ΤΕΧΝΟΛΟΓΙΚΟ ΕΚΠΑΙΔΕΥΤΙΚΟ ΙΔΡΥΜΑ
ΤΕΙ ΗΠΕΙΡΟΥ

European Territorial Cooperation Programme
Greece - Italy
2007-2013

INVESTING IN OUR FUTURE
Co-funded by the European Union (ERDF) and by National Funds of Greece & Italy

Project Title:

Towards a Common Quality Control and food chain traceability system for the Greek – Italian primary sector of activity

Agroquality

Deliverable Title:

Study for the development of an electronic record | 3.2.1.

Part A. Development of ECR from an agronomist's point of view

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Author	:	TEI of Epirus (LP)
Type	:	Document/ Software /Content
Document Reference	:	Internal / Draft / Final
Version	:	04
Date	:	Jan 15, 2013

Control Page

Deliverable Number	**D.3.2.1**
Corresponding WP Title	3 Studies
Corresponding Action Title	3.2 Study for the development of an electronic record – Two Pilot Cases
Responsible Partner:	TEI of Epirus (LP)
Working Group	**Part A. Development of ECR from an agronomist's point of view** Georgios Manos Tsirogiannis Ioannis
Scientific Coordinator:	Georgios Manos
Creation Date:	01/03/2012
Last Update:	15/01/2013
Type:	Document
Version:	4

Modification Control

VERSION	DATE	COMMENTARY/STATUS	AUTHOR
1	27/7/2012	1st internal version	TEI of Epirus (LP) Manos G., Tsirogiannis I.L.
2	1/9/2012	2nd internal version (DRAFT)	
3	30/11/2012	3rd version (working DRAFT)	
4	15/1/2013	4th version, FINAL (Part A. Development of ECR from an agronomist's point of view)	

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1 Introduction

The present Document constitutes the deliverable 3.2.1. "Study for the development of an electronic record -two pilot cases (Document)" of the Action 3.2 "Study for the development of an electronic record" of the project "AGROQuality: Towards a Common Quality Control and food chain traceability system for the Greek – Italian primary sector of activity". TEI of Epirus, the leader partner (LP) of Agroquality, was in response to implement the corresponding study for the Region of Epirus.

Modeling and placing Quantitative Rules is a self-evident need in most substantial human activities. Thus initially we have adopted the Electronic Health Record for Humans and the Animal Health Certificate for animals and livestock.

The rational following question *"how can we issue a health certificate for plants?"* is the core question for the AGROQuality project, which leads the initial concept and the overall development.

The main objective of the present Document is to guide the development of the AgroQuality Electronic Cultivation Record.

The present Document is being elaborated along with the whole series of studies (D3.1.1-D3.2.2) of the project. The intermediate and final findings of these studies will be further processed for the detailed features of the AGROQuality ECR specification.

Towards this, the attributes, the factors and the features of interest are being identified and the related standards presented.

2 AGROQuality Electronic Cultivation Record Overview

2.1 Traceability

Traceability is a well documented system of actions that accompany a product and start from the farmers, pass through the processing activities and continue to the storing and merchandise in order to bring information regarding the whole route to the consumer.

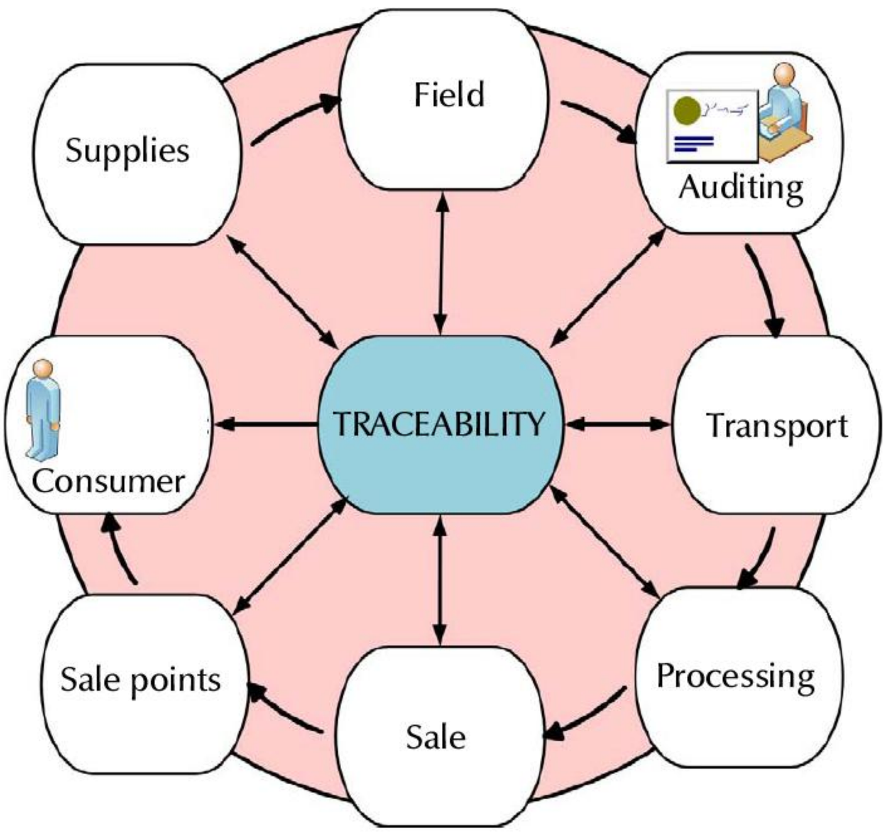

Figure 1 Traceabiliy palyers and interconnections (Giorgoudeli, 2010)

CODEX ALIMENTARIUS (3/5/2004) defines traceability as the capability to follow of the mobility of a food entity along the phases of production, processing and transportation". In the framework of food & beverages process sector, Moe (1998) defines as traceability, the capability to find for a food cargo, its time line through all the production chain, from harvest, transport, storage, process till distribution and sale. According to Bollen (2009), traceability should also concern the cultivation stage as crucial factors regarding the product quality are the use of fertilizers, plant protection substances etc. The use of chemicals during post harvest stages is also significant. The main factor that gave significance to traceability is the public health. The European Food Safety Authority (EFSA), has made obligatory since 2005 the existence and operation of traceability systems in every enterprise that is engaged with food and relevant products.

Nowadays, consumers are not interested only if the product has been produced according to the applied legislation but also for additional information like the place of origin, the cultivation method, the farmer, the transport, process and storing conditions etc. In the future, the design and the operation of food and beverages supply chain will be subjected in stricter rules and more intense monitoring.

In commercial systems, a traceability system is an integrated system of identification, the main objective of which is the development of a dynamic data file for each product in every stage of the production stage, from the field to the table of the consumer. This file is determined by a code which is revered as lot number. There are two main types of traceability: a) downstream: one can track all the lot numbers of the final products, using a specific lot number of raw material and b) upstream: by knowing the lot number of the final product one can track all the available data for the raw materials and the production stages (Giorgoudelli, 2010).

The main advantages of a traceability system is that:

- it provides information regarding the best control of processes (i.e. optimization of raw material use, information regarding storage, production scheduling, quality control etc), for the customers, the auditing organizations etc,
- they support the crisis management (problems spotting, withdraw of problematic lots etc),
- the can document at any phase the characteristics of a product (i.e., quality, place of origin etc)

Current traceability systems start at the stage of raw material delivery (for the case olive oil and table olives) and continue the registration up to the production of the final product (packaged olive oil and olives). The minimum data that a system of this kind registers are: name, address of the producer (farmer, mediator etc) and kind of products; name, address of the customer and kind of products that were delivered to the customer; date of trade action; quantity and lot number; analytical characteristics of the products. The proposed system (ECR) will begin at the stage of cultivation and will come either a) up to the delivery to the merchant, processor etc after the end of each cultivation period or b) up to the final product and the store shelf, depending of the available resources for the system development. In every case the system will contain: a) contain special designed forms for the collection of data; b) tools for the scientific support of each stage and c) feed back and feed forward utilities regarding production factors. The system will provide analytical information regarding the route of the product and the parameters of each stage in the form of special designed for each group of users descriptive and spatial reports.

A number of prototypes and systems for traceability have been already designed for the special case of agricultural products (Giorgoudeli, 2010). Nanseki and Morooka (1991), Lazzari and Mazzetto (1996), Ekman (2000), Torkamani (2005) and Biswas and Pal (2005) developed prototypes for the optimal use of the infrastructer that a farm has. Jones et al (2003) and Caixeta-Filho (2006) designed prototypes focusing in the improvement of the organoliptic characteristics and the quality of the products. Alocija and Ritchie (1990), Sumanatra and Ramirez (1997), Higgins et al. (1998) , Leutscher et al. (1999), Raju and Kumar (1999), Glen and Tipper (2001) and Caixeta-Filho et al. (2002) developed prototypes for scheduling the agricultural practices and maximize profit. Adesina and Sanders (1991) and Kaiser at al. (1993) combined climatic factors with profit. Visagie et al. (2004) embedded risk management approaches. Higgins (2002), Maatman et. (2002), Jones et al. (2003), Recio et al. (2003), Vitoriano et al. (2003) developed cost diminussion strategies -which included climatic factors affection- during planting, cultivation practice, transport and process of products. Kazaz (2004), Allen and Schister (2004) and Ferrer et al. (2008) developed prototypes for decisions regarding harvest. Most of the above mentioned approaches do not meet the standards of a traceability system as they focus on selected stages of the agricultural products chain. Apaiah and Hendrix (2005) developed an almost integrated system that concerns the production chain of beans.

2.2 Agroquality traceability approach

In our days, a significant concern of the consumers is related to the high-quality and the known origin of raw and processed agricultural products they purchase. In developed countries, with high living standards and strong incomes, the majority of consumers are willing to pay more for relevant certifications. For the case of table olives and olive oil, the quality is affected by the variety, the origin, the applied cultivation methods, the processing and storing methods. Traceability is the ability to verify the history, location, or applied process on a product by means of documented recorded identification. The aim of a traceability system is to register as much as possible data for every stage of cultivation, production and storing. The more detailed the recording of conditions and methods of cultivation and production, the more integrated the traceability system is. Another aspect of such systems is their simplicity, reliability and efficiency in order to be easily adopted and applied by the concerned people (farmers, processors, merchants etc). A novel point regarding such a system is to integrate also tools which will provide good practice information regarding all stages of cultivation, production and storing and could support, via a feedback procedure, the improvement of the applied methods. Finally, feed forward features, such as expected meteorological conditions, or market needs would give extra added value to such a system. In every case accessibility to the relevant information should broadly available to each group of users (farmers, processor, merchants and of course consumers).

Non-electronic production and traceability systems in which data are recording by hand, using special forms, do not comply with the above mentioned characteristics. Moreover in most cases there is no linkage between cultivation and production and the available information is more or less general. Note that different standards can be applied in cultivation, processing and storage stages along the the agri-food supply chain and in every case a system has be in line with them in order to have good perspectives to be used. Achieving full traceability requires both individual and collective effort from all the involved parties, from the farmers, to processors, merchants, state organizations and consumers.

In this study the characteristics of a system at farm level is presented. The Electronic Cultivation Record (ECR), is a tool that helps farmers to apply best cultivation practices in the frameworks of existing certified cultivation systems. The system has the potential to be part of an integrated traceability system regarding olive products that will cover all the way from the field to the consumers table. The system is base on the development of special software, which will facilitate the data acquisition process in the field and provide useful information for the next stages (processing, merchandise etc). All the interest parties (including the consumers) will be able to easily retrieve via internet, descriptive and spatial reports all information (data of origin, farming operations, quality characteristics etc) concerning the product. The ECR has to be evaluated via pilot application under field conditions in order to prove it's reliability, accuracy and efficiency. This procedure will show any weaknesses and should identify any improvements to be made.

AGROQuality Electronic Cultivation Record Constitutes a core component of the proposed platform. It is the connecting link among the GIS-resided geospatial information, the existing standards, agronomics knowledge and know-how, cultivation practices, individual farmer and the final product (fruit).

To realise the content and the actual placement of the ECR in the AGROQuality platform, the major repositories are depicted in Figure 2.

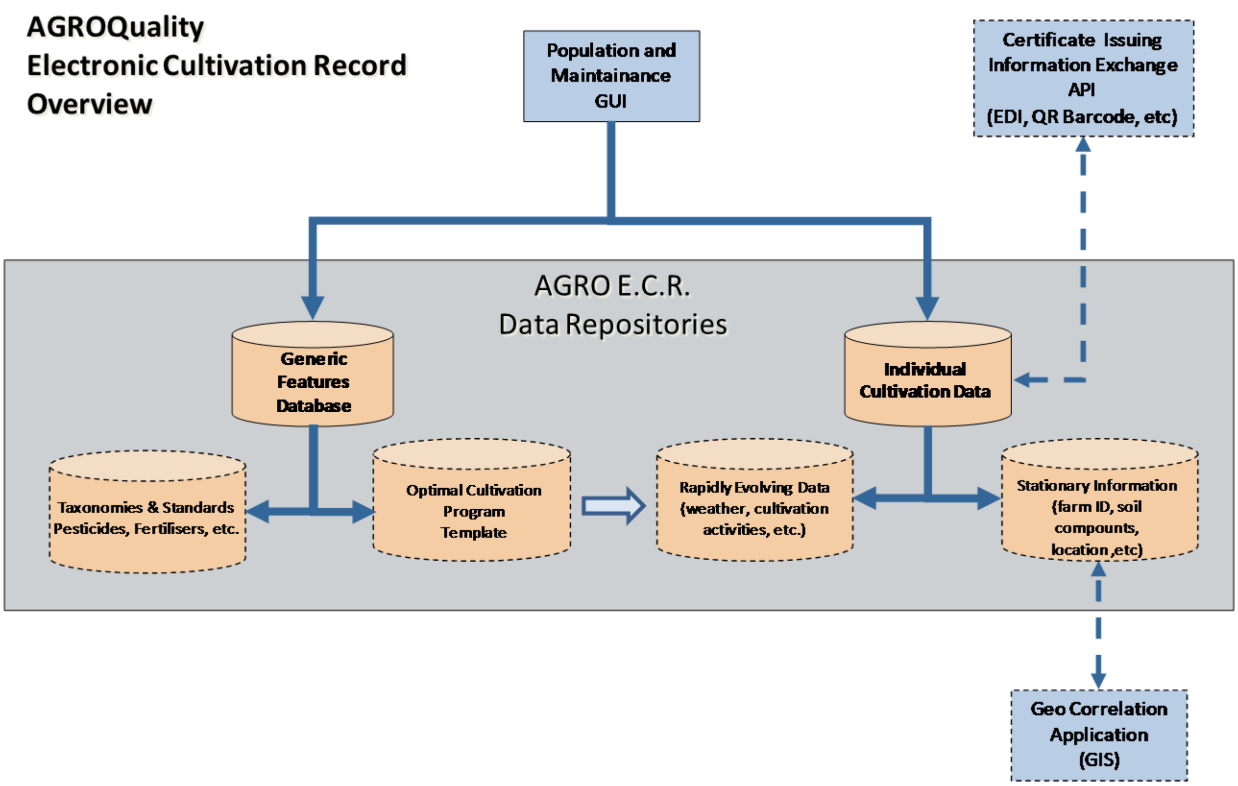

Figure 2 AGROQuality ECR organisation

AGROQuality ECR information content is initially divided in two major categories:

- **The Generic Features Repository:** which contains all the agronomics knowledge in terms of taxonomisation, pesticides, fertilizers and chemicals, biological practices, as well as best or proposed cultivation practices
- **The Individual Cultivation Data:** which contains all the “farm-specific” information and is further subdivided into the
    - **stationary data** (i.e. location, farm-er ID, soil mechanical characteristics and compounds) and generally all information remaining (almost) constant over a single cultivation period and the
    - **rapidly evolving data** (i.e. weather, soil humidity, pests, cultivation activities, etc.); data that generally vary over a single cultivation period.

Being primarily focused on olive and olive-oil, this study covers:

- **Generic Features:**
    - Taxonomisations

- Terminologies and agronomic standards involved
- Cultivation Plan Templates

- **Individual Cultivation Data:**
  - Initial Cultivation Data Identification (features)
  - Cultivation Monitoring Templates

This will guide the development of the AGROQualiry ECR databases and the overall architectural design of the platform.

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3 The olive tree and its cultivation

3.1 Olive tree classification

Olea, the olive tree: the common name olive comes from the Latin word oliva and the Greek word **elaia**.

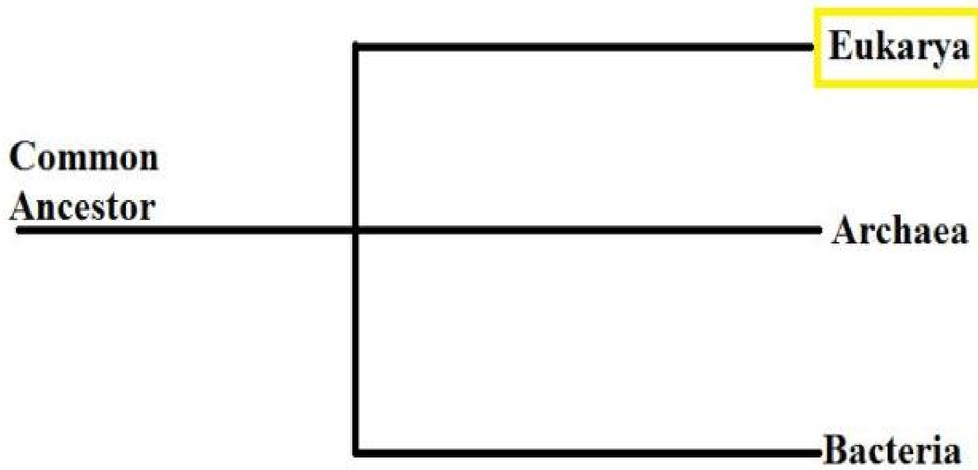

Figure 3 Olive in the major division of living organisms

According to the classical taxonomies, olive may be classified as:

Eukaryotes - Nucleated Cells	
Kingdom:	Green Plants
Subkingdom:	Tracheobionata - vascular plants
Superdivision:	Spermatophyta - seed plants
Division:	Magnoliophyta - flowering plants
Class:	Magnoliopsida - Dicotyledons
SubClass:	Asteridae
Order:	Scrophulariales or Lamiales
Family:	Oleaceae - ash, privet, lilac and olives
Genus:	**Olea**
Species:	**Europa**

According to the "Tree of Life":

Table 1 Olive Europea classification (classic and ToL accordingly)

Eukaryotes - Nucleated Cells
Green Plants
Embryophytes
Spermatophyta - seed plants
Angiosperms - flowering plants
Euangiosperms
Eudicots (Tricolpates)
Core Eudicots
Asteridae
Lamiales
Oleaceae
Olea
Europa

Oleaceae Family, known as the Olive Family, comprises of 600 species in 24 genera (one extinct) and occur on all continents. Other Genera in the family Oleaceae are: Ligustrum (Privet), Syringa (lilac), Fraxinus (ash) and Olea (olive).

Subclass Dicotyledonae; Tenuinucelli. Dahlgren's Superorder Gentianiflorae; Oleales. Cronquist's Subclass Asteridae; Solanales.

APG (1998) Eudicot; core Eudicot; Asterid; Euasterid I; Lamiales. Species 600. Genera 24; Abeliophyllum, Chionanthus, Comoranthus, Fontanesia, Forestiera, Forsythia, Fraxinus, Haenianthus, Hesperelaea, Jasminum, Ligustrum, Linociera, Menodora, Myxopyrum, Nestegis, Noronhia, Noronhia, Notelaea, Nyctanthes, Olea, Osmanthus, Phyllyrea, Picconia, Schrebera, Syringa Tessarandra.

3.2 Attributes and important factors

Aiming on the development of the AGROQuality ECR, it is of high importance to identify the all the attributes and the factors influencing both the cultivation methods and the Qualtity and Quantity of the production.

<u>Inflorescence, floral, fruit and seed morphology</u>

Flowers solitary, or aggregated in 'inflorescences'. The terminal inflorescence unit cymose. Inflorescences racemes, panicles or fascicles. Flowers bracteate, or ebracteate; often fragrant; regular; usually 2–6 merous; tricyclic, or tetracyclic. Free hypanthium absent. Hypogynous disk present (around G), or absent; intrastaminal.

Perianth with distinct calyx and corolla (usually), or sepaline (the corolla sometimes lacking); typically 8; 2 horled (usually), or 1 whorled; isomerous. Calyx 4(–15); 1 whorled; gamosepalous; entire, or lobulate, or lunt-lobed, or toothed (sometimes obsolete); regular; valvate. Corolla when present (i.e. usually) 4(–

12); 1 whorled; polypetalous (rarely, more or less), or gamopetalous; imbricate, or valvate (or induplicate-valvate), or contorted; regular.

