,500	1,633	11,500	1,622	14,000	2,044
<i>Barley</i>	154,000	18,172	134,000	15,812	128,000	15,232	36,000	4,284	54,000	6,804	112,700	14,313
<b>VEGETABLES &amp; MELONS</b>												
<i>Potatoes</i>	135,000	26,630	234,000	42,935	228,000	31,061	81,500	16,633	138,092	26,746	161,500	24,739
<i>Carrots</i>	2,000	486	2,200	514	2,100	603	2,000	520	1,900	557	1,850	450
<i>Tomatoes</i>	30,000	7,620	38,000	7,106	36,000	7,272	34,000	8,806	38,000	9,956	40,000	7,240
<i>Water melons</i>	29,000	4,698	36,000	4,428	34,000	4,454	34,500	4,451	37,000	5,291	40,500	4,253
<i>Sweet melons</i>	8,500	2,338	9,000	2,349	9,500	1,995	9,000	1,971	10,500	2,478	10,400	1,778
<i>Cucumbers</i>	12,300	4,121	14,000	4,140	13,000	3,796	13,500	3,969	16,000	4,416	18,500	5,069
<b>FRUIT &amp; OTHER TREE CROPS</b>												
<i>Grapes</i>	92,000	11,857	118,000	15,257	114,000	16,736	101,000	14,504	124,000	18,834	105,300	16,017
<i>Oranges</i>	46,000	4,094	55,000	5,445	52,500	5,880	50,500	5,252	44,500	4,851	52,800	5,966
<i>Lemons</i>	31,000	2,790	28,500	2,679	26,500	3,339	23,000	3,358	21,500	2,903	22,100	2,961
<i>Grapefruit</i>	58,000	3,480	73,500	4,484	52,000	3,796	47,000	3,666	35,000	2,444	44,200	3,182
<i>Apples</i>	7,500	5,685	9,300	7,068	10,000	6,590	9,500	5,615	11,000	6,204	11,500	5,026
<i>Pears</i>	1,200	901	1,000	739	1,300	993	950	618	900	635	1,100	734
<i>Peaches</i>	1,900	1,573	2,250	1,319	2,400	1,236	2,500	1,425	3,000	1,350	2,900	1,473
<i>Cherries</i>	1,400	1,159	1,300	1,157	1,300	871	1,000	1,023	1,700	1,195	1,100	1,139
<i>Bananas</i>	7,500	3,743	10,500	3,360	10,000	3,260	9,500	4,066	13,000	4,147	13,500	3,254
<i>Almonds</i>	550	347	3,500	2,048	1,250	844	1,360	911	1,600	1,090	1,100	556
<i>Olives</i>	12,000	6,600	13,500	7,358	12,500	6,700	9,000	5,418	10,700	6,623	14,000	8,848
<i>Carobs</i>	2,600	460	6,300	964	8,800	1,056	5,100	566	4,850	427	5,400	427

## Production of Main Crops 2000-2002

Source: Statistical Service

Crop	2000		2001		2002	
	Q/ty (tonnes)	Value (C£000's)	Q/ty (tonnes)	Value (C£000's)	Q/ty (tonnes)	Value (C£000's)
<b>CEREALS</b>						
<i>Wheat</i>	10,000	1,460	10,500	1,523	12,900	1,974
<i>Barley</i>	37,600	4,738	116,500	14,796	128,400	17,077
<b>VEGETABLES &amp; MELONS</b>						
<i>Potatoes</i>	117,000	20,132	121,000	24,998	148,500	25,866
<i>Carrots</i>	1,890	556	1,860	577	1,850	518
<i>Tomatoes</i>	35,600	8,722	37,500	10,125	37,000	9,990
<i>Water melons</i>	30,000	4,650	37,000	8,029	39,500	5,925
<i>Sweet melons</i>	9,200	2,512	10,100	2,808	10,600	2,332
<i>Cucumbers</i>	16,500	5,280	17,500	5,338	16,400	5,412
<b>FRUIT &amp; OTHER TREE CROPS</b>						
<i>Grapes</i>	108,018	16,939	88,073	14,121	62,400	10,173
<i>Oranges</i>	42,700	5,124	36,500	4,380	45,500	5,915
<i>Lemons</i>	20,900	2,801	23,000	3,082	22,000	2,750
<i>Grapefruit</i>	28,100	2,248	27,800	2,224	29,300	3,223
<i>Apples</i>	11,300	5,763	9,300	4,948	10,800	6,588
<i>Pears</i>	1,200	868	1,050	788	1,100	920
<i>Peaches</i>	3,500	1,715	2,800	2,128	4,000	2,688
<i>Cherries</i>	1,070	972	1,100	1,139	600	1,050
<i>Bananas</i>	8,500	2,703	9,800	4,410	10,500	4,515
<i>Almonds</i>	1,800	882	500	275	2,000	1,030
<i>Olives</i>	21,000	13,692	17,500	9,205	27,500	13,338
<i>Carobs</i>	7,300	686	2,850	274	7,200	691

