160th CSO Meeting 1-2 December 2004
Proposal for a new COST Action

Cost 863

'EUROBERRY RESEARCH: FROM GENOMICS TO SUSTAINABLE PRODUCTION, QUALITY AND HEALTH'

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DRAFT

MEMORANDUM OF UNDERSTANDING

For the implementation of a European Concerted Research Action designated as

COST 863

'EUROBERRY RESEARCH: FROM GENOMICS TO SUSTAINABLE PRODUCTION, QUALITY AND HEALTH'

The signatories to this 'Memorandum of Understanding', declaring their common intention to participate in the concerted Action referred to above and described in the 'Technical Annex to the Memorandum', have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/01 'Rules and Procedures for Implementing COST Actions' the contents of which the Signatories are fully aware of.

2. The main objective of the Action is to improve the quality and production of berries to benefit health of the consumers and maintain profitable European production using sustainable systems.

3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at Euro 130 million in 2004 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

5. The Memorandum of Understanding will remain in force for a period of four years, calculated from the date of first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

Technical Annex

COST 863

'Euroberry Research: From genomics to sustainable production, quality and health'

A) BACKGROUND

COST Action 836, **Towards an Organisation of the Integrated Research in Berries: Model for a Strawberry of Quality, in Respect with the Environment Rules and Consumers' Requirements (…Integrated Berry Production…),** which finished in November 2003, has been very successful in achieving the objectives set out in the MoU and has made significant progress in improving the integration of interdisciplinary research and experimental programmes in Europe.

Twenty countries created the idea of the project, signed the Memorandum of Understanding (all 15 EU countries plus Norway, Switzerland, Poland, Turkey and Romania) and participated in its realisation. The project, originally focused on strawberry and then on other berries, was aimed to promote the development of analogous systems for production and crop protection that will guarantee a reliable production in Europe, secure in economic terms for the producer in terms of safety and quality for the consumer. The action focused initially on strawberries, with five working groups, but from 2000 WG6 was dedicated to co-ordinating research and development on cane and bush fruits, including raspberries, currants and blueberries.

The activities of the 6 WGs resulted in several important achievements, mainly in the following topics:

- Creation of a European genetic resource database for strawberry (3010 accessions, 1049 cultivars) and a core collection of 106 strawberry cultivars. Each maintained on at least two sites in Europe.
- Definition of breeders' evaluation methods and standardisation for disease resistance and fruit quality traits.
- Seventeen countries and 30 members participated in variety trials located at 26 sites, using a standardised design and criteria for observations and measurements.
- Improved strawberry plant quality for different seasons of production and out-of-season production.
- Physiological studies on dormancy and chilling, flower induction and differentiation.
- Optimisation of nutrition in soil and soilless culture and development of laboratory methods.
- Review of the major diseases and pests of berry fruits.
- Survey of the extent of integrated and organic production in Europe.
- Development of new cane and bush fruit cultivars suited to modern integrated crop management programmes.
- Information on systems for out-of-season production of cane and bush fruits has been exchanged, aiming to increase the availability of berries over longer periods of the year.
- The synthesis of results is available on the Internet, linked to COST 836 web pages (http://www.agr.univpm.it/ricerca/prog_ric/cost836.htm), and published in Acta Horticulturae 649.

The large participation in COST Action 836 demonstrates the interest in berry cultivation throughout Europe. COST 836 has focused primarily on strawberries and the achievements can be used as a model to integrate fully the other berry crops. Currently within Europe there is research on berries at the national level but few international programmes.

Within the area of insect pests there is a link to COST 842 (*Biological Control of Pest Insects and Mites with Special Reference to Entomophthorales*), but this action is mainly related to tree fruits. Other relevant links are within the IOBC♦ Working Group '*Integrated protection of fruit crops*', with a small subgroup on soft fruits that is involved with activities complementary to the proposed programme on IP systems.
From 1998 to 2000 there was an EU-Craft project '*Reduced Application of Chemicals in European Raspberry production (RACER).*

Other recent relevant programmes focused on the area of human health are:
Action 916: *'Bioactive plant cell wall components in nutrition and health'*
Action 926: *'Impact of the new ~~technologies on the health~~ benefits and safety of bioactive plant compounds'*

Finally, some connections can be expected with COST Action 924 on *'Enhancement and preservation of quality and health promoting components in fresh fruits and vegetables'.*

The importance of a new COST Action on berry research is supported by the large group of countries involved in the cultivation of berries. This will improve co-operation between research programmes, including high level science and technology, to develop a European berry production system characterized by a reduction of chemical inputs that are harmful to the environment along with lower production costs (reduced labour costs) and increased benefits for the consumer (healthy fruits). All the previous 23 countries plus at least seven new countries have these aims for their berry production. The new action is characterised by a new organisation of more focused priorities. The WGs are completely reorganised. The first (*From genome to berry fruit*) and third (*Sustainable berry production*), are developments from the previous action but with new topics that are more focused and at higher scientific level; the second (*Quality assurance of planting material*) and fourth (*Bioactive compounds of berry fruits affecting human health*) are completely new themes.