Androecium 2 (usually), or 4 (rarely). Androecial members adnate (to the corolla), or free of the perianth; ree of one another; 1 whorled. Androecium exclusively of fertile stamens. Stamens 2(–4); reduced in number relative to the adjacent perianth; oppositisepalous; filantherous, or with sessile anthers. Anthers dorsifixed, or basifixed; dehiscing via longitudinal slits; introrse. Endothecium developing fibrous hickenings. Microsporogenesis simultaneous. The initial microspore tetrads tetrahedral, or isobilateral, or T-shaped, or linear. Anther wall initially with one middle layer, or initially with more than one middle layer. Tapetum glandular. Pollen grains aperturate; (2–)3(–4) aperturate; colpate, or colporate colporoidate, occasionally rupate); 2-celled, or 3-celled.

Gynoecium 2 carpelled. Carpels reduced in number relative to the perianth. The pistil 2 celled. Gynoecium syncarpous; synovarious to eu-syncarpous; superior. Ovary 2 locular. Gynoecium median, or transverse, or oblique; stylate. Styles 1; pical. Stigmas 2 lobed; dry type; papillate, or non-papillate; Group II type. Placentation axile. Ovules (1–)2(–50) per locule (usually two, but Jasminoideae with 1, 4 or 'many'); pendulous, or ascending; with dorsal raphe; usually collateral; non-arillate; anatropous, or amphitropous; unitegmic; tenuinucellate. Endothelium differentiated. Embryo-sac development Polygonum-type, or Allium-type. Polar nuclei fusing prior to fertilization. Antipodal cells formed; 3; not proliferating;

Ephemeral. Synergids hooked. Endosperm formation cellular. Embryogeny caryophyllad, or solanad (?).

Fruit fleshy, or non-fleshy; dehiscent, or indehiscent, or a schizocarp. Mericarps when schizocarpic, 2; samaroid. Fruit when non-schizocarpic, a capsule, or a berry, or a drupe. Capsules loculicidal. Fruit 1–4 eeded. Seeds endospermic, or non-endospermic. Endosperm oily. Embryo rudimentary at the time of seed release (in Fraxinus excelsior), or weakly differentiated to well differentiated (?). Cotyledons 2. Embryo achlorophyllous (5/12); straight.

Seedling. Germination phanerocotylar, or cryptocotylar.

Physiology, Biochemistry

Not cyanogenic.

Alkaloids present (commonly), or absent. Iridoids detected;

Route I' type (normal and seco).

Verbascosides detected (4 genera). Cornoside detected (Forsythia).

Proanthocyanidins absent. Flavonols resent, or absent; quercetin, or kaempferol and quercetin.

Ellagic acid absent (8 genera, species).

Arbutin absent. Ursolic acid present.

Saponins/sapogenins present, or absent.

Aluminium accumulation not found.

Sugars transported as oligosaccharides + sucrose, or as sugar alcohols + oligosaccharides + sucrose (and sucrose nowhere predominating).

3.3 Olive tree phenological stages and climatic preferences

The phenological stages of olive tree (Olea europaea L.) provide useful guidance for the scheduling of cultivation interventions. The phenological stages of olive trees are presneted in Table 2 and Figure 4 (Sanz-Cortez et al., 2002).

Table 2 Olive tree phonological stages, codes refered to the relevant image (Sanz-Cortez et al., 2002)

Code / Description
Principal growth stage 0: Bud development
00 Foliar buds at the apex of shoots grown the previous crop-year are completely closed, sharp-pointed, stemless and ochre-coloured (00).
01 Foliar buds start to swell and open, showing the new foliar primordia.
03 Foliar buds lengthen and separate from the base.
07 External small leaves open, not completely separated, remaining joined by apices (07).
09 External small leaves opening further with their tips inter crossing (09)
Principal growth stage 1: Leaf development
11 First leaves completely separated. Grey-greenish coloured(11)
15 The leaves are more separated without reaching their final size. First leaves turn greenish on the upperside.
19 Leaves get the typical variety size and shape.
Principal growth stage 3: Shoot development
31 Shoots reach 10 % of final size.
33 Shoots reach 30 % of final size (33).
37 Shoots reach 70 % of final size.
Principal growth stage 5: Inflorescence emergence.
50 Inflorescence buds in leaf axiles are completely closed. They are sharp-pointed, stemless and ochre-coloured.
51 Inflorescence buds start to swell on its stem.
52 Inflorescence buds open. Flower cluster development starts(53).
54 Flower cluster growing
55 Flower cluster totally expanded. Floral buds start to open(55).
57 The corolla, green-coloured, is longer than calyx (57).
59 The corolla changes from green to white colour.
Principal growth stage 6: Flowering
60 First flowers open (60).
61 Begining of flowering: 10 % of flowers open.
65 Full flowering: at least 50 % of flowers open (65).
67 First petals falling.
68 Majority of petals fallen or faded (68).
69 End of flowering, fruit set, non-fertilized ovaries fallen.
Principal growth stage 7: Fruit development
71 Fruit size about 10 % of final size (71).
75 Fruit size about 50 % of final size. Stone starts to lignificate (it shows cutting resistance).
79 Fruit size about 90 % of final size. Fruit suitable for picking green olives (79).
Principal growth stage 8: Maturity of fruit
80 Fruit deep green colour becomes light green, yellowish.
81 Begining of fruit colouring (81).
85 Increasing of specific fruit colouring.
89 Harvest maturity: fruits get the typical variety colour, remaining turgid, suitable for oil extraction (89).
Principal growth stage 9: Senescence
92 Overripe: fruits lose turgidity and start to fall (92).

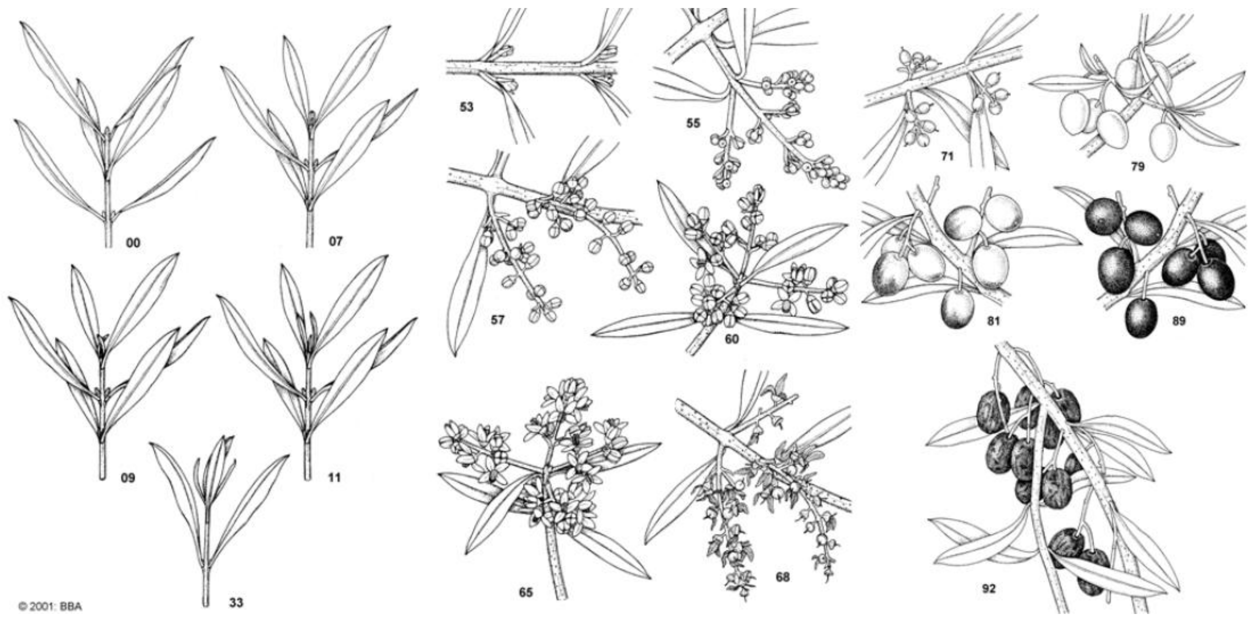

Figure 4 Olive tree phonological stages (Sanz-Cortez et al., 2002)

3.4 Climatic preferences

Climate

There is sensitivity to low temperatures during winter.

Temperature Range:

- Mean annual. 15-20^{o}C
- Absolute maximum up to 40^{o}C
- Minimum not below -7^{o}C
- The influence of the temperature is being correlated to other factors such as a sharp fall of temperature, the presence or absence of wind, frost, atmospheric lifetime and humidity, germination condition of trees etc.
- Should not be grown in areas with spring frosts
- The Green product is more sensitive than the black
- Temperature between-10 and-5^{o}C, causes significant damage to full aged olive trees

Near the equator, the olive tree haw only adequate stem due to the lack of winter cold for the diversification of the blooms.

3.5 Olive tree cultivation and products overview

Olive farming is an ancient pursuit dating back to biblical times. Olive trees, fruit and oil have played important roles in Middle Eastern, Greek, Roman and European cultures for centuries. Today more than 750 million olive trees are cultivated worldwide, the greatest number of which (c.95%) are planted in the Mediterranean region. In addition, there are at least fifty different varieties of olive, each with its own distinct characteristics. The main producing areas in Greece are Crete and the Peloponnese, where the most important variety for oil production is the Koroneiki. In Greece, there are an estimated 120,000,000 olive trees and 350,000 Greek families involved in olive tree cultivation.

The coastal regions of Greece have the perfect climatic conditions it needs and a suitable ecosystem for the tree to grow and bear fruit. The trees are slow to grow, taking four or five years to yield their first fruits and another 10 to 15 to reach their full capacity. Once established, however, the olive tree can live for many years. There are stories of trees which have stood for a thousand years.

The olive tree, Olea europaea, in mainly cultivated for olive oil, fine wood, olive leaf, and the olive fruit (table olives).

The cultivation of olive concers a number of interventions: soil processing, pruning, fertilization (adding fertilizers and amendments to soil), pests and diseases control, weeds management, irrigation and harvest. Everything that happens to the olive tree, from pruning in spring through flowering and harvesting in the late autumn, will have a bearing on the quality of the fruit, and thus on the product. The bulk of the work associated with olive farming concentrates at two points in time: pruning and harvesting. Pruning is the first thing a farmer does after harvesting to prepare the tree for the next crop. Harvest time in Greece is usually between September and December depending on autumn rainfall, and may even go on into February. The harvest is an extremely critical time as far as ripeness is concerned. Most growers want to produce as much good quality oil as possible and this means optimum ripeness, but if the olives are left on the trees too long they will over ripen and oxidize as soon as they are picked, producing unpleasant oil. In Greece olive harvesting still remains predominantly a "family affair", with everyone contributing to the work: parents, grandparents (as long as they can still walk!), children back from school, and even members of the family who have opted for jobs in the city. In recent years a large influx of immigrants to Greece has also provided a ready seasonal work force.

In order to produce olive oil, after harvesting, the olives are taken to the local olive mill where they are washed to remove leaves, twigs or earth, and crushed to produce a homogeneous mixture from which the liquid can be extracted. There are two basic methods of extraction. The first is called traditional and involves the crushing of the olives and their pits. The pits are important: the broken parts help to channel the oil when the paste is pressed. The milling process continues for about half an hour. During this time the cells of the fruit start to break down and release the oil. The paste is then spread evenly over small round woven mats which are piled up in batches of 30 or 40 on the hydraulic press. The mats are designed to allow the oil to trickle out and down the stack and collect at the bottom of the press. The presses produce a reddish-brown liquid which is part oil and part natural vegetable water. The two are separated in a centrifuge. In the past this process was carried out by slowly decanting the oil into troughs. The oil was then skimmed off as it rose to the surface. Some estate producers still like to use this method today, in which case the oil may be labeled Affiorato. It is important to note that very little olive oil today is produced using the "traditional method" mainly because of the higher costs involved. The second and most widely used method is called continuous where extraction is entirely by centrifuge. Here the olives are crushed by mechanical crushers and the resulting paste is spun at high speed to separate the flesh and the oil. The main drawback of this modern method is that the mechanical crushers involve high temperatures and the hot water often added to the centrifugal phase to extract more oil contributes to washing out precious vitamins and nutrients from the oil.

The main grades of olive oil that a consumer is likely to find in the shops in order of quality are as follows:

- Extra virgin olive oil: This is the top grade of olive oil. It is the natural juice of the olive with the olive water removed. Its free acidity level must not exceed 0.8g per 100g. It must also have fault free aroma and flavour.
- Virgin olive oil: This is the next grade of olive oil. It too, is the natural juice of the olive with the olive water removed. Its free acidity level must not exceed 2g per 100g. It must also have fault free aroma and flavour. Very little of this quality is sold in the shops
- Olive oil: This oil is obtained by blending refined olive oil and virgin olive oil. Its free acidity level must not exceed 1g per 100g. In some countries this is known as 'pure' olive oil.
- Olive pomace oil: This oil is obtained by blending refined olive-pomace oil with virgin olive oil. It free acidity level must not exceed 1g per 100g.

Greece is the third largest olive oil producing country worldwide (after Spain and Italy), while the competitive advantage of Greek olive oil in relation to that of other countries is its fine quality: 80% of the olive oil produced in Greece is extra virgin. This compares with only 50% of Italian and 20% of Spanish. In terms of bottled olive oil, Italy and Spain hold first place in the international market: Italy was the first off the mark in promotion, while Spain has become the largest industrial producer. However, no other country can yet compete with Greece in terms of quality. Ironically, the same reasons that render Greece unable to compete in terms of volume of production also underpin the superior quality of the oil itself. The inaccessible mountainous areas do not lend themselves to machine-picking. The labour intensive nature of Greek production, whereby small groves of trees in remote areas are regularly tended by farmers, olives are hand-picked, and the crop is pressed on the day of picking, are factors which have prevented Greece from being competitive in mass market terms. Of course other factors include lack of effective marketing strategies: until very recently the Greeks have not tried to market their oil as a premium product, and so presentation and packaging have been minimal.

Production of olive oil in Greece fluctuates between 300 and 400 thousand tonnes. About 2/3 of domestic production is covered by Crete and the Peloponnese and especially by the counties of Heraklion and Messinia. The olive presses in Greece are small-sized family run businesses, which are set up in oil producing areas. There are approximately 3,000 of these mills in operation throughout Greece! The olive oil is either offered directly for consumption, or further processed and/or bottled. Most companies which process and/or bottle olive oil are also involved in its distribution in bulk, while there are also other trading companies (wholesale) dealing exclusively with sales within Greece and abroad. Moreover, a number of cooperatives are involved not only in the production, but also in trading and bottling of their oil.

About one half of the annual olive oil production in Greece is exported. Average yearly Greek olive oil exports amount to 140,000 tons per year, while only seven to ten thousand tons reflect the bottled product. Greek exports primarily target countries of the European Union, the main recipient being Italy, which receives about three quarters of Greece's total exports. Due to the superior quality and excellent organoleptic properties of Greek olive oil it is not surprising that bulk exports quietly sneak into bottles and cans packaged and sold elsewhere. For this reason it is more than likely that a regular olive oil consumer has tasted Greek olive oil at least once. The average annual domestic olive oil consumption of Greeks is estimated to be around 170,000 tons. The largest part of that (42%) relates to personal consumption (Greeks consume more olive oil per capita than any other people in the world at almost 16 kilos annually!), the quantities of bulk olive oil which is traded by producers themselves comes up to 33%, while bottled olive oil covers just about 25% of total domestic consumption.

Table olives are the other significant product of olive cultivation. There are three major types of Greek table olives: 1.The Green olive;2.The Kalamata olive and 3.The Black olive. More analytically:

1. Geen olives:
    a. Green Halkidiki olives are grown in the peninsula of Halkidiki region of northern Greece. The deep blue of the Aegean Sea, the bright sun and the fertile Greek land created these impressive and tasty table olives.
    b. Green "Amfissa" olives are an excellent quality Greek table olive grown in Amfissa, Central Greece near the oracle of Delphi. Amfissa olives enjoy protected designation of origin (PDO) status.
2. Kalamata olives:
    a. The Kalamata olives with their brownish-black color and their characteristic "almond" shape have a unique and splendid taste from all other olive varieties of the world. The Kalamata olives grow only in specific regions of Greece, in limited quantity, so they are considered a very special product.
3. The black olives:
    a. Black natural olives are grown in various places in Greece, mainly in Central and West Greece (Agrinio, Amfissa, Arta, Lamia, Pilio). Some of them are PGI products. They are also called conservoelia (Olea europaea var. Rotund) and they usually take the name of the place where they grow. The shape of the olive is quite round and one of the biggest of Greek olive varieties. Another characteristic of the conservoelia olives is the their color variation according to their maturity. The color varies from green, "blonde" to black, while they are renown for their excellent quality.

The price of table olives is commonly linked to their size. A commonly used classification of olives is the following (Size Pieces of olives / kg): ATLAS 70-90 , SUPER MAMMOUTH 91-100 , MAMMOUTH 101-110, SOUPER COLOSSAL 111-120 , COLOSSAL 121-141 , GIANTS 141-160 , EXTRA JUMBO 161-180 , JUMBO 181-200 , EXTRA LARGE 201-230 , LARGE 231-260 , SUPERIOR 261-290 , BRILLIANT 291-320 , FINE 321-250 and BULLETS 351-380.

Olives are a naturally bitter fruit fermented or cured with lye or brine to make them more palatable. Green olives and black olives are typically washed thoroughly in water to remove oleuropein, a bitter glycoside. Green olives are allowed to ferment before being packed in a brine solution. In addition to oleuropein, freshly picked olives are not palatable because of phenolic compounds. Curing can employ lye, salt, brine, or fresh water. Salt cured olives (also known as dry cured) are packed in plain salt for at least a month, which produces a salty and wrinkled olive. Brine cured olives are kept in a salt water solution for a few days or more. Fresh water cured olives are soaked in a succession of baths, changed daily. Green olives are usually firmer than black olives. Olives can also be flavoured by soaking in a marinade or pitted and stuffed. Popular flavourings include herbs, spices, olive oil, chili, lemon zest, lemon juice, wine, vinegar, and juniper berries; popular stuffings include feta cheese, blue cheese, pimento, garlic cloves, jalapenos, almonds, and anchovies. Sometimes, the olives are lightly cracked with a hammer or a stone to trigger fermentation. This method of curing adds a slightly bitter taste.

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4 Olive cultivation products

The main objective of the present section is to appoint the different products that may delevoped in the framework of olive cultivation.

4.1 Products codification approaches

The basic philosophy behinf the categorization and codification of products is the following: "every different product or service or place must have a unique code, which will be used for identification purposes". If for example the international system GS1[1] is applied, then everywhere in the world the definitive indentification of each product is made.

4.2 In the framework of statistical classification for the economic activity sectors (STAKOD)

The statistical categorization of Economic Sectors Activities (in Greek: ΣΤΑΚΟΔ) provides a national framework for the registration and presentation of statistical data and information per sector. ΣΤΑΚΟΔ is published by the Greek State Statistical Agency according to the relevant international standards of categorization (NACE).

Indicatevely it is refered that:

- category 013.1 refers to olive trees cultivation
- category 154.1. refers to olive mills

4.3 In the framework of financial / development management of Greek state for professional activities categorization (KAD)

The Activity Code Numbers (in GreekΚΑΔ) constitutes a systems of the General Secreteriat of Informatics Systems of the Greek Ministry of Economics for the categorization of the professional activities. It includes a number of activities which are directly related with the products of olive cultivation (ΓΓΠΣ, 2012). Indicatevely we refer the following[2]:

- 01.30.10.27 (National activities) Cultivation of olive trees in nursery
- 01.26.12 (CPA subcategories) Cultivation of olive trees for olive oil production
- 01.26.11 (CPA subcategories) Cultivation of table olives
- 10.41.23.02 (National activities) Olive fruit milling services
- 10.41.23 (CPA subcategories) Production of olive oil which is employed in raw form
- 10.41.53 (CPA subcategories) Production of olive oil and its fractions, purified but not chemically processed
- 10.41.99.02 (National activities) Procesing and packaging services of olive oil
- 47.29.22.07 (National activities) Processing ervices of olive oil and its fractions, purified but not chemically processed
- 20.41.31.01 (CPA subcategories) Production of luxury soap

[1] Since 1977, the organisation EAN International –now known as GS1-, contributes to the categoriesation of products, you can find more at: http://www.gs1greece.org/.