## The main aromatic and pharmaceutical plants of Cyprus (by Apostolos Gollaris)

Serial No.	Scientific Name	Common Name in Greek	Family
<b>PTEPIDOPHYTA</b>			
1.	CETERACH OFFICINARUM DC.	Scorpithi	ASPLENIACEAE
2.	DRYOPTERIS PALLIDA ssp LIBANOTICA Rosenst.	Chrysochorto Arrenopteris	ASPIDIACEAE
3.	POLYPODIUM CAMBRICUM L.	Polypothis	POLYPODIACEAE
4.	PTERIS VITTATA L.	Fteri	PTERIDACEAE
<b>SPERMATOPHYTA</b>			
<b>GYMNOSPERMAE</b>			
5.	CEDRUS LIBANI Subsp. Brevifolia Hook	Kedros	PINACEAE
6.	JUNIPERUS OXYCEDRUS L.	Arkethos	CUPRESACEAE
7.	JUNIPERUS PHOENICEA L.	Aoratos	CUPRESACEAE
8.	PINUS HALEPENSIS Mill	Pefkos	PINACEAE
<b>ANGIOSPERMA</b>			
<b>MONOCOTYLEDONEAE</b>			
9.	AGROPYRON REPENS L.	Ergasti or agropyro	GRAMINEAE
10.	ALLIUM CEPA L.	Kromythis	ALLIACEAE
11.	ARUM ITALICUM Mill	Drakontia	ARACEAE
12.	ASPALTUM BITUMINOSUM L.	Vromochorto	LEGUMINOSAE
13.	ASPARAGUS ACUTIFOLIUS L.	Koutsagreli	LILIACEAE
14.	ASPHODELUS AESTIVUS Brot.	Spurtulous	LILIACEAE
15.	COLCHICUM TROODI Kotschy	Crocuthi	LILIACEAE
16.	CROCUS VENERIS Tappeiner	Crocus	IRIDACEAE
17.	CYNODON DACTYLON L.	Agriatha	GRAMINEAE
18.	CYPERUS ROTUNDUS L.	Capuras	CYPERACEAE
19.	ORCHIS ITALICA Poir	Nuros tou alupu, Salepi	ORCHIDACEAE
20.	ORCHIS MORIO ssp PICTA Loisel.	Nuros tou lau, Salepi	ORCHIDACEAE
21.	RUSCUS ACULEATUS L.	Arkuthovatos	RUSCACEAE
22.	SMILAX ASPERA L.	Pernari, Agriomersini	SMILACACEAE
23.	TAMUS COMMUNIS L.	Vrionia, Ovria	DIOSCOREACEAE
<b>DICOTYLEDONEAE</b>			
24.	ALKANA LEHMANII Tineo	Vaforiza	BORAGINACEAE
25.	AMMI MAJUS L.	Asprokefalo	UMBELLIFEREAE
26.	AMMI VISNACA L.	Chalvana	UMBELLIFEREAE
27.	ANETHUM GRAVEOLENS L.	Anithon	UMBELLIFEREAE
28.	APIUM CRAVEOLENS L.	Selleno	UMBELLIFEREAE
29.	ARISTOLOCHIA SEMPERVIRENS L.	Aristolochia	ARISTOLOCHACEAE
30.	BALLOTA NIGRA L.	Piperitsa	LAMIACEAE
31.	BORRAGO OFFICINALIS L.	Mporantsino	BORRAGINACEAE
32.	BRASSICA NIGRA L.	Sinapi	CRUCIFERAE
33.	BRYONIA CRETICA L.	Vryonia	CUCURBITACEAE