The EUROBERRY Action has a new and advanced approach to promote the integration of research, production systems, quality control, added nutritional value and consumer acceptance. The action will be organised with a new integrated approach: From laboratory via farm to consumer table. EUROBERRY has, as a special aim for the future, the objective to create a European Berry Association (EBA) that could act as a permanent organisation able to promote and sustain integration in science and berry production technology.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to improve the quality and production of berries to benefit health of the consumers and maintain profitable European production using sustainable systems. The new project will benefit from the experiences developed on strawberry during COST Action 836 and will be extended to other berry species that are important in European countries. By using a new interdisciplinary approach the programme will focus on selected topics of major importance for the European berry production system and quality control.

The objective will be achieved by focussing on four areas of research and development:

♦ *International Organisation for Biological Control of Noxious Animals and Plants.*

- From genomics to variety evaluation.
- Nursery production system and plant quality control.
- Plant physiology and culture management.
- Health for the consumer: components and factors affecting berry nutritional value.

The overall goal of the Action will remain the development of a European berry production system able to assure the following attainments:

Sustainable cropping: growers throughout Europe need cultivars and growing systems that allow environmentally safe production that is economically viable. Nowadays, to face the globalisation of the market they strongly need to reach high standardisation for production systems.

Quality and security: high quality berries are required for fresh consumption and for industry. They should have a good sensory and nutritional value and consumers must be satisfied that they are safe and produced with minimum pesticide applications.

Health benefits: the levels and benefits of antioxidants and other bioactive compounds found in these berries should be understood. Accurate and substantiated information must be provided to consumers so that the health benefits are well understood to allow informed choices.

Maintaining profitable production in Europe: Berries are popular with consumers and demand within Europe is strong. The threat of excessive imports from non-European countries with low labour costs must be countered by developing modern, profitable production systems. This will maintain employment in berry growing and also ensure a supply of fresh, high quality products.

The improvement of berry cultivation efficiency and increased commercial value of the fruit will help in **overcoming the labour problems** by achieving more efficient production and meeting the expense of higher labour costs from added value.

C. SCIENTIFIC PROGRAMME

1: FROM GENOME TO BERRY FRUIT

Development of new varieties is essential for all the berry-producing regions in order to maintain the competitiveness, improve the sustainability, and increase the nutritional value of European berries. The experimental power of genetics, including genome science, is now permeating every discipline of biology, making it possible to apply contemporary tools to berry fruit crops. Accelerating pace in plant gene discovery has surpassed our capability to understand biological functions in crop plants. Sequencing provides a wealth of genomic and EST (extensive sequencing) information that must be matched by research to locate, annotate and assign function. Only a fraction of annotated genes have been associated with phenotypes that provide a predictive framework for understanding and eventual manipulation. There is thus a gap in knowledge limiting our understanding of attributes of natural raw materials that form the basis of our diet and food chain. Notably, complex traits such as resistances, flavour, texture and appearance are poorly understood at the molecular/biochemical level. Focus on ‘closing the phenotypic gap’ (Bochner & Peter 1996) will allow us to obtain benefit from the genomics revolution in the life sciences. Integration of robust phenotypic data representing structural features of fruit with meiotic mapping offers new opportunities for analysis of quality, previously intractable and for the generation of diagnostic markers for those traits of greatest value.

An integrated approach is required in the application of all these technologies and the use of recombinant DNA technology will be an important tool for studies on functional genomics. The final output from all these activities is the cultivar release. An appropriate evaluation of the cultivar adaptability and quality performance in the different cultivation areas still remains the primary undertaking for a standardisation of the production systems.

The impact of new genomic approaches (molecular and biotechnology) in berry research should bring:

a) generation of new genotypes, which are necessary for sustainable agriculture and to limit the application of pesticides and pollution of the environment.
b) increasing breeding effectiveness by shortening the time of selection from applying knowledge of the berry genomes.

Topics

1.1 Genomics in berry
1.2 Breeding and molecular methods of selection
1.3 Variety evaluation
1.4 Dissemination of the results for all crops *via* a dedicated web page.

1.1 Genomics in Berry Fruits

In recent years a dramatic increase in the number of European research groups working on the molecular genetic aspects of berry fruit has been evident. For example, in strawberry, more than a dozen groups are currently investigating using molecular tools for various aspects of fruit quality traits. Some of the groups have initiated large-scale functional genomics programmes including extensive sequencing (ESTs) and DNA microarrays for gene expression analysis. As a result of such activities there are a relatively large number of publications in scientific journals particularly for strawberry. Such activities have positioned the European research in the front line of the worldwide effort on molecular genetics and genomics in berries. As the number of research programmes using genomics to understand the molecular basis of quality traits around Europe is clearly increasing, there is a strong requirement for coordinating such activities. The COST Action programme will not only coordinate the activities of European groups working on berry genomics but will also allow the integration of the molecular aspect with physiological studies. It will also reduce the large gap existing between the study of genes and their function and the breeding programmes.

1.2 Breeding and molecular methods of selection

There are many national programmes for the different berry crops. Using new methods of early plant selection involving molecular markers can enhance progress on common breeding objectives, such as resistance and improved nutritional value. Their presence is independent on environmental factors and season of experiment and they are more useful for new breeding and cultivation than markers based on morphological characters. The techniques used for marker generation assures very precise selection of desired traits.

The objectives of the network will be:
- Definition of common methods for desired trait selection and exchange of data.
- Evaluation of germplasm by molecular analyses for the major characters e.g. disease and pest resistance, adaptability, quality and nutritional components.
- Investigation of the inheritance and molecular genetics of important traits in relation to the different environments in Europe.