[2] The tool http://www.forin.gr/tools/kad was used

Categorisation of products is also applied in the framework of development and entrepreneurship financing programs (π.χ. Measure 123A « Processing and trading of agricultural products», Community Initiative Leader etc).

4.4 In the framework of logistics systems for labeling and traceability purposes

The management of production and of supply chain are very complicated issues. For this reason, moden enterprises have since decades installed relevant informatic systems (ERP, WMS, etc) which facilitate both products and relevant information flows. Information systems in order to operate efficiently demand reliable and prompt data supply from the various production, storing and transporting points. This has to do with both the raw materials and all the intermediate phases to the final products (Θεοδώρου, 2008). This necessity –and not only- has to be covered by the traceability systems which monitor the production and supply chains in almost real time basis. In this way they operate as tools for the complete transparency of the internal processes, the direct response in case of crisis, the protection of the enterprice in case of mistakes and the general improvement of the production line through the tracking of the problems' source (Θεοδώρου, 2008). The basic structural element of a traceability system is the categorization of products, in other words their identification with the information that follow them (Lot, Expiration date, etc) during the production and commercing line (Θεοδώρου, 2008). This way each, and in our case an agricultural originated product is identified using it's production information acquiring a unique ID which follows it through all the phases of the route from the field to the consumer's table.

4.5 Olive cultivation products

The following table contains the most common products from olive cultivation.

For olive oil except of the variety and the maturing stage (soor-green / matured) the acidity is a critical characterist. These are the qualities of olive oil according to the internationally recognized classification of olive oil:

Category 1:		**Category 2:**	**Category 3:**
VIRGIN OLIVE OIL		OLIVE OIL	OLIVE-POMACE OIL
extra virgin oil	fine virgin olive oil	made by blending refined & virgin olive oils	
Maximum acidity: 0.8g in 100g of olive oil (or 0.8% acidity)	Maximum acidity: 2g in 100g of olive oil (or <2% acidity)	Maximum acidity: 1g in 100g of olive oil (or <1% acidity)	Maximum acidity: 1g in 100g of olive oil (or <1% acidity)

<table>
<tr><th>Category 1:</th><th>Category 2:</th><th>Category 3:</th></tr>
<tr><td>VIRGIN OLIVE OIL</td><td>OLIVE OIL</td><td>OLIVE-POMACE OIL</td></tr>
<tr><td>In essence, this is the natural fruit of olives that has not been subjected to any processing apart from crushing and, possibly, transfusion, centrifugation or filtration (productive processes) that do not alter its final quality (low temperatures at the olive oil mill, etc.). The category of virgin olive oil is separated into two sub-categories, depending on the degree of acidity, as well as the olive oil flavour:</td><td rowspan="2">This is a blend of good quality virgin olive oil and re-fined olive oil. The blend ratios used vary, but, in any case, the final product must have a pleasant flavour and scent, as well as a light, yellow-greenish colour.</td><td rowspan="2">This is a blend of olive oil that contains processed oils and oils that originate directly from olives. It may also be an olive oil blend consisting of olive oil and oils originating from the processing of olive stones.</td></tr>
<tr><td>Extra virgin olive oil is considered to be the top oil in terms of quality (natural juice). The extra virgin olive oil made from the first, unripe olives is called agoureleo (“unripe oil”) and considered even better than extra virgin olive oil, as it preserves all the characteristics of extra virgin oil, but to a higher degree. It is made in limited quantities by gathering the finest olives while they are still unripe. They must be picked by hand instead of harvested by striking the tree or picking them off the ground. Unripe oil has a limited lifespan of just 9 months.</td></tr>
</table>

For table olives except of the variety and the maturing stage (green / black) the size is a critical characteristic. A commonly used classification of olives is the following:

Size	**Pieces of olives / kg**
ATLAS	70-90
SUPER MAMMOUTH	91-100
MAMMOUTH	101-110
SOUPER COLOSSAL	111-120
COLOSSAL	121-141
GIANTS	141-160
EXTRA JUMBO	161-180
JUMBO	181-200
EXTRA LARGE	201-230
LARGE	231-260
SUPERIOR	261-290
BRILLIANT	291-320
FINE	321-250
BULLETS	351-380

Table 3 Olive culture products

Origin	Products	Codes and examples
GOODS		
Trunk, sprouts	Wood	Olive wood for heating (W_01)  Olive wood for masonry, furniture, wood sculpture (W_02)  Examples: http://www.antonoliva.gr/index0.asp
Fruit	Olive oil, table olives, industrial oil, olive pate, olive sweet, olive marmalade, soap from olive oil (white)	Olive oil (S_01)  Examples:

Origin	**Products**	**Codes and examples**
		▪ http://www.blauel.gr ▪ http://www.selinountas.com ▪ http://www.moriaelea.com http://www.speironcompany.com Table olives (S_02)  Examples: ▪ http://www.deasolives.gr ▪ http://www.lelia.gr ▪ http://biotzavas.gr ▪ http://www.gaea.gr/ Industrial oil (S_03) Olive pate (S_04)

Origin	Products	Codes and examples
		 Examples: ▪ http://www.altis.com.gr ▪ http://www.lyrakisfamily.gr ▪ http://www.lelia.gr ▪ http://www.organicvillage.gr ▪ www.gaea.gr Olive sweet (S_05)

Origin	Products	Codes and examples
		 Examples: ▪ http://www.odisia.gr/ ▪ http://www.korakis-marinos.gr/preserves_rect.asp http://www.kianonerga.gr/index.php?option=com_content&view=article&id=53&Itemid=63 ▪ http://www.pyliakigi.gr/index.php/el/pyliakigi.html Olive marmalade (S_06)

Origin	Products	Codes and examples
		 Examples: ▪ http://www.odisia.gr/ ▪ http://www.expertaste.com/about_gr.php Soap from olive oil (white) (S_06)  Examples: ▪ http://www.dimitra-natural.gr/ ▪ http://www.tosapouni.gr/index.php/products ▪ http://fisikashop.com/el/ ▪ http://www.tzortzopoulos-estate.gr/

Origin	**Products**	**Codes and examples**
		▪ http://www.ellinikaproionta.gr/
Leafs	provender (bulk feed for livestock), olive leef decoction /tea, compost - fertiliser	Provender (bulk feed for livestock) (L_01) Olive leef decoction / tea (L_02)  Examples: ▪ http://bioagrofarmhellas.blogspot.gr/2012/09/blog-post_15.html ▪ http://www.alibaba.com ▪ http://www.etsy.com Compost – fertilizer (L_03)
Stone	Stone as heating material, Stone Olive, Stone Wood, Pellet, Brigette, Stone coal, Stone dust, Soap from olive	Stone as heating material (S_01) Examples: ▪ http://www.energeiakatzakia-sompes.com/product_detail.jsp?prdId=KOYKOYTSI ▪ http://koukoutsi-elias.blogspot.gr/ Stone Olive (S_02)

Origin	Products	Codes and examples
	stone (green), Handicrafts	 Examples: ▪ http://oliveoilgreece.gr/shop/index.php ▪ http://www.lyrakisfamily.gr/index.php ▪ http://www.hfo.gr/gr/company/default.htm Stone Wood (S_03)  Examples: ▪ http://www.klimiscoal.gr ▪ http://www.mills.gr/Consumer_goods.aspx?id=936&lang=el

<table>
<tr><th>Origin</th><th>Products</th><th>Codes and examples</th></tr>
<tr><td></td><td></td><td>Pellet (S_04)

Examples:
http://www.klimiscoal.gr
http://hotpower.gr/seed-oil.html
http://kalogiropoulos.gr/el/pellets---el/pellet------el.html
Brigette (S_05)

Examples:</td></tr>
</table>

Origin	Products	Codes and examples
		▪ http://www.ksila.eu/ ▪ http://www.klimiscoal.gr Stone coal (S_06)  Examples: ▪ http://www.infrareds.eu/coal.html ▪ http://www.paraschos.com/product.php?products_id=418 ▪ http://www.klimiscoal.gr/sellpoint.php Stone dust (S_07) Examples: ▪ http://www.karvouna-promitheas.gr/index.php?lang=1&trig=8 ▪ http://www.klimiscoal.gr/profil.php Soap from olive stone (green) (S_08)

Origin	Products	Codes and examples
		 Examples: ▪ http://www.dimitra-natural.gr/ ▪ http://www.tosapouni.gr/index.php/products ▪ http://fisikashop.com/el/ ▪ http://www.tzortzopoulos-estate.gr/ ▪ http://www.ellinikaproionta.gr/ Handicrafts (S_09)  Examples: ▪ http://www.plus4u.gr ▪ http://www.ricardo.gr/buy/rouxa-papoutsia/andrika-aksesouar/kompologia/kompoloi-me-hantres-apo-xulo-elias-teleutaia-kommatia/v/an695007546/

Origin	**Products**	**Codes and examples**
Other	Cosmetics, Humo Olea, Decorative olive trees	Cosmetics (O_01)  Examples: ▪ http://belleandbeautybykaterina.blogspot.gr/2013/02/amalthia.html ▪ http://www.cretanature.gr/index.php Humo Olea (O_02) Decorative olive trees (O_03)  Examples: ▪ http://www.anastasopoulos-nurseries.com/text.aspx?id=4 ▪ http://www.cretanolivetrees.gr/el/olive-trees.html ▪ http://www.4umarket.gr/p-16786/elia-mponsai.html
SERVICES		
Agrotouristic	Participation in	Agrotouristic activities (AT_01)

Origin	Products	Codes and examples
activities	olive cultivation, processing or packaging activities, holiday, eating, education etc	  Examples: http://diakopes.in.gr/trip-ideas/article/?aid=208544 http://www.paragaea.gr

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5 Development of an Electronic Cultivation Record (ERC) for the area of Arta

5.1 Introduction

In order to describe in detail an Electronic Cultivation Record (ERC) the following steps must be made:

1. Identification of the needs, the framework and the capabilities regarding record keeping (information from: 3.1.1., Best practices and Questionnaires Agro section analysis chapters and 4.1.1. Questionnaires IT section analysis chapter will be used).
2. Review of the current solutions (hand writing systems, electronic systems, manual and automatic registrations etc).
3. Analytical definition of the model that will be followed and the characteristics of the Electronic Cultivation Record (ECR).

In this framework olive sector stakeholders must be invited to participate in the procedure by commenting the proposed ECR model.

5.2 Stakeholders of olive products sector in Greece

In oreder to finalise the description of the ECR, extensive contacts with the stakeholders of olive production (both local and national) must be made. This will ensure that the ECR will have great potential to be accepted by the sector and that it's use will be broadly promoted. The following are proposed to be contacted:

State stakeholders

- Greek Ministry of Agricultural Development and Food, Sector of olive cultivation, http://www.minagric.gr/index.php/el/for-farmer/crop-production/elialadi.html
- Decentralised Administration of Epirus and West Macedonia, Directorate of Agricultural Affairs of Epirus, http://www.apdhp-dm.gov.gr/portal/index.php/diarthrosi-ipiresion/stoixeia-epikoinonias.html
- Perfectional Unit of Arta, Directorate of Agricultural Economy and Veterinary, http://www.peartas.gov.gr/index.php?option=com_content&view=article&id=39:2011-06-03-07-07-31&catid=8:2011-05-31-05-52-53&Itemid=9
- Agricultural Products Certification and Supervision Organization (Agrocert), http://www.agrocert.gr/pages/category.asp?lang=en[3]
- Greek Payment Authority of Common Agricultural Policy (OPEKEPE), Olive Cultivation Registy, http://www.opekepe.gr/english/
- Greek Unified Organisation for Food Auditing (EFET), http://www.efet.gr/

[3] This period AgroCert, is preparing a general traceability software for all the cultivations.

Cooperatives and their unions

- Pan-Hellenic Confederation of Unions of Agricultural Co-operatives (PASEGES), Sector of Olives and Olive oil, http://www.paseges.gr/el/news?subject=OliveTree_OliveOil
- Central Cooperative Union of Olive Cultivation Producers (Elaiourgiki), http://www.eleourgiki.gr/
- Union of Agricultural Cooperatives of Arta and Filippiada (EASAF), http://www.easaf.gr

Market associations

- Panhellenic Union of Processosing and Packaging Companies of Table Olives (PEMETE), http://www.pemete.gr/
- Greek Association of Industries and Processors of Olive Oil (SEVITEL), http://www.sevitel.gr/el/index.jsp
- Greek Union of Handicrafts for Olive Oil Packaging (ESVITE), http://www.virginoliveoil.gr/
- National MultiProfessional Organisation for Olive oil and Olives (EDOEE), http://www.edoee.gr/

Scientific stakeholders

- Geotechnical Chamber of Greece (GEOTEE), http://www.geotee.gr/
- Greek National Agricultural Research Foundation (N.AG.RE.F.), Olive Institutes, http://www.nagref.gr/

Additionally, selected experts from the olive cultivation and products sectors (i.e. major enterpneurers, certification companies directors, publishers of specialised magazines, administrators of specialised web sites etc) must be invited.

5.3 A brief review of cultivation systems and origin certification of olive cultivation which have interest for the area of Arta (Epirus)

It is considered useful to refer at this point some basic information regarding Integrated Management System (IMS), Organic Agriculture (OA), Contract Farming (CF) and Protected Geographical Indication (PGI) regarding olive cultivation. The reason for this is that IMS, OA and CF require detailed record keeping regarding cultivation activities (among them IMS is broadly appied at Arta). This means that the farmers that apply these systems are familiar with recordkeeping and have the need for tools like the ECR which will facilitate the relevant procedures.

Another significant fact for the area is that the main local variety of Arta (Konservolia Artas) is officially defined as a PGI prodect and thus the need for geographical proof of the product is a reality.

Figure 5 From left to right: EU logo for organic farming products (SOEL, 2002); AGRO 2.1, 2.2 logo (Agrocert); PGI logo (EU)

5.4 Agrocert

The Agricultural Products Certification and Supervision Organization, under the distinctive title AGROCERT (www.agrocert.gr) is a Private Law Legal Entity operating for the public benefit under the supervision of the Greek Ministry of Rural Development and Food. It is an established body responsible for the implementation of national policy on quality in agriculture. The main competences of AGROCERT are as follows:

- Certification of agricultural production systems
- Certification of agricultural products
- Evaluation, approval and supervision of Control and Certification private bodies, accredited by the National Accreditation System.
- Preparation and publication of optional sectoral standards and development of specifications towards quality assurance of agricultural products.

In this framework it's main fields of activity are:

- Integrated Management in Agricultural Production
- Organic Agriculture
- PDO, PGI, Traditional Specialty Guaranteed Agricultural Products
- Quality Assurance of Pork Meat
- Special Poultry Farming
- Quality Assurance of Bovine Meat
- Quality Assurance of Aquaculture Products
- ISO - HACCP

5.5 Integrated Management System (IMS) of olive cultivation

In the framework of this system (it is referered as Integrated Management System (ISM) or Integrated Crop Management System (ICM)) the cultivation is realized by the integrated crop management and it targets to the production of edible olives. In the framework of an IMS, the structure and procedures developed and implemented by farmers, to produce quality and safe agricultural products, with respect to the environment and sustainable development are considered. In fact, is a system based on compliance with legal requirements that monitors and controls all phases of the production aiming at branded, high quality, safe and competitive products. Application of this system enhances the working environment of the farmers, produces quality agricultural products that are completely safe and as a result: ensures quality to the consumers.

The advantages of the integrated crop management are the following: a) better scheduling of work activities; b) rational use of all inputs (water, fertilizers, plant protection products); c) implementation of good agricultural practice rules; d) tracebility; e) reduction of the production costs; g)Health status and safety of products; h) products with competitive advantages and i) protection of workers and the environment.

The Integrated Management Systems in the Agricultural Production against AGRO 2 (AGRO 2.1, 2.2) present an extension of the ISO 14000 standard enhasing elements of the ISO 9000. In order to satisfy the customers demands and moreover the harmonization with the national and international demands, the agricultural sector has to be based on aspects that will assure quality and safety of its products and respect the environment in the way it is operating. Under this philosophy a need emerged for the design and implementation of Integrated Crop Management Systems (ICM). An independent certification body certifies ICM systems in order to bring “an external good evidence” for the way they are managed and functioned. ICM inspection prototypes are based on a combination of the ISO 14000 (Environmental Management Systems) and ISO 9000 (Quality Management Systems). The basic steps for the establishment of the system are:

- Policy definition of the agricultural production and more specifically the coverage of the legal matters concerning the environment and the produced agricultural products, the prevention of pollution and the continual management improvement in respect with the environment, the safety and the quality of the agricultural products
- Planning of environmental issues, their legal demands, aims and objectives of the operation, and plan of improvement
- Performance in respect to the organizing, the training, the communication, the documentation, the documents handling, the basic functions of the operation, the risk management, and the trace ability of the produced product
- Internal Audit, Corrective and Precautionary Actions
- Management review and investigation for the correctness and effectiveness of the system

Moreover there are legal and technical matters that aim in the production of safe quality products and the best environmental management. The ICM demands cover all the activities in the agricultural operation, such as:

- Variety selection General agricultural practices
- Soil management Nutrition of plants Irrigation Plant protection
- Harvest and storage
- Energy efficiency and machinery management
- Pollution control and waste management
- Environment and biodiversity
- Health & safety and worker training

With respect to the above the establishment of an ICM system accomplishes the full control of the agricultural operation. The processes in the agricultural operation are based on pre-designed demands and consequently minimize the unpredictable (basic element of malfunction). ICM systems are implemented in agricultural operations of every capability, from Producers Management Organizations (PMO) to private growers contracts. The basis of the system is the promotion of knowledge, experience and Good Agricultural Practices in the further acceptance of the agricultural products in the national and international market. Moreover, the system can work as an aid-giver in the difficulties farmers face in the establishment of sustainable agriculture.

The certification procedure includes the valuation of completeness and correctness of the Integrated Crop Management Manual, the on-site inspection for the audit of implementation of the System. With the successful competition of the audit a three-year internationally accepted certificate is issued. After the certification valuation annual surveillance audits are worked out in order to ensure the continuity and the improvement of the system.

The Union of Agricultural Cooperatives of Arta and Phillipiada (EASAF, www.easaf.gr) applies for several years an IMS for olive groves in the area of Arta.

5.6 Organic Agricultre (OA)

Organic agriculture is a system that relies on ecosystem management rather than external agricultural inputs. It is a system that begins to consider potential environmental and social impacts by eliminating the use of synthetic inputs, such as synthetic fertilizers and pesticides, veterinary drugs, genetically modified seeds and breeds, preservatives, additives and irradiation. These are replaced with site-specific management practices that maintain and increase long-term soil fertility and prevent pest and diseases (FAO, 2012a). Organic agriculture systems and products are not always certified and are referred to as "non-certified organic agriculture or products". This excludes agriculture systems that do not use synthetic inputs by default (e.g. systems that lack soil building practices and degrade land). Three different driving forces can be identified for organic agriculture:

- Consumer or market-driven organic agriculture. Products are clearly identified through certification and labelling. Consumers take a conscious decision on how their food is produced, processed, handled and marketed. The consumer therefore has a strong influence over organic production.
- Service-driven organic agriculture. In countries such as in the European Union (EU), subsidies for organic agriculture are available to generate environmental goods and services, such as reducing groundwater pollution or creating a more biologically diverse landscape.
- Farmer-driven organic agriculture. Some farmers believe that conventional agriculture is unsustainable and have developed alternative modes of production to improve their family health, farm economies and/or self-reliance. In many developing countries, organic agriculture is adopted as a method to improve household food security or to achieve a reduction of input costs. Produce is not necessarily sold on the market or is sold without a price distinction as it is not certified. In developed countries, small farmers are increasingly developing direct channels to deliver non-certified organic produce to consumers. In the United States of America (USA), farmers marketing small quantities of organic products are formally exempt from certification.

Certified organic products are those which have been produced, stored, processed, handled and marketed in accordance with precise technical specifications (standards) and certified as "organic" by a certification body. Once conformity with organic standards has been verified by a certification body, the product is afforded a label. This label will differ depending on the certification body but can be taken as an assurance that the essential elements constituting an "organic" product have been met from the farm to the market. It is important to note that an organic label applies to the production process, ensuring that the product has been produced and processed in an ecologically sound manner. The organic label is therefore a production process claim as opposed to a product quality claim.