34.	CAPPARIS SPINOSA L.	Cappari	CAPPARIDACEAE
35.	CARTHAMUS TINCTORIUS L.	Saflori, Safrani	COMPOSITAE
36.	CENTAURIUM ERYTHRAEA Rafn.	Thermovotano	GENTIANACEAE
37.	CERATONIA SILIQUA L.	Teratsia, Charoupia	LEGUMINOSAE
38.	CHRYSANTHEMUM CORONARIUM L.	Cimiluthi	COMPOSITAE
39.	CISTUS LADANIFER L.	Xistarka, Kunuklia	CISTACEAE
40.	CISTUS PARVIFLORUS Lam.	Xistarka, Kunuklia	CISTACEAE
41.	CISTUS CRETICUS VAR. CRETICUS Boiss	Xistarka, Kunuklia	CISTACEAE
42.	CLEMATIS VITALBA L.	Arkoklima	RANUNCULACEAE
43.	CNICUS BENEDICTUS L.	Kalagatho	COMPOSITAE
44.	CONIUM MACULATUM L.	Tsamputhia, Compuhia	UMBELLIFERAE
45.	CORIANDRUM SATIVUM L.	Colliandros	UMBELLIFERAE
46.	CRATAEGUS MONOGYNA Jacq.	Coccinomosfilia	ROSACEAE
47.	DATURA INNOXIA Mill	Tatura, Zornes	SOLANACEAE
48.	DATURA STRAMONIUM L.	Tatura, Zornes	SOLANACEAE
49.	ERICA MANIPULIFLORA Salisb.	Reiki	ERICACEAE
50.	EUCALYPTUS GOMPHOCEPHALA D.C.	Efkalyptos	MYRTACEAE
51.	EUPHORBIA PEPLIS L.	Galochorto	EUPHORBIACEAE
52.	FOENICULUM VULGARE Mill	Marathos	UMBELLIFERAE
53.	FUMARIA OFFICINALIS L.	Karnochorto	FUMARIACEAE
54.	GERANIUM ROSEUM L.	Kiouli, Gerani	GERANIACEAE
55.	GLYCYRRHIZA GLABRA L.	Glygoriza	LEGUMINOSAE
56.	HEDERA HELIX L.	Kissos	ARALIACEAE
57.	HYPERICUM PERFORATUM L.	Psillina	HYPERICACEAE
58.	INULA VISCOSA Ait	Konizos	COMPOSITAE
59.	JASMINUM GRANDIFLORA L.	Yiasemi	JASMINACEAE
60.	JUGLANS REGIA L.	Karithkia, Karydia	JUGLANDACEAE
61.	LAVANDULA ANGUSTIFOLIA Mill	Levanta	LAMIACEAE
62.	LAVANDULA STOECHAS L.	Myrofora	LAMIACEAE
63.	LAURUS NOBILIS L.	Dafni, Vayia	LAURACEAE
64.	LINUM USITATISSIMUM L.	Linari	LINACEAE
65.	LONICERA ETRUSCA Santi	Ayioklima	CAPRIFOLIACEAE
66.	MALVA SYLVESTRIS L.	Molocha	MALVACEAE
67.	MANDRAGORA OFFICINARUM L.	Mandragoras	SOLANACEAE
68.	MARRUBIUM VULGARE L.	Vromochorto	LAMIACEAE
69.	MATHIOLA INCANA L.	Violettes	GRUCIFERAE
70.	MATRICARIA CHAMOMILIA L.	Chamomili, Muiochorto	COMPOSITAE
71.	MELISSA OFFICINALIS L.	Melisochoorto	LAMIACEAE
72.	MENTHA LONGIFOLIA Huds	Potamoyitonas	LAMIACEAE
73.	MENTHA PULEGIUM L.	Printziolos	LAMIACEAE
74.	MICROMERIA MYRTIFOLIA Boiss	Micromeria	LAMIACEAE
75.	MYRTUS COMMUNIS L.	Mersinia, Myrtia	MYRTACEAE
76.	NEPETA CATARIA L.	Nepeta	LAMIACEAE
77.	NERIUM OLEANDER L.	Arodafni, Rodothafni	APOCYNACEAE