This part of project will be based on the previously established database of strawberry varieties and the core collection of important European varieties that are now maintained in at least two locations, and a similar organisation will be developed for the other berries. The objectives connected with germplasm analysis will allow a rationalisation of the European collection of strawberry (concentration on the traits most important for the breeding programmes) and characterisation of germplasm collections of *Rubus, Ribes* and *Vaccinium.* Molecular relationships will enable locating donors of the traits most important for sustainable berry production.

1.3 Variety evaluation

Fundamental to the effectiveness of all improvement programmes is the availability of good genetic resources that are well preserved, catalogued and evaluated. There are many germplasm collections of the berry crops in Europe, but there is a need for co-ordination, rationalisation and pooling of resources. COST Action 836 established a database of strawberry varieties and identified a core collection of important European varieties that are now maintained in at least two locations through a collaborative programme. It is now important to develop a similar organisation for the other berries and improve the information database by completing further evaluations for all the berry crops.

The new evaluation strategy has to be organised for more homogenous growing zones (northern, central and southern Europe) and production systems.

A trials network will also be developed for the other berry crops. The objectives are:

- Investigation of the influence of geographic and climatic conditions on plant performance, fruit quality and disease resistance.
- Definition of a common protocol for notation (descriptors and data to be recorded) for cane and bush fruits.

2. QUALITY ASSURANCE OF PLANTING MATERIAL

The basis for the sustainable production of high quality berries is the provision of planting material of high quality and purity. The variability of the various national standards appeared to be insufficient to solve the problems emerging on an international market. There is a need for scientific co-operation in the field of berry plant propagation techniques, quality control and certification.

Receiving diseased plants forces growers to use more and more pesticides and in consequence the risk of pesticide residues on the fruits is increased. Production of healthy plant material is strategically important in controlling many pathogens.

Expanding European berry production to different cultivation conditions and culture techniques is strictly related to the availability of a nursery production of plants with the proper quality for sustaining an efficient production.

Topics

2.1 Variety identification
2.2 Plant health and diagnostics
2.3 Nursery Plant management and physiological quality
2.4 Dissemination of the results for all crops *via* a dedicated web page.

2.1 Variety identification and propagation

Purity of the variety, standardisation of methods for variety identification in propagation, genetic stability and genetic certification are required to meet demands of the industry. Aspects related to plant variety rights and their implications on nursery production systems will be also taken in account. The propagation techniques are also important to sustain a high standard of plant production. A correct integration of *in vivo* and *in vitro* (micropropagation) methods that are commonly used for berry propagation is required

For each species the most common propagation techniques are already well developed, but a more dynamic approach to plant propagation with specific requirements for out-of-season production is required. Therefore a better integration of the knowledge available for the different species can lead to further improvements of propagation efficiency and plant quality.

The development and implementation of methods for the identification and certification of plant biotic status, following the biotization techniques (including mycorrhization), should also be developed to fully evaluate genetic plant quality.

2.2 Plant health and diagnostics

With perennial crops such as berries there is a significant risk of spreading diseases by movement of infected plants. Receiving diseased plants forces growers to use more and more pesticides and in consequence the risk of pesticide residues in the fruits is increased. Production of healthy plant material is strategically important in controlling many pathogens.

For quarantine pests the European and Mediterranean Plant Protection Organisation (EPPO) provides standardised protocols for the detection. Still there are many non-quarantine pests disseminated by infected planting material and for their detection various methods are used.

The objectives are:

- Exchange of experiences in the implementation of EPPO protocols for the detection of quarantine pests between different laboratories
- Collection of new non-quarantine pests and diseases in Europe, that are disseminated by infected planting material.
- Work towards standardising protocols for the detection of non quarantine pests and diseases

2.3 Nursery Plant management and physiological quality.

Sustainable berry production has a strong relation with a properly developed root and aerial system. This feature is strictly related to the nursery production techniques that are able to assure the production of high quality plants. Plant adaptability to the different cultivation systems (e.g. soilless, out of season, etc.) is strictly related to the type of plant treatments affecting plant development in the nursery. Root system, plant nutritional status, carbohydrate and reservoir level in the root and crown are all together effective in determining the success of transplanting and cultural techniques.

The development and improvement of methods to record physiological quality (flowering potential and forecast, flower differentiation, dormancy and chilling requirement) for different growing techniques (open field, protected, out-of-season, soil-less) in very diverse latitude are now considered important tools for nursery plant quality certification. Nursery plant quality is generally related to the development and emergence of inflorescences and also the number and quality of flowers per inflorescence which significantly affects the production systems. New common standardized methods useful to analyse and standardise these quality features are considered of particular importance.

The development and implementation of efficient methods for biotization (including mycorrhization) techniques of berry plants (e.g. strawberry runners, blueberry in vitro plants) in nurseries is expected as an important output for the improvement of nursery plant health and quality.

Alternative methods of sustainable nursery production systems (e.g. bio-fumigation, cover crops (*brassicacae*) will be taken in account to improve the quality of the certificated nursery material. Furthermore, a discussion related to the EU rules for plant certification will be also considered with the aim to improve knowledge, method of detection and control systems within all countries joining the action and interested in berry plant production and exchange.