5.7 Contract Farming (CF)

Contract farming (CF) can be defined as agricultural production carried out according to an agreement between a buyer and farmers, which establishes conditions for the production and marketing of a farm product or products. Typically, the farmer agrees to provide agreed quantities of a specific agricultural product. These should meet the quality standards of the purchaser and be supplied at the time determined by the purchaser. In turn, the buyer commits to purchase the product and, in some cases, to support production through, for example, the supply of farm inputs, land preparation and the provision of technical advice (FAOb, 2012)

Both partners engaged in contract farming can benefit. Farmers have a guaranteed market outlet, reduce their uncertainty regarding prices and often are supplied with loans in kind, through the provision of farming inputs such as seeds and fertilizers. Purchasing firms benefit from having a guaranteed supply of agricultural products that meet their specifications regarding quality, quantity and timing of delivery.

As with any other form of contractual relationship, there are also potential disadvantages and risks associated with contract farming. If the terms of the contract are not respected by one of the contracting parties, then the affected party stands to lose. Common contractual problems include farmer sales to a different buyer (side selling or extra-contractual marketing), a company's refusal to buy products at the agreed prices, or the downgrading of produce quality by the company. A frequent criticism of contract farming arrangements is the uneven nature of the business relationship between farmers and their buyers. Buying firms, who are invariably more powerful than farmers, may use their bargaining clout to their short-term financial advantage, although in the long run this would be counterproductive as farmers would cease to supply them. These problems notwithstanding, the balance between advantages and disadvantages for both firms and farmers seems to be on the positive side: contractual arrangements are more and more frequently being used in agriculture worldwide.

In principle, contracting farming can be applied in all type of agriculture products. There are numerous examples of successful contract farming arrangements regarding olive products. While the applicability is fairly general, there is evidence that the most successful schemes are associated with agricultural products that are high-valued or produced for processing and /or exports. Products for which there is high local demand may be more susceptible to side selling and thus may be less suitable for contract farming.

The typical clauses of a contract concern: a) general reciprocal obligations: the overall responsibilities of the contracting partners; b) specification of the agricultural product to be produced / sold under the contractual obligation; c) production technology to be used, involving items such as seed variety, soil preparation and cultivation methods, plant or animal disease controls, transportation procedures, storage and quality standards, among others; d) Conditions for purchase, payment obligations, timing and modality of delivery; e) the system to determine the final prices to be paid to farmers, frequently considering effects of variations in product quality and any applicable loan repayments associated with the provision of inputs or services; choice of a jurisdiction to govern the contract, from the legal standpoint. If the two parties are located in states or municipalities that are not in the same legal jurisdiction, then only one should be chosen to be applied; reference to a dispute settlement mechanism or to an arbitrator to resolve disagreements, which is always preferable to legal action.

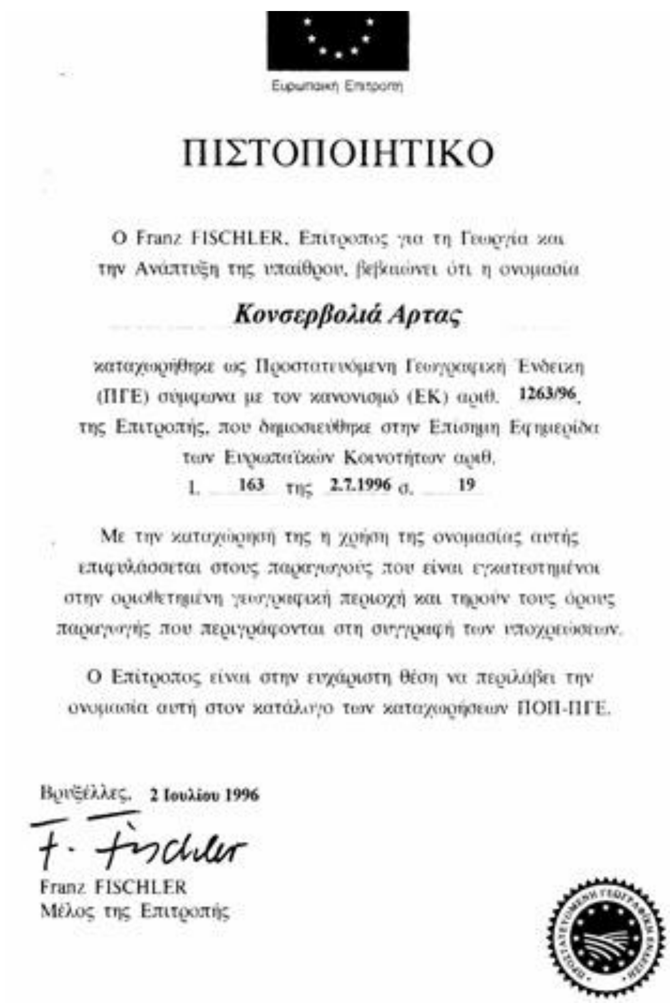
Regarding legislative issues for regulating contract farming, while there is specific legislation about contract farming in some countries, in many others general contract laws have sufficed. There might be a need to reconcile general contract laws with other types of legislation affecting agricultural production, agricultural marketing and / or land use, for instance.

5.8 Protected Geographical Indication (PGI)

Three EU schemes known as PDO (protected designation of origin), PGI (protected geographical indication) and TSG (traditional speciality guaranteed) promote and protect names of quality agricultural products and foodstuffs (EU, 2012).

The following EU schemes encourage diverse agricultural production, protect product names from misuse and imitation and help consumers by giving them information concerning the specific character of the products:

- PDO- covers agricultural products and foodstuffs which are produced, processed and prepared in a given geographical area using recognised know-how.
- PGI- covers agricultural products and foodstuffs closely linked to the geographical area. At least one of the stages of production, processing or preparation takes place in the area.
- TSG- highlights traditional character, either in the composition or means of production



Ευρωπαϊκή Επιτροπή

ΠΙΣΤΟΠΟΙΗΤΙΚΟ

Ο Franz FISCHLER, Επίτροπος για τη Γεωργία και την Ανάπτυξη της υπαίθρου, βεβαιώνει ότι η ονομασία

Κονσερβολιά Αρτας

καταχωρήθηκε ως Προστατευόμενη Γεωγραφική Ένδειξη (ΠΓΕ) σύμφωνα με τον κανονισμό (ΕΚ) αριθ. **1263/96**, της Επιτροπής, που δημοσιεύθηκε στην Επίσημη Εφημερίδα των Ευρωπαϊκών Κοινοτήτων αριθ. L **163** της **2.7.1996** σ. **19**

Με την καταχώρηση της η χρήση της ονομασίας αυτής επιφυλάσσεται στους παραγωγούς που είναι εγκατεστημένοι στην οριοθετημένη γεωγραφική περιοχή και τηρούν τους όρους παραγωγής που περιγράφονται στη συγγραφή των υποχρεώσεων.

Ο Επίτροπος είναι στην ευχάριστη θέση να περιλάβει την ονομασία αυτή στον κατάλογο των καταχωρήσεων ΠΟΠ-ΠΓΕ.

Βρυξέλλες, **2 Ιουλίου 1996**

F. Fischler

Franz FISCHLER
Μέλος της Επιτροπής

Figure 6 The EU certification of Konservolia Artas as PGI (source: EASAF)

A European Union definition, PGI is slightly less stringent than PDO (Protected Designation of Origin), but still demands that the product be produced in the geographical region whose name it bears. The geographical link must occur in at least one stage of production, processing or preparation. It is sufficient for only one of the stages of production to have taken place in the defined area; for instance, the raw materials may come from another region. This allows for a more flexible link to the region and can focus on a specific quality, reputation or other characteristic attributable to that geographical origin.

The local variety of Arta "Konservolia Artas" has been defined as PGI with the Ministerial Desicion (Greek Ministry of Agriculture) No: 317.713, published at the Governement Journal (FEK): 17b, 14/1/1994 (Figure 6)[4].

5.9 Maturing the concept for the development of an ECR

The main questions regarding the development of ECR are the following:

1. Why to develop an ECR?
2. Who may be interested in using it, which are the target groups needs?
3. Who will support it's operation?

The ECR is in it's simplest form is an electronic journal that the farmer uses to register all cultivation activities. In all the certified systems like organic farming and integrated management, farmer's are obliged to keep such records. This is usually written by hand in relevant forms. A number of relevant software applications have been already developed in order to cover this need.

A main issue that have to be confronted in the design stage of an ECR has to do with the potential user's of the system and if they are ready to adopt, use, support and contribute to the improvement of such a tool. The potential users are:

- Farmers
    - For this group, the question is if they are aware of the need to adopt such a system and if they are ready to use it (IT skills)
- Agronomists – Olive cultivation Experts
    - This group will have great benefit from the use of an ECR, as the dissimination of advices and the reporting capabilities of the system will make their work much simpler and efficient.
- State and private certifying authorities
    - These authorities have great need for central, electronic recordkeeping as this evolution will facilitate in great extend their operation.
- Process, storage and market stakeholders
    - The most competent stakeholders are already asking for such systems as they have full understanding of the valuable information that they provide regarding the availability of

[4] See the decision at: http://www.wipo.int/wipolex/en/details.jsp?id=1894

the olives and the adding value that they give to the products and the protection they give against problematic lots (traceability potential).

- Consumers
    - The question is if they are willing to pay more for a product which is well documented regarding it's origin and the route to their plate or if they would prefer a product which provides this information.

5.10 Software for cultivation management

Cultivation management has a variety of aspects which is covered by a number of software products regarding financial management, cultivation recordkeeping, counseling and alerting, calculation tools, expert systems, mapping, traceability, precision agriculture etc. Some indicative examples (some of which are already available at the project area) are given bellow:

- Public services:
    - A range of online public services related to the agricultural and food sector is available in Greece. Typical examples can be found at: Greek Ministry of Agriculture: www.minagric.gr (Farmers Reigstry, agricultural alerts), www.opekepe.gr (Official Agricultural Cultivation Registry), www.agrocert.gr, www.elga.gr, www.nagref.gr, www.efet.gr
- Integrated software:
    - Plasma (Integrated Management Software, covers: Crop budgeting and farmers' financing plan, Farmer membership registration, Material and final Crop inventory management, Crop registration, Crop activities and performance monitoring, Crop buying and grading, Crop selling and delivery management, Farmers loan distribution(cash and material) http://www.linkedin.com/company/pt-profescipta-wahanatehnik/plasma-integrated-agriculture-software-749650/product
- Counseling:
    - Kyklopas (olive cultivation calendar: http://www.kyklopas.com/site/index.php?option=com_content&view=article&id=4&Itemid=8&lang=el and preset questions and replies in the «Ask the Agronomist» section, http://www.kyklopas.com/site/index.php?option=com_content&view=article&id=4&Itemid=8&lang=el)
    - Agricultural Alerts. The agricultural alerts are provided by the Greek Ministry of Agricultural Development and Foods (http://www.minagric.gr/index.php/el/for-farmer/agricultural-warnings.html)
    - Cultivation guidelines. The cultivation guidelines for the application of integrated cultivation of olives which are provided by EASAF (http://www.easaf.gr/index.php?ID=wwY7hYVKJtuabdZM)
    - Information System for Agricultural Advices (OPEKEPE, in Greek: http://www.e-asp.gr/)
- Record keeping:
    - AgExpert Field Manager PRO(http://www.agexpert.ca/)
    - FarmKeeper (http://www.farmkeeper.com.au/)

- efarmer (http://www.efarmer.gr/) and logbook of FoodStandard (http://www.foodstandard.gr/). In Greek and for olive cultivation
- i-grow (Protypon, http://protypon.eu). General integrated cultivation management software.
- FarmManager (http://web2.teiser.gr/web-programming/FarmManager/welcome.html). General integrated cultivation management software.

▪ Mapping:

- FarmKeeper (http://www.farmkeeper.com.au/)
- NewLand (www.neagh.gr)

▪ Knowledge management / electronic libraries / repositories:

- Confolio (http://oe.confolio.org/apps/index.html)
- Electronic Library / Agro-Index (OPEKEPE, in Greek: http://www.opekepe.gr/vivliothiki.asp?id=1)

▪ Financial management – Book keeping:

- FINPACK (http://www.cffm.umn.edu/FINPACK/producers.aspx)
- Farm Business Software (http://www.fbssystems.com/products/)
- AgExpert Analyst (http://www.agexpert.ca/)
- FarmKeeper (http://www.farmkeeper.com.au/)

▪ Traceability:

- SmartAgriFood (OPEKEPE, in Greek: http://www.opekepe.gr/smartagrifood.asp)
- iknow, of FoodStandard (http://www.foodstandard.gr/). In Greek and for olive cultivation.
- Electronic traceability system for olive cultivation products (Georgoudeli, 2010)

▪ Expert systems:

- SAIFA (Plant protection of olives, Andalusia, Spain) (http://www.sciencedirect.com/science/article/pii/S0168169911001773)

▪ Weather forcastrs with special section regarding agrometeorology:

- Hellenic National Meteorological Sercive: www.hnms.gr, RiskMed (University of Ioannina, high detail forecasts for the region of Epirus): http://www.riskmed.net

▪ Calculation tools:

- ProBioSis Irrigation Management. The tool for calculating cultivation irrigation needs (olive cultivation is included) and preparing irrigation schedules using actual meteorological data that has been developed by TEI of Epirus in the framework of Interreg III Greece-Italy, ProBioSis project (http://www.agriculture.gr/arta/)
- Assoco di Puglia. The calculation tool for irrigation, fertilization and plant protection of the Region of Puglia (AssocodiPuglia,

http://www.agrometeopuglia.it/opencms/opencms/ Agrometeo/home_agro -> Servizi Agronomici e Fitosanitari)

In the framework of Agroquality project the ECR is proposed to have as main goal to cover the farmer's needs for counseling, alerting, cultivation recordkeeping and reporting . In this framework three examples (case studies) are presented:

5.11 Software Case study: Efarmer

Efarmer (www.efarmer.gr), is a simple software (developed with XTML5) that was developed in 2008 by FoodStandard (2012) for the Union of Agricultural Cooperatives of Messinia. The tool supports the "integrated cultivation management" system for olives in the area.

Figure 7 Intro screen of efarmer

Efarmer has been developed by Food Standard in order to cover the needs of a specific user (the Union of Agricultural Cooperatives of Messinia) the main products of which is related to olive (olive oil, table olives and pasta). The Union asked for an easy to use software which will facilitate the recordkeeping needs in the framework of the IMS that is applied. The project was financed from Reg. 867/2008) and was completed in 2009. The basic characteristics of the software are the following:

- It is developed in XTML5 for iphone and ipad, and it operates both ofline and online. The user can insert data at any time, regardless if there is an active internet connection and when the computer (phone/pad) is inline a synchonisation process send the new data to the server of the Union.

- The selection of the operation in such portable devices, was made in order to be able to use the system at the field and also for the administrators to have facts (GPS data accompany every input) regarding the place that the date were inserted. Each activitys' inputs are made before the activity is actually made. This is in line with the only alert signal that the software provides, which has to do with the permition to harvest in conjuction with the plant protection activities that have preceded. Another auditing activity that is covered, has to do with the input of soil test results for each field, which then are examined (manually) by the Union's expert. The check has to do wether there are in accordance with the fertilizers that have actually applied at the field.
- The system covers the basic (only selected cultivation activities, some activities like irrigation and actions regarding infrastructure are not recorded) recordkeeping needs of the IMS (farm or producers cultivation journal) and provides information (documents and databases) regarding cultivation techniques (IMS guidelines and relevant material like photos, videos etc), materials (plant protection and fertilizing materials in accordance with the relevant databases of the Greek Ministry of Agricultural Development and Food) and information for identification of pests and enemies (database).

(a) (b) (c) (d)

Figure 8 Typical screenshots from efarmer: a) farmer and fields information, b) fields mapping, c) database of plant protection materials and c) alert tool (harvest time linked to plant protection activities)

The system has a diminishing appealing to farmers, they begun with about 200 farmers but now the actual users are about 35. The plans for upgrading to a new version contain the support of organic farming too, the inclusion of special plant protection tools (photo and info which could be sent to an expert in order to give advice).

FoodStandrad has also developed a very simple recordkeeping application (Logbook) and an integrated traceability system for olive oil (iknow). The latest, according to the director of the company (Manousos, 2012) took about 3 years of intensive work and numerus meetings with olive oil stakeholders in order to be accomplished.

5.12 Software Case study: I-grow

This is a integrated management software for agricultural products developed by PROTYPON company.

Figure 9 I – grow software

The system covers all the basic recordkeeping needs of the IMS (farm or producers cultivation journal) and provides information (documents and databases) regarding cultivation techniques (IMS guidelines and relevant material like photos, videos etc), materials (plant protection and fertilizing materials in accordance with the relevant databases of the Greek Ministry of Agricultural Development and Food) and information for identification of pests and enemies (database).

5.13 Software Case study: Farm Manager

This a free smartphone (Android) application which is offered by the Technological Educational Institute of Serres (GREECE). It has been developed in the framework of a B.Sc dissertation and it can cover the minimum recordkeeping needs of the IMS regarding farm or producers cultivation journal. It has a GIS capability which is based on Google Maps.

5.14 Software Case study: ProBioSis irrigation Management

The evaluation of local irrigation practice for three of the main cultivations of Arta (olive cultivation is one of them) revealed significant problems which lead to low water use efficiency. Based on the assumption that with the given infrastructure, irrigation systems efficiency could almost immediately increased if more reasonable water management was applied, a relevant web service was developed and adjusted for the area of Arta (Tsirogiannis I.L. and S. Triantos, 2009). The tool was a deliverable of TEI of Epirus in the framework of Interreg III Greece – Italy ProBioSis project. In the tool environment, cultivation's water requirements are calculated and formations of irrigation schedules are carried out using inputs of climatic, crop, soil and irrigation system data. The tool which is addressed to farmers or agricultural counsellors is already in use and the end-users' opinions are positive (more than 8500 schedules have been proposed during the last 4 years).

The main features of the developed web tool are the publication of information regarding daily evapotranspiration –based on actual meteorological data- and an estimator –based on water balance calculations- for the time and duration of the next irrigation event. The tool is hosted at www.agriculture.gr/arta , is available in Greek language and provides (Figure 10):

- information regarding the evapotranspiration (ETo and ETc of selected cultivations) of the previous day,
- archive with historical evapotranspiration data,
- estimator for the time and the duration of the next irrigation event and
- help regarding the use of the tool and the estimation of the information that the user should provide.

The web tool is based on a straightforward concept. Meteorological stations gather climatic information which is retrieved by the site at the end of each day. The use of a dense network of stations gives better accuracy regarding the microclimatic effects. By now for the estimation of cultivation's water needs in the plain of Arta, two meteorological stations where used (model Vantage Pro2 Wireless, Fan-aspirated, DAVIS), one at Vlaherna (39^{o} 10' 21.74''N, 21^{o} 05' 01.87''E) and one at Kompoti (39^{o} 10' 21.74''N, 20^{o} 59' 57,92''E). Both stations where equipped with air temperature and relative humidity sensors, pyranometer, rain and wind speed meter.

Reference and cultivation potential evapotranspiration for the selected cultivations of the region are calculated at the end of each day using the Penman-Monteith approach (Allen et al. 1998). The use of proper Kc factors which reflect the characteristics of local varieties, cultivation period and local agricultural practice is of great significance for the precision of the each cultivation's potential evapotranspiration. For this purpose the relevant literature should be studied in depth (Balatsouras, 1992; Michelakis et al., 1996; Palomo et al., 2002; Charthoulakis et al, 2006; Orgaz et al, 2006; Testi et al, 2006; Moriana et, 2007). The ET information (reference and potential for citrus, kiwi, olives and grass) is then posted at the first page of the site and stored at the database. The farmer or it's counselor can use this information to form irrigation schedules.

The site also includes an estimator for the time and the duration of the next irrigation. The user provides basic information regarding the site of the field, the soil type, the cultivation, the available flow and the irrigation system type as well as information regarding the time and duration of the last irrigation. Then a script which is based on water balance equations -as described in FAO paper56 (Allen et al. 1998)- and uses the stored historical ET information along with ET and rain forecasts for the next 3 days –calculated using the Bolam model (Lagouvardos, 2003)- provides advice regarding the time and duration of next irrigation. The advice with the relevant water balance can be printed as a report.

In order to support the use of the site and the formation of irrigation schedules relevant information is provided. A guide regarding the use of the tools and the estimation of the various factors which are used in the next irrigation estimator is available along with documents and links regarding the general concepts and special techniques of irrigation scheduling.