78.	NICOTIANA GLAUCA R. Grah.	Yiatros, Argokarnos	SOLANACEAE
79.	NIGELLA DAMASCENA L.	Kutsulochoorto	RANUNCULACEAE
80.	OCIMUM BASILICUM L.	Vasilikos	LAMIACEAE
81.	ONONIS SPINOSA L.	Ononis	LEGUMINOSAE
82.	ORIGANUM DUBIUM Boiss	Regani	LAMIACEAE
83.	ORIGANUM SYRIACUM L.	Regani	LAMIACEAE
84.	ORIGANUM MAJORANA	Sapsishia	LAMIACEAE
85.	PAPAVER SOMNIFERUM L.	Chaskasi, Afioni	PAPAVERACEAE
86.	PARIETARIA JUDAICA L.	Anemochorto	URTICACEAE
87.	PETROSELINUM SATIVUM Hoffm.	Maintanos	UMBELLIFERAE
88.	PHACELLIA TANACETIFOLIA Benth.	Vakeloti	HYDROPHYLLACEAE
89.	PHYTOLACCA PRUINOSA Fenzl.	Melanies	PHYTOLACCACEAE
90.	PIMPINELLA ANISUM L.	Glykanison	UMBELLIFERAE
91.	PLANTAGO CORONOPUS L.	Chinopothi	PLANTAGINACEAE
92.	PLANTAGO LANCEOLATA L.	Pentanevro	PLANTAGINACEAE
93.	PLANTAGO MAJOR L.	Pentanevro	PLANTAGINACEAE
94.	PLANTAGO AFRA L.	Psillochoorto	PLANTAGINACEAE
95.	POLYGONUM AVICULARE L.	Polygonatos	POLYGONACEAE
96.	RESEDA LUTEA L.	Amureta, Chemeli	RESEDACEAE
97.	RHUS CORIARIA L.	Routhi, Soumaki	ANACARDIACEAE
98.	RICINUS COMMUNIS L.	Kurtunia, Retsinolathia	EUPHORBIACEAE
99.	ROSA DAMASCENA Mill	Rothi, Triandafylia	ROSACEAE
100.	ROSMARINUS OFFICINALIS L.	Lasmari, Dendrolivano	LAMIACEAE
101.	RUBIA TINCTORUM L.	Mpoyia, Rizari	RUBIACEAE
102.	RUMEX AQUATICUS L.	Lapatho	POLYGONACEAE
103.	SALIX ALBA L.	Itia	SALICACEAE
104.	SALVIA FRUTICOSA Mill	Spatzia, Faskomilia	LAMIACEAE
105.	SALVIA WILLEANA Holboe	Spatzia, Faskomilia	LAMIACEAE
106.	SALVIA VIRIDIS L.	Salvia	LAMIACEAE
107.	SAMBUCUS EBULUS L.	Zamboukos	CAPRIFOLIACEAE
108.	SAMBUCUS NIGRA L.	Zamboukos	CAPRIFOLIACEAE
109.	SATUREIA THYMBRA L.	Throumbi	LAMIACEAE
110.	SCROPHULARIA PEREGRINA L.	Gurunochorto	SCROPHULARIACEAE
111.	SIDERITIS CYPRIA Post.	Sideritis	LAMIACEAE
112.	SIDERITIS PERFOLIATA L.	Tsai tou Vunu	LAMIACEAE
113.	SILYBUM MARIANUM Gaertn	Gaiduragatho	COMPOSITAE
114.	SINAPIS ALBA L.	Sinapi, Lapsana	GRUCIFERAE
115.	SORBUS ARIA	Survia	ROSACEAE
116.	SPARTIUM JUNCEUM L.	Sparto, Nymfe	LEGUMINOSAE
117.	TEUCRIUM MICROPODIOIDES Rouy	Meteres	LAMIACEAE
118.	THYMUS CAPITATUS L.	Thimari	LAMIACEAE
119.	THYMUS INTEGER Griseb	Thimari	LAMIACEAE
120.	TRIGONELLA FOENUM – GRAECUM L.	Trigonella	LEGUMINOSAE
121.	ULMUS COMPESTRIS L.	Ftelia	ULMACEAE
122.	URTICA DIOICA ssp CYPRIA Lindberg	Skitha, Tsouknida	URTICACEAE
123.	URTICA PILULIFERA L.	Skitha, Tsouknida	URTICACEAE

124.	URTICA URENS L.	Skitha, Tsouknida	URTICACEAE
125.	VERBENA OFFICINALIS L.	Stavrochorto	VERBENACEAE
126.	VITEX AGNUS – CASTUS L.	Agnia, Lygaria	VERBENACEAE
127.	VINCA MAJOR L.	Vinga	APOCYNACEAE
128.	WITHANIA SOMNIFERA Dunal	Mertzania	SOLANACEAE