Particularly for all these aspects, nursery production needs a strong coordination to reach the maximum result in quantity and quality of the production.

3. SUSTAINABLE BERRY PRODUCTION

A sound understanding of the mechanisms involved and factors affecting the production of high yields of good quality berries are essential. This requires knowledge of the physiology of the plants in different environments and ecosystems, as well as in relation to the nutritional status of the plants and pest and disease management. A research network will provide advanced knowledge, useful for the development of new sustainable cultivation systems, the adaptability to different pedo-climatic conditions for different growing systems, with the aim to fulfil the requirements of both the producers and the customers by improvement of berry production and quality, health and nutritional value of fruits. The major output should contribute to the harmonisation of product quality standards within Europe.

Topics

3.1 Factors affecting plant development and differentiation
3.2 Cultivation factors improving efficiency in plant productivity and berry quality
3.3 Pest and Disease Management
3.4 Dissemination of the results for all crops *via* a dedicated web page.

3.1 Factors affecting plant development and differentiation

Plant growth and development are controlled and regulated by endogenous (phyto-hormone balance, stage of development, etc.) and exogenous interacting signals (temperature, mineral nutrition, photoperiod, etc.). Thus the evaluation of endogenous hormone balance in different cultivars and situations might contribute to the understanding of their behavior. Comparison of the phyto-hormones balances in different berries may be useful for selection of berry cultivars exhibiting different dormancy-breaking potential. The exogenous application of natural substances could be used with advantage for extending the production season, breaking dormancy or anticipating bud break.

This research network would help in developing a better control of the production systems, which are significantly changing the schedule of the phenological growing phases in several berry species. As for example, the level of Abscisic Acid (ABA), the key component of several stress-induced defense mechanisms can be tested as a marker of chilling-resistance in different berry cultivars. Alternative, efficient and easier methods based on measurements of chlorophyll fluorescence are now also available to assess chilling resistance.

Auxins are involved in rooting; high levels of auxins may induce dormancy, sustain fruits development and affect fruit ripening and quality. Gibberellins are commonly used for breaking dormancy in out of season production systems, to better control the leaf petiole and inflorescence peduncle elongation when a lack of chilling is endangering bud growth. Dormancy can be broken also by cytokinins.

Cytokinins are known to be involved in regulation of the uptake, assimilation and allocation of nitrogen in plants. It is known in other species that the nitrogen economy is increased following cytokinin application at flowering, namely due to the increased nitrate uptake, nitrogen assimilation and allocation within the plant. Moreover cytokinins are known to delay senescence, increase the leaf vigor and prolong photosynthetic activity of leaves. Factors affecting senescence, like mineral nutrition (especially N) increase cytokinin supply from roots to shoots. It is also known an elicitor effect of cytokinins on plant resistance, namely to pathogenic fungi.

Temperature has a special impact on plant development; while thermo-photoperiod and light quality are essential in breaking dormancy, inducing flowering and influencing plant architecture. Temperature, and to some extent, light quality (day and night) is frequently a limiting factor in strawberries and raspberries grown under protection (polythene or glass) particularly in northern countries. It is important to optimise growing conditions and reduce energy input.

All these interactions are influenced by the environmental and, particularly in berry, to specific cultivation conditions (e.g. open field, tunnel, soil-less culture).

Several research programmes are aimed to better study these physiological interactions occurring during the plant differentiation process, having a particular importance for improving plant efficiency and adaptability to the different cultivation conditions by keeping high fruit quality standard. In particular significant insights into this complex interacting signal network will be gained by proteomic efforts.

3.2 Cultivation factors improving efficiency in plant productivity and berry quality

The network will improve the knowledge of root-to-substrate interaction and dynamics to optimise nutrient uptake and make plants less vulnerable to stresses and pathogen infections. In fact, modern intensive growing systems for strawberries result in a degraded root system. To a lesser extent this is also true for other berry crops. However, for sustainable production it is important that the root system is properly developed, depending on chemical, physical and organic characteristics of the substrate including allelopathic factors (soil fertility). Soil fertility must be completely recovered before replanting. Such a simple principle is commonly overcome by a higher mineral nutrient application, fumigation and short rotation, but the result is soil degradation and replant disorders and diseases. Soil amendment and humification of residues are the key features for reaching a much higher level of sustainability together a higher quality of berry production. This is also important for production of high quality plants in the nurseries.

This aim is to provide a sound scientific basis of nitrogen (N) fertilisation of European cultivars in field and soil-less production, thus increasing the sustainability. It will be important to determine how and in what quantity N is required to secure optimal growth and high fruit quality, without polluting the ground water.

Particularly in soil-less culture, which is increasing in importance within Europe, it will be important to introduce an effective fertilisation system by re-use of drainage water to make this knowledge universal through common guidelines issued to growers in the different European countries. For this aspect(s) most of the work will be on the standardisation of the methods for the measurement of nitrogen requirement and status of plants at different stages of development to optimise fertilisation for excellent fruit quality and to minimise leaching of nutrients from field and soil-less culture.