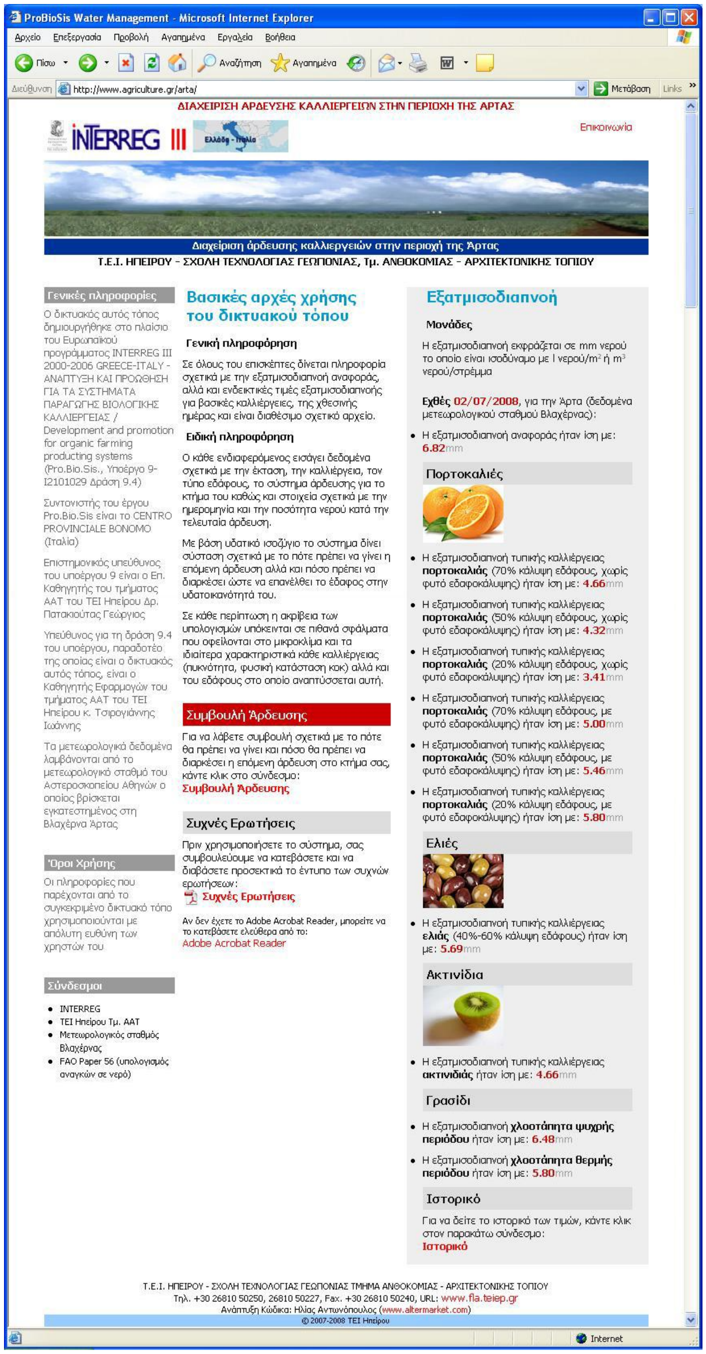


Figure 10 The home page of the irrigation management web service

The dynamic web tools were developed using PHP scripting language (Zend Technologies, 2008). Temporary and permanent data are stored in a MySQL database (Sun Microsystems, 2008). Web tools were designed following the object oriented approach. A series of classes were developed for fetching meteorological data and field measurements from external sources. Classes fetching external data are invoked periodically using two Cron Jobs and on the web server data are fetchedusing CURL operations. Fetched data are stored in the database. Another set of classes were developed in order to perform the required calculations, display historical data and provide advice regarding the time and duration of next irrigation. Configuration parameters are stored in special files.

5.15 Software Case study: Electronic traceability system for olive cultivation products

This system has been developed by the Agricultural University of Athens (Giorgoudeli, 2010). The system user's are the farmer, the olive mill (where the olive oil is produced), the counseling, auditing and certification organizations, the quality analysis laboratories, the store where the final products are sold and finally the consumer which asks for information regarding the olive oil that is about to purchase. More analytically:

- The farmer cultivates the olive trees making all the necessary interventions and transports the harvested olives to the olive mill in order to produce olive.
- The olive mill takes the olives, weigh them, controls the data of the olive's lot, receives the cultivation data and produces the oil. After this it makes the packaging and standardization procedures of the final product (olive). During all these the relevant data are registered.
- The store registers the transport/storage conditions.
- The consumer is able through lot number on the packaging to get information regarding the whole process (cultivation, oil production, transport/storage).

The system architecture is consisted from the following sections:

- Section of data registration at farm
- Section of data registration at olive mill
- Section of data registration during storage and transport
- Section of cultivation data
- Section of final product data
- Section for reporting and presentation of final product information
- Web site
- Servers (data base server, Google Earth server, Google Maps server, ArcGIS server)

The farmer registers data regarding each olive field and the cultivation interventions in year basis (from harvest to harvest). Special forms are used for these tasks. Special databases, for example databases for organic cultivation fertilizers help the farmer to fill the fields. Also data regarding conditions (i.e. climatic) during the cultivation periods are collected. <u>In this system data for each specific tree can be entered</u>.

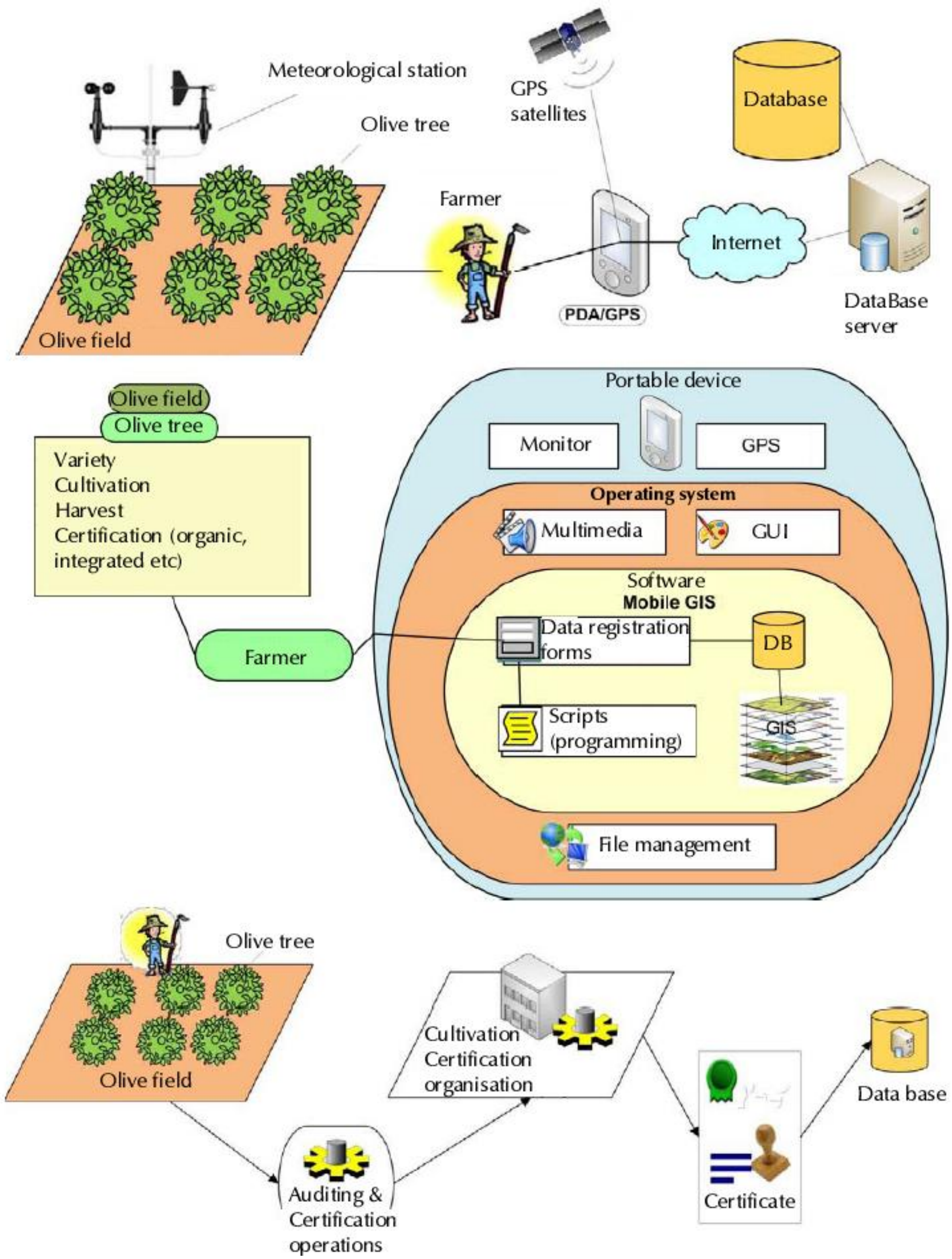


Figure 11 AUA traceability system, farmer side (Giorgoudeli, 2010)

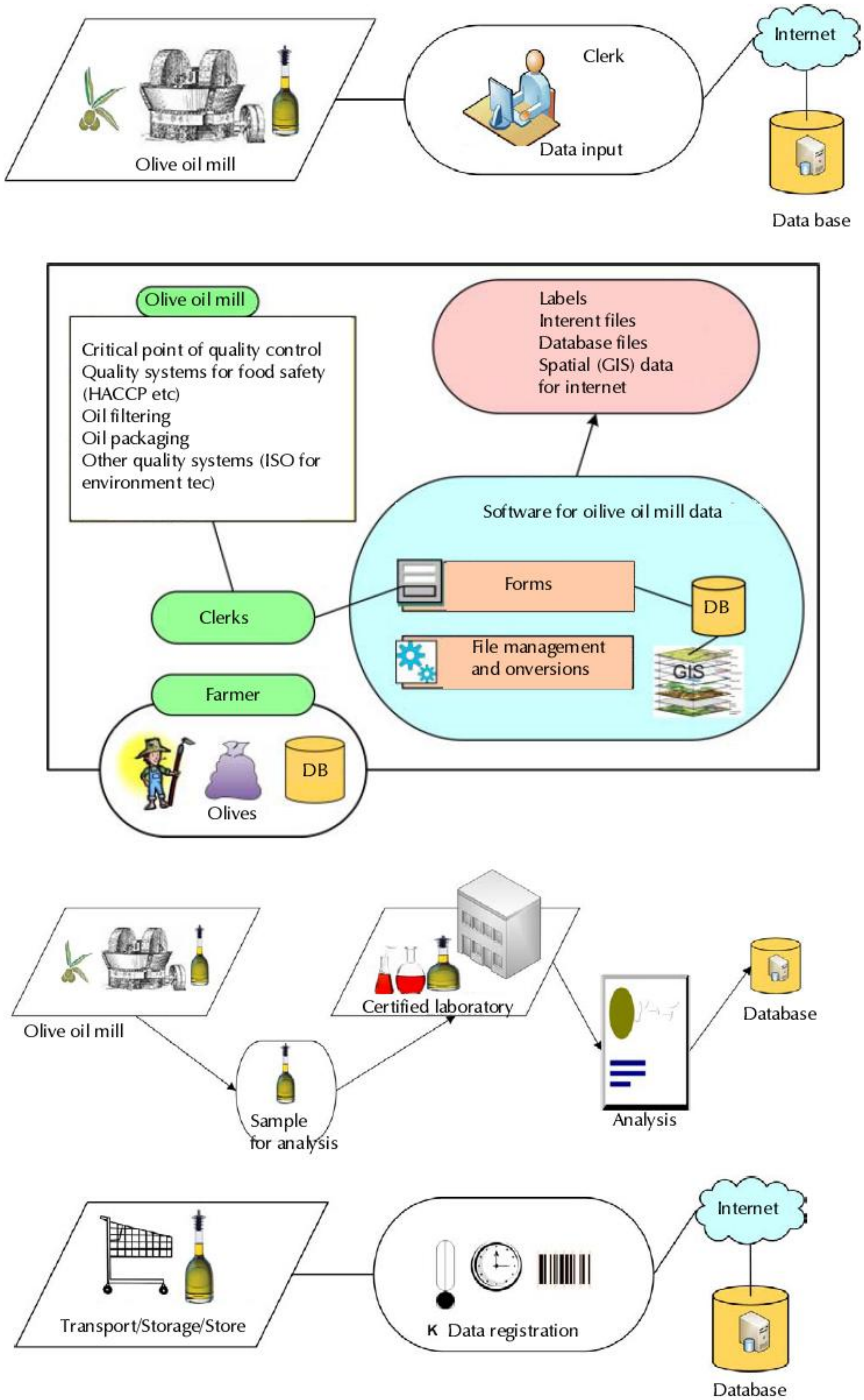


Figure 12 AUA traceability system, process and storage side (Giorgoudeli, 2010)

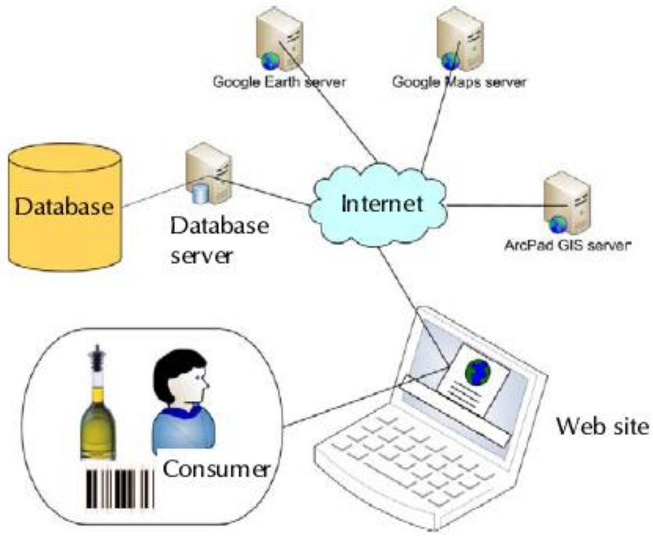


Figure 13 AUA traceability system, consumer side (Giorgoudeli, 2010)

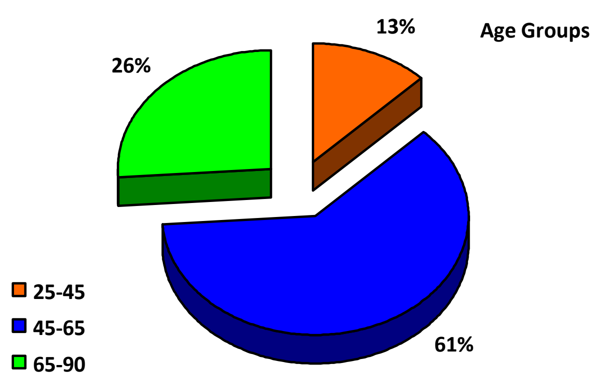
Figure 14 AUA traceability system, frontpage screenshot (Giorgoudeli, 2010)

For the data registration a palm PC with GPS is used. The counseling/auditing/certification organization can electronically follow the data and provide extra information and certification. The olive mill takes the olives. On every sack or crate is marked with the olive lot number. With this number the olives are linked to the cultivation data. These data are send automatically or be email to the mill. All the olive making stages in the mill are registered at the system via special forms. The quality characteristics of the product (i.e. from chemical analysis) are also included. All the applied quality systems (ISO, HACCP etc) of the mill are registered. Also the filtration and the packaging procedures are registered. From all these data, information for the label of the final product is created. Then the final products continued to the sale points. Transport and storage conditions (for dates, example routes, climatic conditions via sensors etc) are registered. All these could be available to the consumers.

The system concept is graphically presented in Figure 11,Figure 12 and Figure 13. Figure 14 present an indicative screenshot of the system web site.

5.16 Local needs and potentials - Information from questionnaires' statistical analysis[5]

According to EASAF (2010), Arta consists a regional unit of the Region of Epirus. At Arta, olive groves cover an area of about 5.000ha, which host about 1M olive trees. From these about 0.7M are considered to be active. In the framework of Agroquality actions 3 and 4, a questionnaire was developed in order to gather information regarding the current situation of olive cultivation in Arta. This questionnaire had two distinctive parts, the agricultural (Agro) and the information technology (IT) which were used for the composition of the deliverables of 3.1.1. and 4.1.1. respectively. The specimen consisted of 80 farmers of the greater area of the plain of Arta (they correspond to the 4% of the total area and the 5% of the total olive trees number). The age of the farmers varies from 29 to 88 years, with a mean of 58 years old. Farmers were divided into 3 classes: [25-45), [45,65) and [65,90). As can be seen in the next graph, the larger group is by far farmers between the ages of 45 and 65, with the younger group comprising 13% of the total number and the older group 26% of our population (Figure 15). 47% of the farmers graduated from Elementary school and 26% from High school, with Higher, Technological and Junior High school (Figure 15). The younger the farmer the more years he has devoted into education.



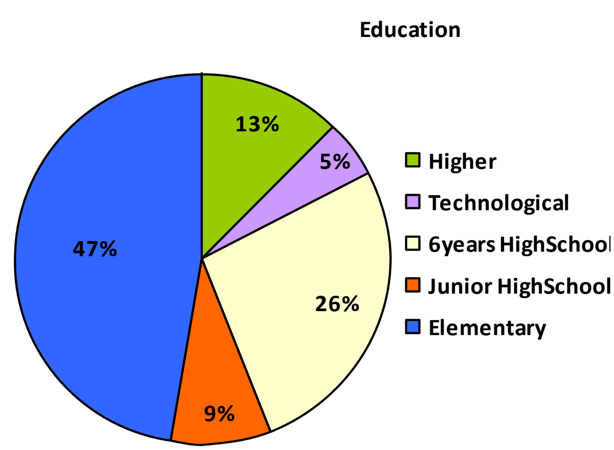


Figure 15 Distribution of olive farmers' age and their education level in Arta (source: 3.1.1.)

[5] source: Deliverables of 3.1.1. and 4.1.1.

As it can be seen in Figure 16, 72% of the farmer's cultivates olives following the "Integrated management" system. This system is broadly applied in the area of Arta as the local union of cooperatives (E.A.S.A.F., www.easaf.gr) promotes it's use. In the framework of this system (the same happens in certified organic cultivation but it's application is limited in the area) and in order the products to be certified, the farmer has to keep detailed records regarding the applied cultivation activities. Among them, recordkeeping of plant protection activities that concern the use of chemicals is very crucial.

Younger farmers (25-45) are more familiar with computers use (Figure 17) as it was expected. The relevant "familiarization with computers" percentage is 60%, while at the next age category (45-65, which represents the bigger part of the farmers population) this percentage falls at 29%. The percentages of computer ownership (Figure 17), use of internet and possession of an e-mail account (data not shown) amongst the farmers are of equivalent number with that of familiarity in computer use.

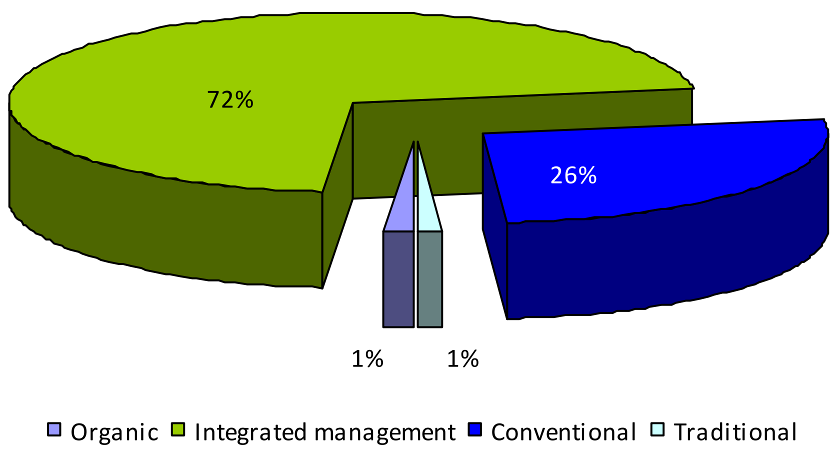
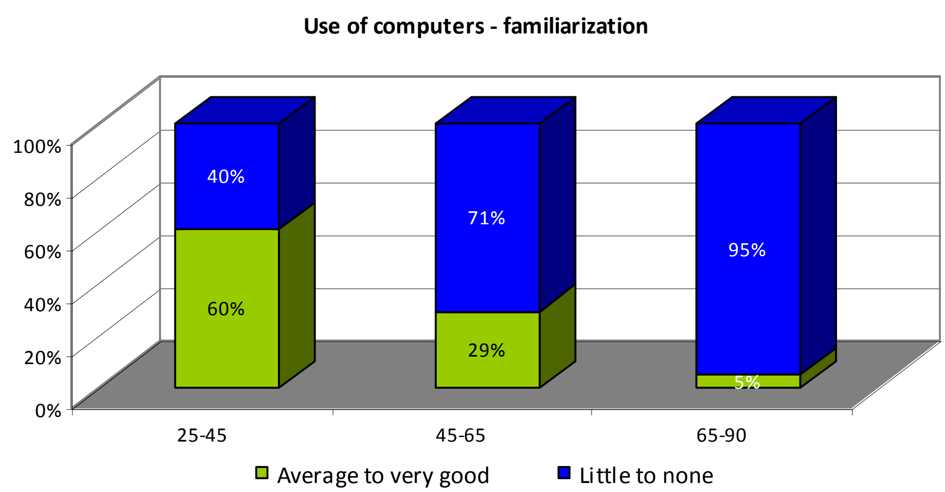


Figure 16 Cultivation system for olive in Arta (source: 3.1.1.)