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### The cultivated plants in Cyprus

Ministry of Agricultural, Natural Resources and Environment, Department of Agriculture  
Section of Aromatic and Medicinal plants

Serial No.	Latin name of plant		English name of plant
1.	Ocimum basilicum	L	Basil
2.	Borago officinalis	L	Borrage
3.	Geranium or Pelargonium roseum	L	Rose Geranium
4.	Glycyrriza glabva	L	Liquorice
5.	Laurus nobilis	L	Bay
6.	Rosmarinus officinalis	L	Rosmary
7.	Origanum dictamus	L	Dictamos
8.	Thymus vulgaris	L	Thyme
9.	Calendula officinalis	L	Marigold
10.	Foeniculum vulgare	M	Fennel
11.	Origanum Majorana		Marjoram
12.	Mentha piperita	L	Peppermint
13.	Capparis spinosa	L	Capparis – Caperbush
14.	Lavandula sp.		Lavender sp.
15.	Hyssopus officinalis		Hyssop
16.	Sideritis sp.		Sideritis
17.	Rosa damascena		Damoscine Rose
18.	Salvia sp.		Sage
19.	Origanum dubium		Origano
20.	Anethum graveoleus		Dill
21.	Melissa officinalis	L	Melissa – Balm
22.	Myrtus communis		Myrtle tree
23.	Artemisia absinthium	L	Wormwood
24.	Crithmum maritimum		Rock samphire
25.	Pistacia lentiscus		Pistacio
26.	Artemisia dracunculus		French tarragon
27.	Mentha viritis		Spearmint
28.	Plantaco coronopus		Plantain
29.	Gentranthus rubber		Valerian
30.	Agrimonia eupatoria	L	Agrimony

31.	<i>Hypericum perforatum</i>		Hypericum
32.	<i>Angelica archangelica</i>	L	Angelica
33.	<i>Artemisia pontica</i>		Marjorr Cypria – wormwood
34.	<i>Valeriana officinalis</i>	L	Common valirean
35.	<i>Humulus lupulus</i>		Hops
36.	.....		Yarrow
37.	<i>Verbena officinalis</i>	L	Verbena
38.	<i>Saponaria officinalis</i>	L	Soapewort
39.	<i>Verbascum thapsus</i>	L	Mullein
40.	<i>Leonurus cardiaca</i>	L	Mother wort
41.	<i>Gentaurea scabiosa</i>		Century Plant Cornflower
42.	<i>Vanilla plantyfolia</i>		Vannila
43.	<i>Gestrum Noxtumum</i>		
44.	<i>Pimpinella Anisum</i>	L	Aniseed
45.	<i>Lippia cidriodora</i>		Lemon Verbena
46.	<i>Sambucus Nigra</i>	L	Elder
47.	<i>Marticana chamomilla</i>		Mayweed
48.	<i>Crocus sativus</i>		Saffron
49.	<i>Urtica dioiea</i>	L	Nettle
50.	<i>Eucalyptus sp.</i>		Eucalyptus
51.	<i>Sanguisorba Minor</i>		Bumet
52.	<i>Allium shoenoprasum</i>		Chives
53.	<i>Allium sativum</i>		Garlic
54.	<i>Petroselinum sativum</i>		Parsley
55.	<i>Psidium guijava</i>		

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**Cultivators of aromatic plants in 2001**

Ministry of Agricultural, Natural Resources and Environment, Department of Agriculture  
Section of Aromatic and Medicinal plants

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20.	Katsos Aristides	Mitsero, Nicosia	22-634366 99-621361
21.	Georgios Patsalis	Astromeritis, Nicosia	22-821042 99-650463
22.	Loukis Sideris	Arodes, Pafos	26-220444
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31.	Pambos Erakleous	Tseri	22-371768 99-609128
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42.	Holy Metropolis of Morphou	Evrychou	22-932401/2/3

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Tel.: 00357-25-352052

Fax.: 00357-25-375868

E-mail: [medochmd@logos.cy.net](mailto:medochmd@logos.cy.net)

## 2. Remedica Ltd - Manufacturers of Pharmaceuticals

Limassol Industrial Estate,

P.O.Box 51706,

Limassol,

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Tel: 00357-25-393444

Fax.: 00357-25-390192

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## 3. Aegis Ltd – Manufactures of Pharmaceuticals

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ANNEX 7

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I would like to express my gratitude to all those who have in any way contributed to the completion of the present work.