It is desirable to replace peat with an effective alternative substrate derived from renewable resources. This will increase the sustainability of the production, with a potential to eliminate the use of non-renewable peat reserves. This also provides an opportunity for recycling waste from the sawmill industry and developing a small new industry based on the production of renewable compost. Coordinated studies on alternative substrates and/or compost will be also included, as well as their effect on ‘water status’. For example bark from pine and spruce is considered of interest as the raw material for composting to produce a substrate base by adding varying amounts of fertilisers, sludge, and organic materials from households and agriculture.

Finally as biotic factor, the beneficial role of mycorrhizal fungi will be taken in account for their ability to enhance soil nutrient uptake and plant tolerance to soil-borne pathogens (see connection with the previous working group on propagation). It has been also shown that mycorrhizal association significantly alters physiological status of host plant. It influences gas exchange (CO_2, H_2O, O_2) by changing stomatal resistance. Thus, water status and photosynthetic activity are regulated to some extent by symbiotic fungi. It has been also postulated that symbiotic fungi affect, either directly or indirectly, plant morphology - they are bigger and produce higher yields.

3.3 Pest and Disease Management

Modern agriculture (horticulture) is under pressure to develop new practices, which improve product quality and are environment-friendly. In this respect symbiosis with some soil microorganisms represent one of the most successful strategies that plants developed to cope with abiotic and biotic stresses (drought, soil acidity, heavy metals, and pathogens). However, strawberry runners produced nowadays in soil sterilised with methyl bromide, as well as those produced in vitro, are devoid of any micro flora, either beneficial or pathogenic.

Agro-technical procedure must be consistent with the needs of the symbiosis. Heavy fertilisation and non-selective fungicides usually prevent proper mycorrhizal establishment. It requires a large-scale commitment to switch away from chemicals towards bio-control with beneficial organisms.

The arsenal of active ingredients is declining rapidly and there are few effective control strategies. In order to facilitate knowledge transfer this Action will be aimed to co-ordinate the national programmes to develop sustainable control strategies for pests and diseases in berry crops. This will allow environmentally safe production that minimises the use of chemical pesticides resulting in safe production of quality berries.

Plants have natural mechanisms to combat stresses caused by pest and diseases. By enhancing the ability of the plants to utilise these mechanisms, it is possible to reduce the requirements for chemical control methods. The policy on reduction of pesticides in agriculture necessitates development of alternative methods of plant protection against pests and diseases.

The Council Directive 91/414/EEC concerning the placing of plant protection products on the market, provides a positive list of active ingredients on the basis of the risk for man, animal, environment as a result of their use for crop protection.

Berries are crops at high risk because it is easy to find residues of pesticides on them, also for their peculiarity of progressive harvest, with the need to be continuously protected from disease. Moreover berries are often grown in greenhouses, or under semi-protected cultivation, where the persistence of products can be different from open field and higher is the need of protection from disease.

Furthermore, this is especially important for strawberry producers since methyl bromide, widely used hitherto on strawberry plantations for control of soil-borne pathogens, will be banned from 2005. One of the prospective measures is the use of elicitors, which induce host plants resistance to a number of pathogens. One example is application of soluble chitosans, which have been shown to reduce fungal disease severity in several crop species. It is postulated that elicitors act as pathogen stress-signalling compounds, which stimulate expression of disease-resistance genes, but the precise mode of their action remains unclear. The research aims at studying the effect of selected elicitors on strawberry resistance to some pathogens, and on biochemical and molecular mechanism of the elicitor-induced host plant resistance.

Implementation of new knowledge in Decision Support Systems (DSS's) to control *Botrytis* leads to improvement of the DSS's and to dissemination of this knowledge by the users. The use of a good DSS will improve the timing of fungicide input and so improve the control and reduce the fungicide input. In this way DSS's can play an important role in IPM.

For this complex theme, the following major aspects will be tackled with a priority:

- identify the active ingredients useful for growing of berries and promote studies for characterisation of acceptable limits of residue on them, that could make possible their trade;
- develop a common study on the effect of mycorrhizal fungi on strawberry physiology (photosynthesis, transpiration, plant morphology) resistance to biotic (*Verticillium, Phytophthora*) and abiotic stresses, in laboratory conditions.
- Test the efficacy of non-chemical measures for control of soil-borne diseases in various climatic conditions. Target organisms: species of *Phytophthora, Pythium, Verticillium, Rhizoctonia*, *Fusarium, Pratylenchus* and *Meloidogogyne.*
- Validate and improve of computerised Decision Support Systems (DSS) for predicting risks of *Botrytis* fruit rots.

- Establish a basis for the registration of elicitors designed to induce plant resistance. Target organisms: *Sphaerotheca* spp*., Botrytis cinerea, Phytophthora cactorum, Tetranychus* spp.
- Develop optimal combinations of control techniques of *Tetranychus urticae* in different climates and growing systems. Develop alternative, non-chemical control methods for A*nthonomus rubi*, *Otiorhynchus* spp*., Lygus* spp*.*, *Byturus* spp.