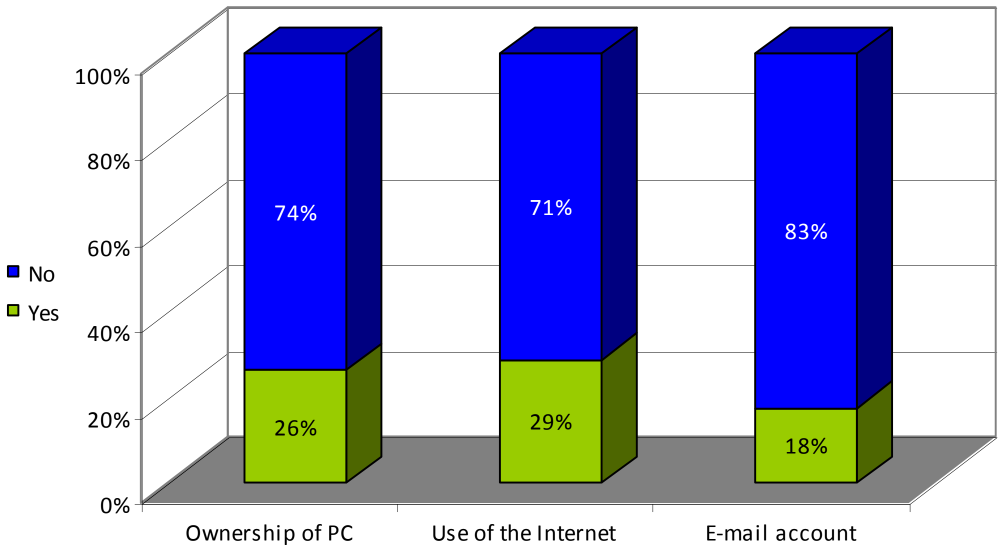


Figure 17 Use of computers and ownership of PC

Regarding recordkeeping, 74% of the farmer show from moderate to big interest for keeping a journal for their cultivation activities (Figure 19). In general the farmers are interested into keeping an electronic task journal which will be available on-line for their customers, 77% of the farmers would be from moderate to very interested in keeping electronic task journal (Figure 19).

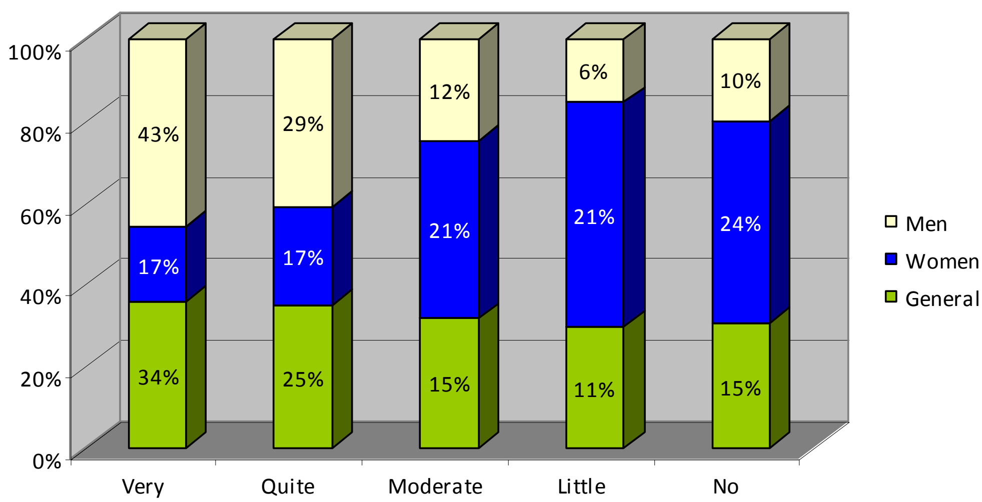


Figure 18 Interest for recordkeeping

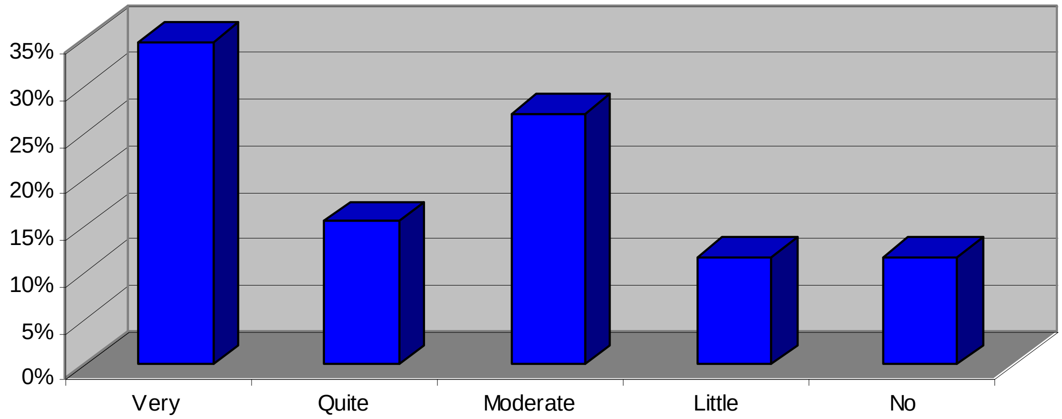


Figure 19 Interest for keeping electronic task journal which would be available to consumers

At the question "How do you keep in track with recent developments in cultivation, packing, storing, alteration and transportation of ones products?", 21% of the farmers replied that they rely on Expert consulting (Agronomist, etc) only, 45% rely on some (State or not) Qualified Service or Agricultural Association as well as Expert consulting and 15% rely on both Internet search and (State or not) Qualified Service or Agricultural Association.

The general conclusion is that farmers need a second (at least) opinion in everything that concerns their profession.

On the subject of e-commerce, the farmers exhibited great interest into getting involved as 77% of the farmers would be interested in selling their products on-line (data not shown).

The general conclusion is that there is a good basis for the development of an ECR for olive cultivation in the area of Arta.

5.17 EASAF IMS for olive cultivation

The Union of Agricultural Cooperatives of Arta and Phillipiada (EASAF www.easaf.gr) applies for several years an IMS for olive groves in the area of Arta (Figure 20). The System of Integrated Management of Olive Production is in accordance with the national standards AGRO 2.1 & AGRO 2.2 of AGROCERT. In this framework the rules regarding Good Agricultural Practices, Safety and Hygiene of Workers, Safety of Products, Traceability and Environmental friendly production methods are combined with improvements which will lead to financialy viable agricultural enterprices. Almost 200 farmers are participating. The farmers are supervised by an expert agriculturalist that works for the Union (Figure 21), while the development and the application of the system is outsourced (EASAF, 2012).

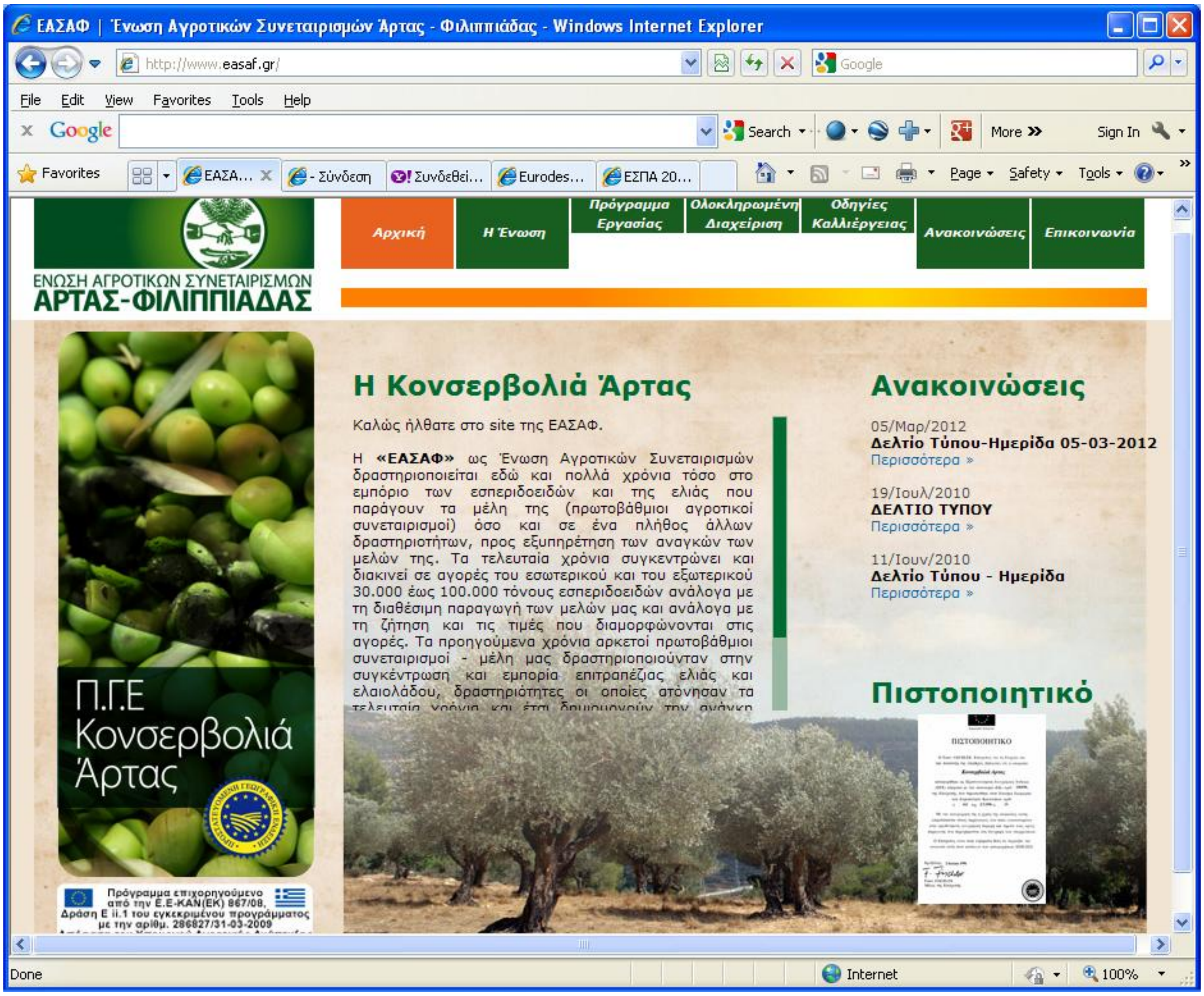


Figure 20 The web site of EASAF which is mainly dedicated to the support of IMS.

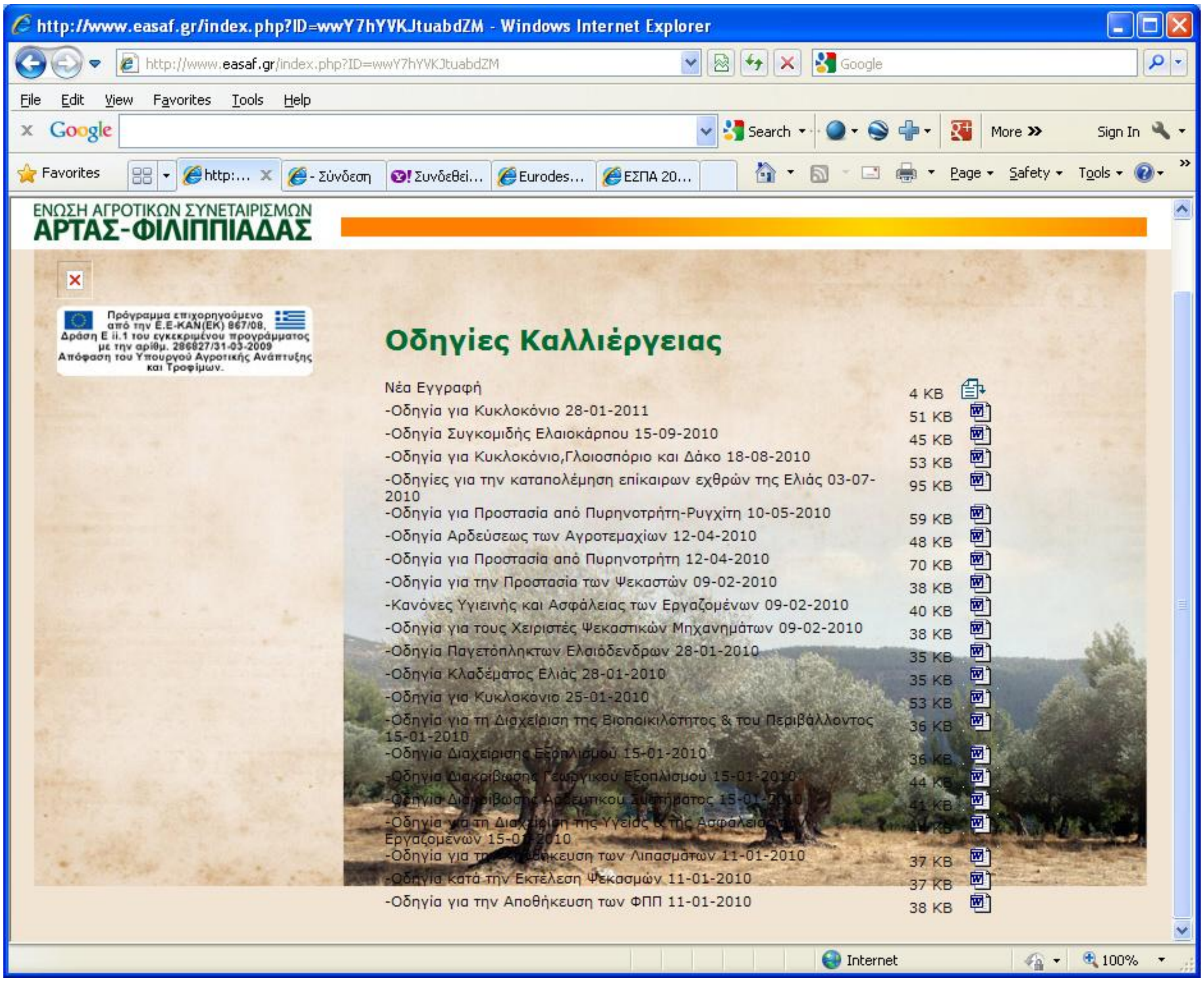


Figure 21 Cultivation guidelines (MS Word format) in the framework of EASAF's IMS

In the framework of the IMS, EASAF has also included activities for improvement of product quality (i.e. new crates distribution etc) as well as publicity activities.

5.18 EASAF - Field journal

The field journal that EASAF provides to IMS farmers is presented in Figure 22, Figure 23, Figure 24 and Figure 25. The filling of the relevant data is obligatory in order for the farmer to get the relevant AGRO 2.1., AGRO 2.2. certification.

Καλλιέργεια: **ΕΛΙΑ**
Έτος: **2009-10**

Σύστημα Ολοκληρωμένης Διαχείρισης της Παραγωγής

Ο.Ε.Φ. - Ε.Α.Σ.Α.Φ.

ΗΜΕΡΟΛΟΓΙΟ ΑΓΡΟΥ

Όνομα Παραγωγού :

Κωδικός Παραγωγού :

Εξουσιοδοτημένος :

Κωδικός Αγροτεμαχίου	Τοποθεσία-Περιοχή	Στρμ.	Ποικιλίες

«Πρόγραμμα επιχορηγούμενο από την Ε.Ε. -καν. 867/08- δράση Β.iv του εγκεκριμένου προγράμματος με την αριθ. 286827/31.03.2009 απόφαση του Υπουργού Ανάπτυξης και Τροφίμων».

ΤΕΧΝΙΚΟΣ ΣΥΜΒΟΥΛΟΣ: AGRO Q O.E.

Figure 22 Field journal of EASAF, page 1 of 4 (EASAF, 2012)

ΕΠΕΜΒΑΣΕΙΣ ΦΥΤΟΠΡΟΣΤΑΣΙΑΣ

Κωδικός Αγροτεμαχίου	Κωδικός ΦΠ.Π. (Πίνακας ΦΠ.Π.)	Δόση στα 100 λίτρα νερό	Απαιτούμενος χρόνος από συγκομιδή (ημέρες)	Στόχος Εφαρμογής	Α/α οδηγίας	Συνολική ποσότητα ΦΓ.Π.	Ποσότητα ψεκαστικού υγρού / στρ.	Ημερομηνία, ώρα εφαρμογής	Τρόπος εφαρμογής - εξοπλισμός (Τ, Μ, Ψ)	Ψεκαστής (υπογραφή)
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Πίεση / μέση ταχύτητα ψεκασμού (PSI) / Km/h	Τουρμπίνα **(Τ)**	Τύπος ψεκαστικού:	
Πίεση: (PSI)	Βυτίο – Μάνικα **(Μ)**	Είδος Ακροφυσίου:	

ΦΥΤΟΠΑΘΟΛΟΓΙΚΟ ΙΣΤΟΡΙΚΟ

	Αγροτεμάχια		**Αγροτεμάχια**		**Αγροτεμάχια**	**Ζιζάνια**	**Αγροτεμάχια**	**Ωφέλιμα**	**Αγροτεμάχια**	**Σύνορα**	**Αγροτεμάχια**
Δάκος		Κόσσος		Καρκίνωση (φυματίωση)		Βέλιουρας		Πασχαλίτσα		Φυτοφράκτες	
Πυρηνοτρήτης		Βαμβακάδα		Γλοιοσπόριο		Αγριάδα		Χρύσοπες		Πηγές-ποτάμια	
Λεκάνιο		Φλοιοφάγος		Αρμιλλάρια		Τσουκνίδα		Chelonus eleaphilus		Αρδευτικό	
Φίλιππα		Φλοιοτρίβης		Ξεροβούλα· Σαπροβούλα		Κύπερη		Trichogramma sp.		Δρόμος	
Πολλίνια		Ρυγχίτης		Ροζελλίνια		Περικοκλάδα		Scutellista cyanea		Κατοικίες	
Ασπιδιωτός		Θρίπας		Ζελατίνα		Αγρωστώδη		Chilocorus bipust.		Αναβαθμίδες	
Παρλατόρια		Ακάρεα		Φόμα		Πλατύφυλλα		Exochomus quadr.		Νερό πόσιμο	
Καλόκορις		Ποντίκια		Κερκόσπορα				Opius concolor		Αποθήκη	
Μαργαρόνια		Βερτισιλλίωση		Κυκλοκόνιο							
Ζευζέρα											

Figure 23 Field journal of EASAF, page 2 of 3 (EASAF, 2012)

ΟΔΗΓΙΑ ΛΙΠΑΝΣΗΣ (ΑΝΟΡΓΑΝΗ, ΟΡΓΑΝΙΚΗ & ΔΙΑΦΥΛΛΙΚΗ)

Τεχνικός υπεύθυνος:

(Ονοματεπώνυμο) (υπογραφή)

Κωδικός Αγροτεμ.	Προτεινόμενη Περίοδος εφαρμογής	Τύπος Λιπάσματος	Ποσότητα (κιλά/ δ.)

ΚΑΤΑΓΡΑΦΗ ΕΦΑΡΜΟΓΩΝ ΛΙΠΑΝΣΗΣ

Ο Παραλαβών:

(Ονοματεπώνυμο) (υπογραφή)

Όνομα, τύπος λιπάσματος	Ποσότητα (κιλά/ δ.)	Τρόπος εφαρμογής	Ημερομηνία Εφαρμογής	Καιρικές συνθήκες	Εφαρμοστής
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			_/_/_		

ΑΡΔΕΥΣΗ

Κωδικοί Αγροτεμαχίων	Τρόπος ποτίσματος	Προέλευση νερού	Ποσότητα νερού	Συχνότητα ποτίσματος

ΕΞΑΙΡΕΤΙΚΑ ΚΑΙΡΙΚΑ ΦΑΙΝΟΜΕΝΑ

Αγροτεμάχια	Ημερομηνία	Παγετός Ένταση ζημίας	Χαλάζι Ένταση ζημίας	Ανεμοθύελλα Ένταση ζημίας	Καύσωνας Ένταση ζημίας
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Σελ. 3

Figure 24 Field journal of EASAF, page 3 of 4 (EASAF, 2012)

ΔΙΑΧΕΙΡΙΣΗ ΖΙΖΑΝΙΩΝ

Κωδικοί Αγροτεμαχίων	Ημερομηνία εφαρμογής	Φρέζα	Χορτοκοπτικό	Καταστροφέας	Ώρες Εργασίας
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ΚΑΤΕΡΓΑΣΙΑ ΕΔΑΦΟΥΣ - ΚΑΛΛΙΕΡΓΗΤΙΚΕΣ ΦΡΟΝΤΙΔΕΣ

Αγροτεμάχια	Ημερομηνία από - έως	Είδος εργασίας (Κλάδευμα, Καλλιεργητής, Άλλη εργασία)	Ημερομίσθια
	__/__/__ έως __/__/__		
	__/__/__ έως __/__/__		
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	__/__/__ έως __/__/__		
	__/__/__ έως __/__/__		

ΕΠΕΜΒΑΣΕΙΣ ΒΕΛΤΙΩΣΗΣ ΤΟΥ ΕΔΑΦΟΥΣ

Αγροτεμάχιο	Ημερομηνία	Κοπριά κυβικά / στρ.	Ασβέστωση κιλά / στρ.	Γύψος κιλά / στρ.	Θειάφι κιλά / στρ.	Άλλο
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	___/___					
	___/___					

ΣΥΓΚΟΜΙΔΗ

Κωδικός Αγροτεμαχίου	Άδεια έναρξης Συγκομιδής (Υπογραφή)	Ημερομηνία Από / έως	Συνολική συγκομισθείσα ποσότητα (κιλά)	Πελάτης
		__/__/__ - __/__/__		
		__/__/__ - __/__/__		
		__/__/__ - __/__/__		
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Figure 25 Field journal of EASAF, page 4 of 4 (EASAF, 2012)

6 Agroquality ECR

6.1 General description

According to Agroquality proposal, the project aims at developing a model of the total management and control of the olive growing process. Environment-friendly products will be obtained by implementing innovative methods and tools made available by the research and the best available technologies. The quality of the product will be certified via a unique bar-code identity per farmer, cultivation and cultivation period, under which the whole of the parameters affecting the quality of the product (soil composition, position, climate, cultivation method, etc.) is kept. The core of the system would be:

a) The definition of the model through analytical analysis of olive growing best practices with regard to their effects in socio-economic and environmental fields. This procedure would identify the practices that have the best effects both with regard to the sustainability of olive growing and incomes for farmers.

b) The Geographical Information System, which will be build to integrate a full Electronic Cultivation Record (ECR) for olive's products. The general features of the GIS platform will be: a) GeoPresentation of the information; composition of new information levels; retrieval of the geo correlated data. Soil composition, hydrological and climate data will be presented on new automatically created levels of information and b) Correlation of the Geographical data with the Electronic Cultivation Record.

The ECR will be evaluated through implementation of the model at farm level, in various typologies of farms. The platform will be delivered in the form of well documented Software, installed on the system server and ready to use.

6.2 ECR concept

The proposed ECR have to cover all the actors that are involved in the production and trading of olive oil and table olives (Figure 26 and Figure 27). Relevant subsystems which will be able to exchange info will be developed for each actor according to the needs which will be revealed by Deliverable 4.1.1 "Use cases identification". The present document is a presentation of the basic function that ECR must cover and it is mainly focused on farmer level.

The ideal should be a system where the farmer under the supervision of an agriculturalist sets cultivation goals and a plan to achieve them. A best practices roadmap should be available by the system in order to assist the plan setting procedure. For example the FAO irrigation to yield model could be used in order to decide how many irrigations will be made. As the cultivation year proceeds, the inputs of the farmer and the meterological facts should be used by the system in order to adjust the plan and make proposals which, the farmer, after counceling the agriculturalist will choose if he will follow or not.

The system should be user friendly with only the absolutely necessary options available at top level (at capability to open special windows for advanced functions). A layout following the Widnows Metro Style is probably the most suitable.

In order to foster territorial cooperation, companies from one country should be able to handle farmers/cultivations in other countries too.

The Agroquality ECR aspires to be a support tool for the application of the excisting systems which at the same time will have the flexibility to adapt to future modifications of them or completely new systems. For this, an open source development should be used.

- Farmers that are applying different cultivation systems (conventional, integrated, organic, contract) will be able to insert data regarding their fields (geographic data, altitude, area, soil, number of trees per variety, age of trees etc) and keep records regarding their cultivation activities in cultivation year basis. All these will be stored in the system and will be available to the farmer via reports which will also include other significant information like meteorological conditions etc.
- A repository of information sources, tools, commitment plans, advices, on-line help and real time data (i.e. meteorological conditions and forecasts) will be available at the farmer. Information from these sources could be incorporated in a relevant field of a cultivation record row in order to justify it. Farmers will be able to comment each source of information.
- Databases regarding varieties, plant protection materials, fertilizers, pest and diseases and meteorological data will be kept.
- Processing, Storing and Market stakeholders will be able to open a profile in the system and get connected with the framers from which they purchase olives. This relationship will be many-many.
- A barcode or QR-code generator will provide labels that can be used at the packages or the informative or advertising material in order to give access to reports regarding the origin and the route of the product.
- Add-ons like demo, book keeping facilities, interent site with e-commerce capabilities creation, label maker etc will be available too for free to the participating farmers and processing, storing and market stakeholders.

Figure 26 Actors (need relevant subsystems) regarding olive oil production and commerce

Figure 27 Actors (need relevant subsystems) regarding table olives production and commerce

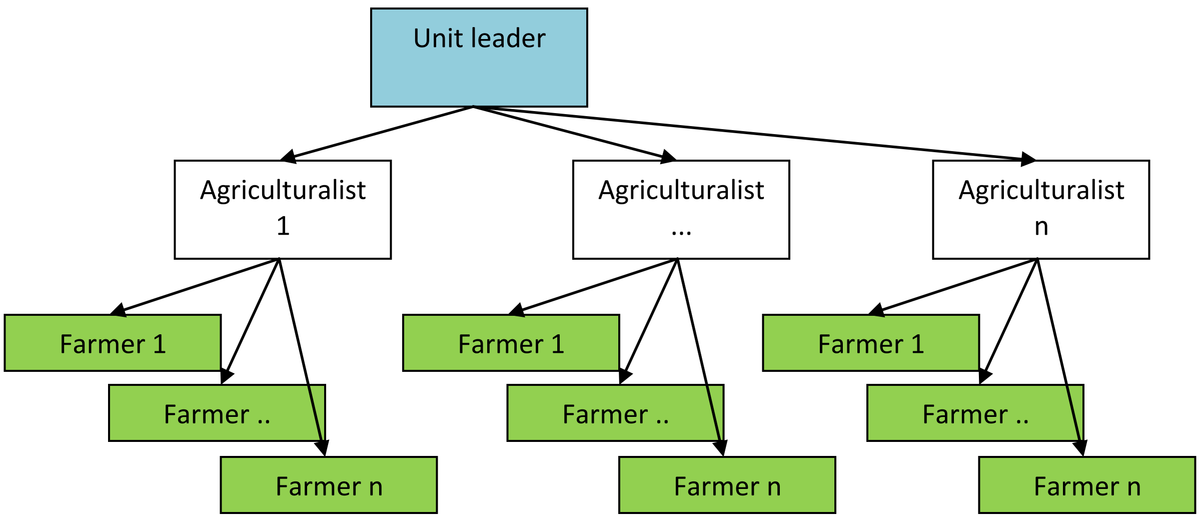

Figure 28 Role tree of the ECR

7 Agroquality ECR – Core info and Farm level subsystem

7.1 Basic characteristics

In Figure 29 a general model of a typical Agroquality ECR window is presented.

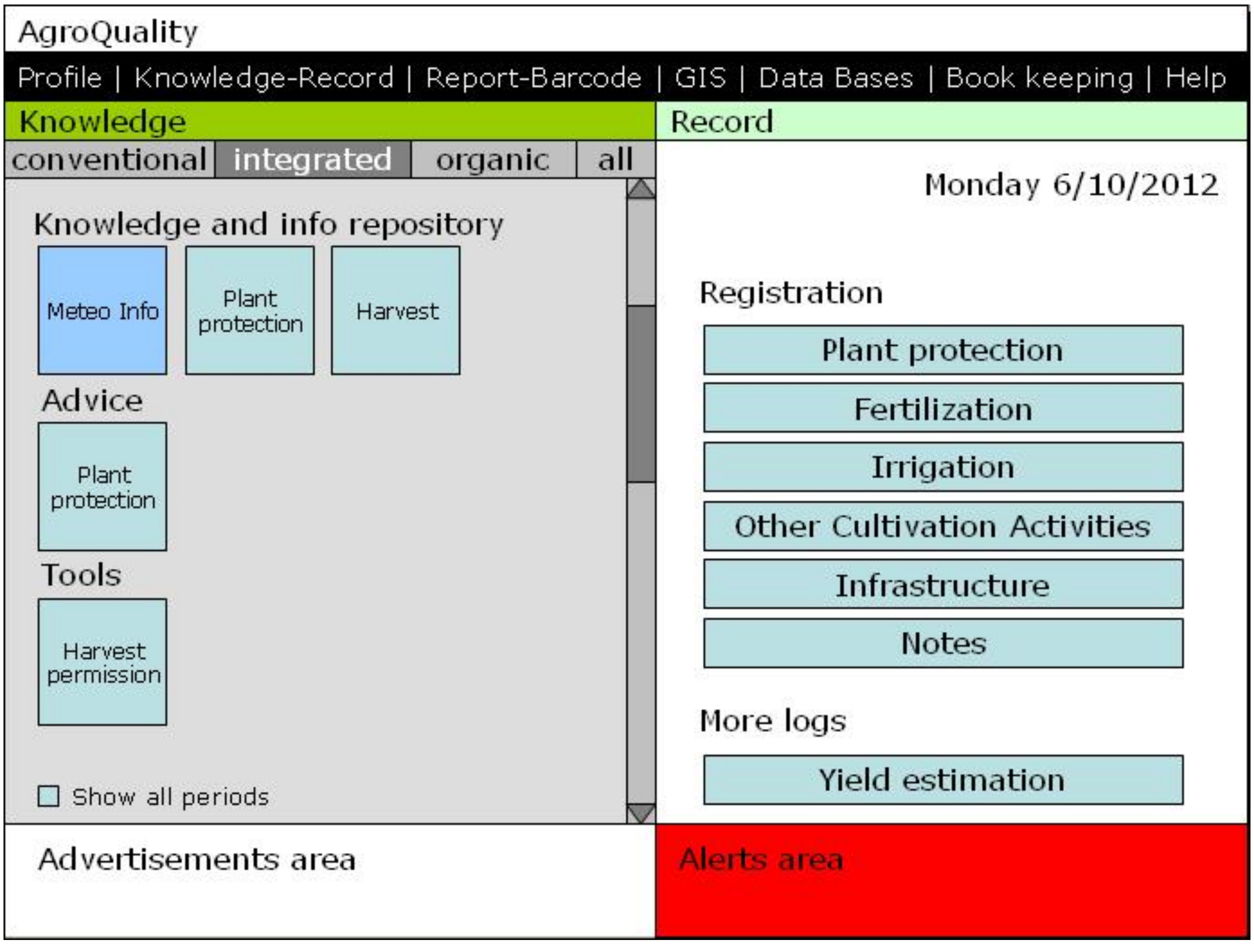

Figure 29 General model of a typical Agroquality ECR window

The basic characteristics of the proposed ECR are the following:

- User friendly, simple layout with easy to understand images which will activate directly the most common functions
- 5 level tree structure (system administrator, organization -company, agricultural cooperation, farmer's group etc-, agriculturalist, farmer, customer) with different rights. This tree structure style should be available as an view (like File Manager) as it would be very helpful.
- Compatible with existing cultivation and quality systems
- Stand alone and web application (with synchonisation capability)

- Extended GIS capabilities
- Open source
- Flexibility – easy adaptation to user's needs
- Ability to run in various devices, platforms and operating systems
- sms alerts
- multinational support, for example the case that the trade names of the various consumables (fertilizes, pesticides, etc) are not the same in different countries should be taken into acconut
- 3 languages (GR, IT, ENG) support[6]
- Broad availability to end users
- bar code or better QRcode support
- web site with e-commerce capabilities generator
- objects, databases, forms and reports (descriptive, diagrammatic and spatial)
- Help and Demo

7.2 Databases, GIS, Activities, Cultivation Systems

Bellow the main features of the system are presented along with the relevant actions in order to develop the system.

<u>Data bases</u>

- Farmers and land parcels
- Processing – Storing – Trading Facilities
- Varieties
- Plant protection materials
- Fertilizers
- Pests & Diseases
- Meteorological data
- Objects' Repository

Actions: a) Forms for users' registration and profile management must be prepared; b) Graphic representation of relevant data and reports should be prepared; c) Source of databases and protocol for their updating must be defined; d) Protocol for the retrieval and storing of meteorological data (historical data, current conditions and forecasts) must be defined.

[6] Regarding the languages, the possibility to develop ECR only in Greek regarding the registration of data and the capability to generate specific reports in English should be concerned. The reason is that the users of ECR that will make registrations will be Greek farmers and in this case the existence of an English version of ECR is not needed. At the other hand olive market stakeholders and international consumers need reports in English.

<u>GIS</u>

- Maps
- Spatial reports

Actions: a) Characteristics of maps should be agreed; b) Potential sources of existing relevant layers that would be useful for the system must be investigated; c) Reports templates and reports content must be defined.

<u>Add ons</u>

- Demo (video or presentation)
- BarCode, QR-Code generator
- Final product label generator
- Book Keeping

Actions: a) Code forms and providerd must be investigated and relevant application must be developed; b) Book keeping needs must be defined and relevant application must be developed; c) The necessity for other probable add ons must be investigated.

<u>Activity categories</u>

- Establishment
- Soil processing
- Weed removal
- Plant protection
- Fertilization
- Irrigation
- Harvest
- Various activities (pruning etc)

<u>Cultivation systems</u>

- Conventional
- Integrated
- Organic
- By contract

<u>Objects</u>

- Knowledge
- Tools
- Commitment Plan (5y organic)
- Official advice (integrated)
- Guru advice (experts that cooperate with the system)
- Record keeping
- Alert
- Descriptive and spatial reports (supervisors, farmers, other interested)
- Advertisement?

Object characteristics

- Activity category
- Cultivation system (conventional, integrated, organic, contract)
- Time period
- Content type
- Content
- Likes - Dislikes
- Comments

Extra

- Web site with e-commerce facility generator

7.3 Complete set of characteristics

The complete set of the characteristics of this subsystem will be revealed by Deliverable 4.1.1 “Use cases identification”.

7.4 Use case senarios

A number of scenarios regarding the use of the proposed ECR are given bellow:

- A farmer wants to keep the IM records electronically, produce easily the yearly reports required reports, have access to other years cultivation data and have the capability to give access to relevant information to gross-merchants and probable direct final buyers (through bar code and internet site)
- A farmer wants has relevant needs but in the framework of OC. This means that the agreed cultivation plan will be available and it’s application should be proved.

- The IM expert of EASAF want's to disseminate easily advices and have an updated view of the farmers that apply the system.
- A gross-merchant want to get information regarding expected quantities, varieties and special characteristics (altitude, cultivation system, PGI requirements (cultivation, space, cultivation activities).
- An olive's packaging unit wants to get connected in cultivation year bases with farmers for which all recorded data will be available and accessible from gross-merchants and consumers.

7.5 Training and Promotion aspects

In order for ECR to be successfully adopted and applied by the farmers and the olive market stakeholders, relevant training and promotion activities should be undertaken in the framework of the project.

Easy to study training material (help and faq documents, guides, presentations, videos etc) should be also available at the ECR web site.

7.6 Cultivation Plan Templates

Cultivation plan templates could be included in the ECR as a result from deliverable 3.1.1.

7.7 Sustainability

In order to be sustainable the ECR must be adopted by a number of certification agents and trading companies. These have the power to require it's use by the farmers.

7.8 Chapter references

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8 Agroquality ECR – Processing level subsystem

8.1 Basic characteristics

This subsystem should communicate with the farmer level subsystem and cover the data registration needs of agents (typical sublevel in case of table olives chain), olive mill (applicable only in case of olive oil chain), processing of olive oil and table olives, storing of final products and transport to trading facilities.

8.2 Complete set of characteristics

The complete set of the characteristics of this subsystem will be revealed by Deliverable 4.1.1 "Use cases identification".

9 Agroquality ECR - Trading level subsystem

9.1 Basic characteristics

This subsystem should communicate with the rocessing level subsystem level subsystem and cover the data registration needs of trading facilities until the final consumer.

9.2 Complete set of characteristics

The complete set of the characteristics of this subsystem will be revealed by Deliverable 4.1.1 "Use cases identification".

10 Analytical information regarding Agroquality ECR's modules and their connections

Bellow the main features of the system are presented analytically along with the relevant actions in order to develop the system.

The current concept covers only the raw product cycle. Probable expansion to process/standardisation/packaging, transport, storage and sale point level is expected in order to develop an integrated counceling and traceability system.

Final adaptions after evaluation under simulated and real life conditions are expected.

10.1 Data bases

- Farmers and land parcels
- Processing – Storing – Trading Facilities
- Varieties
- Plant protection
- Fertilizers
- Pests & Diseases
- Meteorological data
- Objects' Repository

Actions: a) Forms for users' registration and profile management must be prepared; b) Graphic representation of relevant data and reports should be prepared; c) Source of databases and protocol for their updating must be defined; d) Protocol for the retrieval and storing of meteorological data (historical data, current conditions and forecasts) must be defined.

10.2 Farmers and land parcels

<u>Farmer</u>

- Last update
- CODE No
- COUNTRY
- PHOTO
- FARMER FULL NAME (or first, family and fathers name)
- DATE of BIRTH

- Id’s (Tax number and info, id number and info, Social security number and info)
- FARMER'S CONTACT INFO (tel, fax, url, email, skype or other, social networks etc)
- FARMER'S RESIDENCE ADDRESS
- FARMER'S EDUCATIONAL LEVEL and INFO
- FOREIGN LANGUAGES
- YOUNG FARMER
- FARMER AS MAIN PROFESSION (>50% AGRICULTURAL INCOME)
- PARTICIPATION IN OLIVE CULTIVATION UNIONS (COOPERATIONS, FARMERS GROUP ETC)
- AREA (ha), Density, NUMBER OF TREES and MEAN TREE AGE OF PERSONAL OLIVE TREE LAND PARCELS (automatically)
- AREA (ha), Density, NUMBER OF TREES and MEAN TREE AGE OF FAMILY OLIVE TREE LAND PARCELS (automatically)
- AREA (ha), Density, NUMBER OF TREES and MEAN TREE AGE OF RENTED TREE LAND PARCELS (automatically)
- Infrastucture details (storehouses, agriculturar truck, tractor, cultivation machinery)
- ORGANIC or INTEGRATED MANAGEMENT or CONVENTIONAL CULTIVATION
- POD, PGI or other potential (automatically)
- Other

<u>Land parcel (separate for each parcel)</u>

- OSDE, Elaiokomiko, Chartographic or other ID numbers
- Photo gallery
- COUNTRY
- Location/Region
- Geographical position / District (this should be also be available in GIS format as central point or polygon)
- Distance from residence (km)
- Area (ha) (also calculation from GIS available)
- Height (also automatically from GIS)
- Slope (I: Inclined, H: Horizontal, C: Combination)
- Soil type (S: Sandy, C: Clayey, L: Loamy)
- Soil data (connection to soil analysis data)
- Soil and foliage analysis (before how many years, also automatically when soil analysis data are entered)[7]

[7] See: http://www.agrolab.gr/default.aspx?lang=en-US&page=103&categ=54

- Self owend / Rented / Family (overseed)
- Number of trees (Total)
- Variety (connection to relevant database)
- Subject
- Tree age (possibility for more data of notes)
- Tree formation
- Irrigation
    - Water source (Driling (equipment i.e. pumps etc), Water supply (network, drilling, Recycled, Other)
    - Cost (per area, per m3)
    - Distance of land parcel from the water source
    - Water transportation method (pump, tank)
    - Irrigation method (Surface/Flood irrigation, Ditch, Sprinkler, Drip)
    - Irrigation system (Suspended / Surface / Subsurface)
- Electricity
    - Info
- General product orientation (mixed, table olive - olive oil, other products i.e. olive paste)
- Quality Certification (IM: Integrated Management, OC: Organic Culture, Other)
- Alternate-bearing
- Table olive production (mean per year, tn) (present year estimation, automatically calculation from historical data)
- Olive oil production (mean per year, tn) (present year estimation, automatically calculation from historical data)
- Acidity of produced olive oil (mean value, analysis info)
- General quality of the produced olive oil (analysis info)
- Other

10.3 Processing – Storing – Trading Facilities

- Company name
- Company activities
- Location (also on map)
- Contact info
- Quality certificates
- Production capability
- Other

10.4 Varieties data base[8]

- Varieties (general info; photos; climatic, soil, etc preferences; expected yield etc)
- Subjects
- Other

10.5 Plant protection[9]

- Commercial name
- Drastic substance
- General info
- Usage permissions
- Other

Check:

- The list of approved materials provided by the Greek Ministry of Agriculture: http://wwww.minagric.gr/syspest/, and http://wwww.minagric.gr/syspest/syspest_Detail_drastiko.aspx?onomadron=Alpha-cypermethrin
- The Agrotypos database: http://www.agrotypos.gr/index.asp?mod=articles&id=46
- The guidelines of EASAF (olive cultivation integrated management) for applying plant protection materials : http://www.easaf.gr/index.php?ID=wwY7hYVKJtuabdZM

10.6 Fertilizers

- Commercial name
- Elements and percentage
- General info
- Usage permissions
- Other

10.7 Pests & Diseases

- Name
- Info
- Photos
- Identification guide
- Other

[8] Check: http://sviluppoagricolo.regione.puglia.it/web/packages/progetti/locelaion/documenti/olive_varieties.pdf)

[9] Caution should be taken at this point as the market names of the various consumables are some times not the same in different countries.