4: BIOACTIVE COMPOUNDS OF BERRY FRUITS AFFECTING HUMAN HEALTH

The recent joint expert report by the WHO and FAO concerning the relation between nutrition and chronic and degenerative diseases concluded that a convincing association exists between the consumption of fruits (including berries) and vegetables and reduced risk of both Cardio Vascular Disease (CVD) and cancer. The capacity of fruits to reduce the incidence of free radical-promoted disease has been the subject of much interest. Indeed, small (berry) fruit have as a consequence of their chemical diversity, been shown to exhibit significant antioxidant capacities and these have prompted clinical and epidemiological studies which have indicated that the relationship exists between the consumption of berries and reduced incidence of degenerative diseases such as heart disease. However to capitalise upon these developments two main aims are apparent: 1. - study and characterise the constituents responsible for these beneficial health effects and 2. - determine the degree of intra- and inter-species genetic variation of these properties/parameters. These details are paramount if value (both economic and societal) is to be captured. Detailed knowledge about the key and/or predominant antioxidants and their richest source is essential if these traits are to be introgressed via targeted or marker-assisted breeding programmes to improve nutritional value and consequently provide added value to berry fruits.

The Action will ensure a strong integration between these theme/experts and the other three themes/experts involved in the project. The objective of improving the nutritional value of berries can be achieved by both genetic improvement and changes in production and culture techniques. The information available from the advanced knowledge and analytical technologies in theme 4 will facilitate these improvements through the applications of themes 1, 2 and 3. The Chairman of the Action and the WGs Chairman will assume the responsibility to strongly promote the integration and exchange between experts involved in the different research topics. In particular, experts focused on the nutrition studies should bring to all the groups an important integration of knowledge useful at different levels of research on berries: from genome and variety evaluation, to fruit characterisation and valorisation.

Topics

4.1 Development and standardisation of technologies to determine the modes of action of berry derived phytochemicals; smart screens for berry crops in relation to nutritional relevance.

4.2 Polyphenolics in berries – Phytochemical profiling and the relation to quality in human health.

4.3 Factors affecting bioactive compound in berry fruits and their derivates.

4.4 Contribution to the action Website.

4.1 Development and standardisation of technologies to determine the modes of action of berry derived phytochemicals; smart screens for berry crops in relation to nutritional relevance.

A wealth of scientific data points out that cancers, CVD, strokes, inflammation etc. have free-radical initiated reactions at their formative and propagative stages. If berries are to be considered as nutritionally relevant sources of phytochemicals able to inhibit or increase these reactions, then the ability to measure this in a rapid, robust and reproducible manner is vital. Antioxidant capacity determinations such as Trolox Equivalent Antioxidant Capacity (TEAC), Ferric-Reducing Ability of Plasma (FRAP) and Oxygen Radical Absorption Capacity (ORAC) exhibit different sensitivities and a standard "catch all" method is required, at least as an initial screen. Additionally the progression to more '**biomimetic'** screening can be performed *in vitro* for a range of diseases and pathologies.

The implementation of standard technologies such as High Performance Liquid Chromatography (HPLC) and the more specialised, but detailed, Liquid Chromatography-Multiple Mass Spectrometry (LC-MS^n) and Gas Chromatography–Time of Flight-Mass Spectrometry (GC-TOF-MS), commonly addressed as metabolic profiling technologies, provide opportunities to investigate the reaction mechanisms of berry constituents with free radicals and other more pharmacological interactions to provide an insight into the way in which they may act *in vivo*. The application of smart screenings for antioxidant ability (TEAC FRAP etc.) in conjunction with metabolomics and microarray technologies (transcriptomics) mean that functional genomics can be performed to characterise the transcriptional profile and sequence diversity of genes controlling the synthesis and accumulation of pharmacologically relevant phytochemicals, and both the expression and the inheritance of these traits can be monitored. The ultimate aim is, of course, a quick, reliable and robust route to more nutritious fruit.

Animal (or human) biological systems do exhibit large variations in responses if suitable control experiments are not in place. *In vitro* methods for testing efficacy with regard to inhibiting oxidation and, indirectly, CVD, cancer etc., are becoming more popular but their precise design varies. As a consequence, many laboratories developed their own method of analyses. In addition the applicability of such methods to berries and berry products is largely unexplored. The inhibition of Low-Density Lipoprotein (LDL) and DNA (human or plasmid) oxidation (cancer) by berry extracts requires investigation.

With the aim to develop and standardise technologies to determine modes of action and screening for phytochemicals in berry crops, this network will be active mainly on the following topics:

- Investigate the mode of action of berry phytochemicals using HPLC, LC-MS^n and GC-TOF-MS^n (metabolic profiling).
- Establish and ring test a robust 1st stage system for screening berries for putatively beneficial phytochemicals.
- Development of a procedure to study the inhibition of LDL oxidation by berry extracts (CVD mimic).
- Development of a procedure to study the inhibition of DNA oxidation by berry extracts (Cancer mimic).
- Establishment of a standard method to measure quenching of free radicals by berry extracts.

4.2 Polyphenolics in berries – Phytochemical profiling and the relation to quality in human health.

As a complement to the previous chapter (4.1), investigations on Polyphenolics class composition of varieties with the best antioxidant ability will be carried out (flavorous in general; flavones, anthocyanins and flavan-3-ols/proanthocyanidins) via profiling and simple HPLC technologies. The impact of recombinant DNA technologies on quali/quantitative composition of major polyphenolic pools (e.g., anthocyanins, pro-anthocyanidins, flavonols) will be assessed in collaboration with Partners working on chapter 1.1 topics. An added value to these analyses will be that the simple phenolic compounds implicated in pathogen/disease resistance, such as salicylic acid

and hydroxyl-benzoic acids, will be determined concurrently by HPLC, to yield information for sections 1.2, 2.2 and 3.3.