10.8 Climatic and Meteorological data

Table with historical climatic data (better if it could be micrometeorological through spatial interpolation of data from the available data from station within and around the area under interest)

Meteorological data and forecasts could be retrieved automatically from conected weather stations and relevant systems (i.e. HNMS, NOA's meteo.gr etc)

10.9 Objects' Repository

Documents, Photos, Tools, Links etc.

10.10 GIS

10.11 Maps

10.12 Reports

The generation of reports that will help user of any level to get information from the databases is very crucial:

- A number of predefined descriptive, diagrammatic and spatial reports should be available at first level. A typical example is the print in pdf of the farmers notebook for the specific year.
- Application of filters (select by location and select by attributes) with various capabilities (new selection, add to current etc) which will generate a results shapefile (map + table) which can be exported in order to be used in common relevant softwares (i.e MS-Excel for the table, ESRI-ArcGIS for the shapefile) is of great interest as it will help advances users to extract the information they need.
- Probably a prearranged order should be used for the selection (Cooperative / Company, Agricutlturalist, Farmer, Field (table and/or geography can be used at this point), Treatments/Yield (Inputs/Outputs) (also time can be used at this point)). The time field will be used in relevance with Treatment/Yield (Inputs/Outputs) table.
- These will be used to produce multifunctional reports which will contain tables, graphs and maps (with symbology control features i.e. different colors for different yield levels) and statistics (sum, average, standard deviation, max, min etc).

<u>Previous years database</u>

The farmer and the agriculturalist should be able to see the previous years records per activity and relevant meteorological data (temperature, humidity, ET etc) and flag those that are of special interest or can linked with specific problems or with the cultivation goals.

<u>Spatial reports</u>

Actions: a) Characteristics of maps should be agreed; b) Potential sources of existing relevant layers that would be useful for the system must be investigated; c) Reports templates and reports content must be defined.

10.13 Add ons

10.14 BarCode, QR-Code generator

10.15 Book Keeping

- According to the simplified agricultural accounting system or the current law obligations

Actions: a) Code forms and providerd must be investigated and relevant application must be developed; b) Book keeping needs must be defined and relevant application must be developed; c) The necessity for other probable add ons must be investigated.

10.16 Activity categories

10.17 Establishment

- Field
- Date
- Variety – link to relevant database
- Subject – link to relevant database
- Years until full production (estimation or real data)
- Years to depreciation (estimation or real data)
- Connection to relevant advice or obligation according to plan
- Approval (if necessary from applied cultivation system)
- Other

10.18 Soil processing

- Plowing
    - Field
    - Date
    - Machine type
    - Depth
    - Connection to relevant advice or obligation according to plan
    - Approval (if necessary from applied cultivation system)
    - Other specify (perimetrical hoe)

10.19 Weed removal

- Weed killing
    - Field
    - Date

    - Weed-killer – connection to relevant database
    - Quantity per ha
    - Connection to relevant advice or obligation according to plan
    - Approval (if necessary from applied cultivation system)
    - Other

- Weed removal
    - Field
    - Date
    - Machine type
    - Connection to relevant advice or obligation according to plan
    - Approval (if necessary from applied cultivation system)
    - Other

10.20 Plant protection

For each treatment

- Field
- Date
- Enemy (Pest) – link to relevant database
- Pesticide – link to relevant database
- Method of application
- Quantity per ha
- Connection to relevant advice or obligation according to plan
- Approval (if necessary from applied cultivation system)
- Other

10.21 Fertilization

For each treatment

- Field
- Date
- Have you done soil/nutrition analysis (relevant treatment based on results)
- Fertilisers – connection to relevant database
- Kg per tree
- Kg per ha
- Connection to relevant advice or obligation according to plan
- Approval (if necessary from applied cultivation system)

- Other

10.22 Irrigation

- Field
- Date
- Schedule
  - Irrigation frequency (number per month)
  - Water height or water volume or irrigation duration per irrigation event
- Connection to relevant advice or obligation to plan
- Approval (if necessary from applied cultivation system)
- Other

10.23 Yield forecast

From time to time the system should ask the farmer for an estimation regarding the expected yield.

10.24 Harvest

- Field
- Starting date
- Ending date
- Transport method (S: Sack, C: Crate)
- Transport vehicle (tractor, cab car)
- Compostion of harvesting team, A. workers number B. Sex C. Ages D. Nationality
- Participating in the harvest (family members, workers, combination)
- Yield. Quantity of olives per worker (kg/day)
- Final products
  - Olives
  - Olive oil
  - Olive paste
  - Other
- Connection to relevant advice or obligation to plan
- Approval (if necessary from applied cultivation system)
- Other

10.25 Various activities (pruning etc)

- Pruning
  - Field
  - Date

- Type (S: Shaping, R: renewal, F: Fruit)
- Quantity of green wastes per tree
- Method of green wastes management (Burning, Breaking, Fire woods, Combination)
- Connection to relevant advice or obligation to plan
- Approval (if necessary from applied cultivation system)
- Other

If we enter typical process, new activities regarding olive extraction, olive fermentation etc should be added.

10.26 Cultivation systems

- Conventional
- Integrated
- Organic
- By contract

General information for each systems. Contact information with relevant organizations and agents.

10.27 Objects

- Knowledge
- Tools
- Commitment Plan (5y organic)
- Official advice (integrated)
- Guru advice (experts that cooperate with the system)
- Record keeping
- Alert
- Descriptive and spatial reports (supervisors, farmers, other interested)
- Advertisement

10.28 Object characteristics

- Activity category
- Cultivation system (conventional, integrated, organic, contract)
- Time period
- Content type
- Content
- Likes - Dislikes
- Comments

10.29 Extra

- Web site with e-commerce facility generator

11 Added value from QR-Code application

Via a qrcode which could be placed on the product related documents or even it label anyone will have access to information regarding the route of the product from the farm to the store shelf.

QR code (abbreviated from Quick Response Code) is the trademark for a type of matrix barcode (or two-dimensional barcode). A barcode is an optically machine-readable label that is attached to an item and that records information related to that item. The information encoded by a QR code may be made up of four standardized types ("modes") of data (numeric, alphanumeric, byte / binary, kanji) or, through supported extensions, virtually any type of data. The QR Code system his popular in many kinds of industry due to its fast readability and greater storage capacity compared to standard UPC barcodes.

A QR code consists of black modules (square dots) arranged in a square grid on a white background, which can be read by an imaging device (such as a camera) and processed using Reed–Solomon error correction until the image can be appropriately interpreted; data is then extracted from patterns present in both horizontal and vertical components of the image.

In order to provide added value the qr-code that would be available for incorporation on the product label should provide special information that would be interesting for the consumer and document the high quality of the product.

In the framework of the ECR, this information could include:

- The members (one or more) of the productive unit (photos, some personal data such as age, education level, contact information etc)
- Link to spatial information (fields from where the product came from)
- Contact infromation regarding the quality councelor of the productive unit
- Image of the yearly quality certificate
- Contact infromation regarding the auditor of the productive unit

Figure 30 Information available from the ECR via the qr-code connection

12 Initial Cultivation Data Identification – two pilot cases

The analysis of the data collected in the framework of 3.1.1. (Best practices and Questionnaires Agro section) allowed the selection of two typical cases – farmers, which will apply the proposed method (ECR) in order to provide useful feedback for improvements, adjustments and evaluation. The two cases are farms with fair potentials for using the ECR and medium production outcomes (regarding both quantity and quality) in order to have enough margin to get improved.

12.1 First pilot case: Alexi Anna

Questionnaire No: 22 / 2012

GENERAL FARMER, LAND FIELDS AND INFRASTRUCTURE DATA

Residence: Peta, Artas

Educational level: Elementary school

Foreign language: No

Olive farmer as main profession (income from olive cultivation >50% of the agricultural income): Yes

Leader of agricultural exploitation: Yes

New farmer: No

Insurance organisation: Organisation of Agricultural Insurances (ΟΓΑ)

Area (ha) of personal olive tree land parcels: na

Area (ha) of family olive tree land parcels: 1.2 ha

Area (ha) of rented tree land parcels: 0

Number of trees in personal olive tree land parcels: na

Number of trees in family olive tree land parcels: 220

Number of trees in rented olive tree land parcels: 0

Owner of agricultural car: Yes

Owner of arboricultural tractor: No

Other olive cultivation machinery: Mechanical olive size sorter

EU/state economic assistance: Yes

Organic or integrated management or conventional cultivation: Integrated Management (EASAF)

Are you familiar with the term quality certification (y/n): Yes

Do you know what POD (protected designation of origin) product means (y/n): Yes

Do you know what PGI (protected geographical indication) products means (y/n): No

Do you know what ISO is (y/n): No

Do you know what HACCP is (y/n): No

Do you know what OSDE (integrated information system for agricultural exploitations management) is (y/n): Yes

Do you know the factors that affect the quality of your products: Fairly

Would you be interested in quantifing and prove the quality of your products: Fairly

If yes, how much would you dedicate to this: 1 week per year

Would you be interested in keeping a cultivation record: A lot

Would you place common label with other farmers to your product: Yes, under preconditions

By which way are you informed about developments and recent discoveries regarding cultivation, packaging, storing, processing and transportation of your products: From experts and from the cooperation (EASAF).

In which extend do you consider satisfying the different ways you choosed:

Literature: Fairly; Web search: Just a bit; Questions to experts: A lot; Questions to relevant public authority/cooperation: A lot;

How familiar are you with the use of PC: Not at all

Do you own a PC: No

Do you use the internet: No (for this answer all the internet related questions were overcomed)

DATA REGARDING LAND PARCELS AND CULTIVATION TECHNIQUES

The farmer owns 2 land parcels, each of which has an area of 0.6 ha (the mean number of trees per field is 110, while the mean tree density is 183.3 trees/ha). All the trees are of Conservolia Arta variety. The mean age of trees is 70 years.

Some facts regarding the trees:

Planting year: 1932-1952

Years until full production: 8 years

Years to depreciation: 17 years

The fields are at an altitude of 100m. The soil is medium and a soil analysis has been made 3 years ago. There is no irrigation network in the area and no drilling at the fields. There is no connection with the electric power supply network. Both fields are about 1.5km away from the farmers residence.

Some cultivation yield facts are given bellow:

Orientation (table olive - olive oil, other products i.e. olive paste): Combination

Quality Certification (IM: Integrated Management, OC: Organic Culture, Other): IM

Alternate-bearing (Y/N): No

Table olive production (mean per year, tn): 11.5 - 16 tn/year

Olive oil production (mean per year, tn): 4,5 tn of olives / year for olive oil yield about 0.8 tn of oil

Acidity of produced olive oil (mean value): 0,1 (according to the mill testing)

General quality of the produced olive oil: Extra Virgin

Extracting percentage: kg of olive oil / kg of olives: mean 5.5 kg of olives give 1 kg of oil

DATA REGARDING CULTIVATION TECHNIQUES

Cultivation is made according to the IM plan and following the EASAF's expert advices. Details regarding cultivation activities and relevant cost are available at the questionnaire.

DATA REGARDING TRADING

Sell of table olives (Trading as PDO (Protected Designation of Origin)) to cooperation or company: mean 11,5tn/year (price 2010: 0,8€/kg, price 2011: 0,7€/kg, in crates as raw (fresh) product.

Direct sale of table olive oil to final consumer (Trading as PDO (Protected Designation of Origin)): mean 0.8tn/year in 16kg pots (price 2010: 6,25€/kg, price 2011: 5,30€/kg).

The mean economic yield per ha is estimated to 10.720€/ha/year (before taxes) and is considered by the farmer adequate and viable.

DATA REGARDING COLLABORATION DISPOSISSION

Is the farmer disposed for further collaboration in the framework of the project: Yes

Which is her/his opinion regarding the future of olive cultivation at the region: Fair

Advantages of the region regarding olive cultivation: Altitude, good environmental conditions, modern olive mill

Disadvantages of the region regarding olive cultivation: The lack of irrigation

What do you think that you can do for the improvement of the efficiency of olive cultivation: Application of irrigation and proper guidance by experts.

What do you think that public and private organisations can do for the improvement of the efficiency of olive cultivation: Products promotion and guidance

Interest regarding vertical development of the exploitation by founding olive mill: Yes

Interest regarding vertical development of the exploitation by founding olive oil packaging unit: Yes

Interest regarding vertical development of the exploitation by founding olive mill and olive oil packaging unit: Yes

Interest regarding vertical development of the exploitation by founding processing and packaging unit for table olives: Yes

Has she/he submited any investment proposal regarding the expoitation: No

Has she/he meterialised any investement poject regarding the exploitation: No

Which quantity of the produced table olives per year has trading problems: The thin and blond.

Which quantity of the produced olive oil per year has trading problems: There is no problem

Interest for exportation of the exploitation products (table olive): Yes

Interest for exportation of the exploitation products (olive oil): Yes

Interest for the certification of the exploitation as PGI: Yes

Interest of the farmer for cooperation or support for the trading of the products: Yes

12.2 Second pilot case: Nousia Konstantina

Questionnaire No: 57 / 2012

GENERAL FARMER, LAND FIELDS AND INFRASTRUCTURE DATA

Residence: Louros, Prevezas

Educational level: Student at TEI, Agricultural School (technological sector of university level education)

Foreign language: Yes, English

Olive farmer as main profession (income from olive cultivation >50% of the agricultural income): No

Leader of agricultural exploitation: No

New farmer: No

Insurance organisation: Institute of Social Insurances (IKA)

Area (ha) of personal olive tree land parcels: na

Area (ha) of family olive tree land parcels: 2,31 ha

Area (ha) of rented tree land parcels: 0

Number of trees in personal olive tree land parcels: na

Number of trees in family olive tree land parcels: 295

Number of trees in rented olive tree land parcels: 0

Owner of agricultural car: No

Owner of arboricultural tractor: No

Other olive cultivation machinery: Nothing

EU/state economic assistance: Yes

Organic or integrated management or conventional cultivation: Integrated Management (EASAF)

Are you familiar with the term quality certification (y/n): Yes

Do you know what POD (protected designation of origin) product means (y/n): Yes

Do you know what PGI (protected geographical indication) products means (y/n): Yes

Do you know what ISO is (y/n): Yes

Do you know what HACCP is (y/n): Yes

Do you know what OSDE (integrated information system for agricultural exploitations management) is (y/n): Yes

Do you know the factors that affect the quality of your products: Very well

Would you be interested in quantifing and prove the quality of your products: A lot

If yes, how much would you dedicate to this: more than 1 week per year

Would you be interested in keeping a cultivation record: A lot

Would you place common label with other farmers to your product: Yes

By which way are you informed about developments and recent discoveries regarding cultivation, packaging, storing, processing and transportation of your products: From experts and from the internet.

> In which extend do you consider satisfying the different ways you choosed:
>
> Literature: A lot; Web search: A lot; Questions to experts: A lot; Questions to relevant public authority/cooperation: A lot;

How familiar are you with the use of PC: A lot

Do you own a PC: Yes

Do you use the internet: Yes

> Selected questions regarding the use of internet (more data are available at the questionnaire):
>
> Do you know electronic commerce: Yes; Have you ever done purchases or sales via internet: Yes; Would you be interested in trading your product via internet: Yes; Would you interested in keeping an electronic record of your cultivation and to show it to people that are interested for your product: Yes; If yes, how much would you dedicate to this: more than 1 week per year.

<u>DATA REGARDING LAND PARCELS AND CULTIVATION TECHNIQUES</u>

The farmer owns 3 land parcels, the mean area of which is 0.77 ha (the mean number of trees per field is 98.3, while the mean tree density is 156,6 trees/ha). All the trees are of Kalamon variety. The mean age of trees is 40 years.

Some facts regarding the trees:

> Planting year: 1970-1997
>
> Years until full production: 7 years
>
> Years to depreciation: 10 years

The fields are at an altitude of 17m. The soil is medium and a soil analysis has been made only for one field, 3 years ago. Only one field has irrigation capability (connection to irrigation network). There is no connection with the electric power supply network. Both fields are about 0.04km away from the farmers residence.

Some cultivation yield facts are given bellow:

> Orientation (table olive - olive oil, other products i.e. olive paste): Combination
>
> **Quality Certification (IM: Integrated Management, OC: Organic Culture, Other): IM**

Alternate-bearing (Y/N): No

Table olive production (mean per year, tn): 5-7 tn/year

Olive oil production (mean per year, tn): 0.2 tn of oil

Acidity of produced olive oil (mean value): 0-0,1 (according to the mill testing)

General quality of the produced olive oil: Extra Virgin

Extracting percentage: kg of olive oil / kg of olives: mean 10 kg of olives give 1 kg of oil

<u>DATA REGARDING CULTIVATION TECHNIQUES</u>

Cultivation is made according to the IM plan and following the EASAF's expert advices. Details regarding cultivation activities and relevant cost are available at the questionnaire.

<u>DATA REGARDING TRADING</u>

Sell of table olives (Trading as PDO (Protected Designation of Origin)) to cooperation or company: mean 5-7tn/year (price 2010: 1,5€/kg, price 2011: na, packaging unknown, as raw (fresh) product.

Direct sale of table olive oil to final consumer (Trading as PDO (Protected Designation of Origin)): It is not a product of this farm.

The mean economic yield per ha is estimated to 3.550€/ha/year (before taxes) and is considered by the farmer adequate and viable.

<u>DATA REGARDING COLLABORATION DISPOSISSION</u>

Is the farmer disposed for further collaboration in the framework of the project: Yes

Which is her/his opinion regarding the future of olive cultivation at the region: Promising

Advantages of the region regarding olive cultivation: Good environmental conditions

Disadvantages of the region regarding olive cultivation: Difficulties in selling the products

What do you think that you can do for the improvement of the efficiency of olive cultivation: Improve the applied cultivation techniques.

What do you think that public and private organisations can do for the improvement of the efficiency of olive cultivation: na

Interest regarding vertical development of the exploitation by founding olive mill: Yes

Interest regarding vertical development of the exploitation by founding olive oil packaging unit: Yes

Interest regarding vertical development of the exploitation by founding olive mill and olive oil packaging unit: Yes

Interest regarding vertical development of the exploitation by founding processing and packaging unit for table olives: Yes

Has she/he submited any investment proposal regarding the expoitation: No

Has she/he meterialised any investement poject regarding the exploitation: No

Which quantity of the produced table olives per year has trading problems: When the yield is very high

Which quantity of the produced olive oil per year has trading problems: na

Interest for exportation of the exploitation products (table olive): Yes

Interest for exportation of the exploitation products (olive oil): na

Interest for the certification of the exploitation as PGI: Yes

Interest of the farmer for cooperation or support for the trading of the products: Yes

12.3 Chapter references

1. Agroquality, 3.1.1. Deliverable
2. Agroquality, 3.1.1. Questionnaire's sheets, Agro section