These studies will be the basis for the development of markers for antioxidant capacity/bioactive compound traits. Some current research studies are focussed on a segregating *Rubus* cross in which these chemical phenotypes are determined and compared with linkage disequilibrium-marker data to determine the basis of these traits. Such studies will provide breeders with tools to modulate precisely the levels of antioxidants and/or pharmacologically active compounds in new varieties. This is extremely important, since in soybean flavonoids can be viewed as either beneficial (cancer, heart disease, osteoporosis) or deleterious (inhibition of breast cancer treatment – competitive binding with tamoxifen).

4.3 Factors affecting bioactive compound in berry fruits and their derivates.

Currently studies relating to bioactive compounds in berry fruits are focussed on the inter- and intra-species variation of specific phytochemicals. Often these fruits are of unknown origin (retail products) or blindly harvested with no prior knowledge of the effects exerted by factors such as environmental etc.

Within Europe, strawberries, raspberries, blackcurrants and *Vaccinium* are cultivated under different environmental conditions (temperature, irradiation) and growing techniques (cultivation in the open field, soil-less culture, and various fertilisation and irrigation programmes). Berry fruits are consumed as fresh fruits, but also processed into juice or jam. In addition, fruit for fresh and processing end uses are subject to different storage conditions (e.g., at 2 to 4 °C temperature with or without CO_2 for fresh fruits; at –20 °C for various times prior to processing for frozen fruits). Furthermore, the ripening stage at harvest time is often subjective and hence variable, and may be linked to the intended end use of fruits. Also, the harvest stage determined for commercial purposes may not be correlated with the optimal levels of bioactive phytochemicals in the fruits. Therefore, another major objective of this Action will be the evaluation of the impact of environment, growing conditions, ripening stage, storage conditions and processing on bioactive compounds of berry fruits and their derivates.

D. ORGANISATION

Following the theme structure described in section C, the Action will be organised into four Working Groups (WGs).

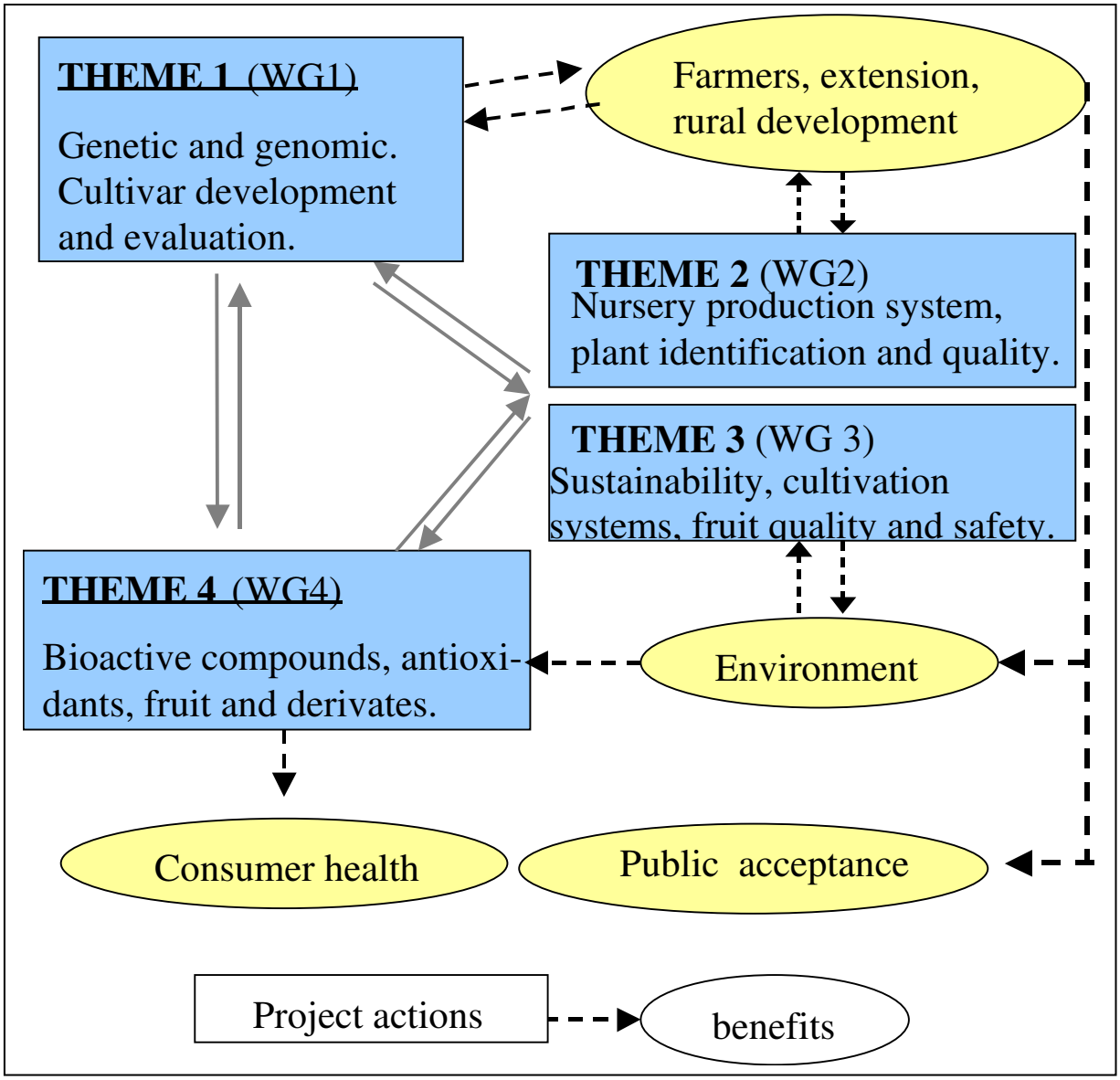
WG1: FROM GENOME TO BERRY FRUIT
WG2: QUALITY ASSURANCE OF PLANTING MATERIAL
WG3: SUSTAINABLE BERRY PRODUCTION
WG4: BIOACTIVE COMPOUNDS OF BERRY FRUITS AFFECTING HUMAN HEALTH

These WGs reflect the research activities funded in the European countries interested to sign the MoU. Different scientists will participate in the different WGs but there will be overall co-ordination by the Management Committee (MC), who will arrange their meetings to coincide with a different WG meeting each time. There will also be some joint WG meetings, to encourage more co-operation and interaction across disciplines. To achieve the overall objective of the action requires a multi-disciplinary approach and it will be the role of the MC to promote exchange of ideas and maximum interaction between the WGs.

Each WG includes topics with a complex perspective *"from laboratory via farm to consumer table"*. Application of the latest knowledge employing modern techniques and technologies, will achieve progress in genomics, breeding and benefits/risk from recombinant technologies (WG1);

plant purity, health and physiological quality (WG2); hormonal physiology and the impact on plant development, culture techniques, rules of pest management systems and traceability of quality and safety (WG3). Methods for detecting the nutritional value of berry fruits (WG4) will involve a different group of scientists and it will be mutually beneficial for these researchers to interact with the other WGs.

The COST Action is aiming at the organisation of berry research activities and benefits for European production and public health, as represented in the following scheme.



Research groups from different countries will join the new Action, and will integrate with the well-known berry research scientists who already improved their collaboration during the previous Action. Researchers from **30** countries (including most of the new member countries) are interested in this COST Action, confirming their interest to improve co-operation on berry research in Europe.

The reduction from six WGs in COST 836 to four in the new action will provide an improved management structure. The organisation of the project will aim at the integration of research activities on genetics and berry varieties, plant production systems and benefits of berries for

consumer health, all-important for expanding the European berry production by promoting rural development and improving public health.

In several areas there will also be potential for collaboration with groups outside the COST Action. For example WG3 have some common interests with COST Action 842 '*Biological control of pest insects and mites with special reference to Entomophthorales'* and with the COST Action 838 *Managing arbuscular mycorrhizal fungi for improving soil quality and plant health in agriculture*; WG1 will link with tree fruit breeders who are organised in the Eucarpia Fruit Group; all WGs will interact with the ISHS Working Groups on strawberries, *Rubus*/*Ribes* and *Vaccinium*.

For the aspects related to nutritional aspects on berries, there are connections with other recent relevant COST programmes focused on the area of human health

Action 916: *'Bioactive plant cell wall components in nutrition and health'*

Action 924 'Enhancement and Preservation of Quality and Health Promoting Components in Fresh Fruits and Vegetables'.

Action 926: *'Impact of the new technologies on the health benefits and safety of bioactive plant compounds'*.

A joint meeting between WG4 and this last Action will be attempted in year 2 or 3 with direct scientist-scientist interaction occurring on a more frequent basis.

The activities of each WG will be co-ordinated by the Chair and Vice-Chair with the help of different WG-coordinators having specific responsibility for particular areas within the WG remit. WG meetings will each be required to have a focus on one or more specific topics and the programme for each meeting will be defined by the MC, taking into account the objectives and programme of the WG.

It is expected that the national experts to WG meetings may change on different occasions, so that the most appropriate experts attend for the meeting programme. In addition to full WG meetings there will be Small Group Meetings (SGM) for a reduced number of scientists to organise collaboration on a specific objectives. Outputs from SGM will be delivered and discussed with the WGs experts.

One of the most productive ways for laboratories or institutes to collaborate effectively is through the exchange of scientists. This will be achieved by a programme of Short Term Scientific Missions (STSMs), which will promote the exchange of new technologies, information and knowledge and the development of common analytical and evaluation methods. STSM applications will be encouraged from all WGs and then evaluated by the MC.

A seminar, in year 2 or 3, will be organized across the working group disciplines and will include discussion on the **ethical aspects** and **public acceptance** of new genomic technologies and the **socio-economical impacts on rural development** deriving from expanding berry production systems.

An open final workshop will be organised at the end of the Action. This will be designed to encourage interaction and exchange of information on important topics that are not restricted to specific WGs and will permit direct interaction with other scientific groups such as other COST Actions or International projects and societies. From the Final WS will be expected the publication of a volume of Acta Horticulturae, as has now been published for Action 836, featuring all the scientific presentations.

Results, reports, and other publications produced by the WGs will be disseminated widely by publication on the designated web site, which will also be used to provide a continuous update of the activities, including meeting dates, STSMs, lists of delegates, minutes, news etc.

From all the activities are expected the following major outputs:

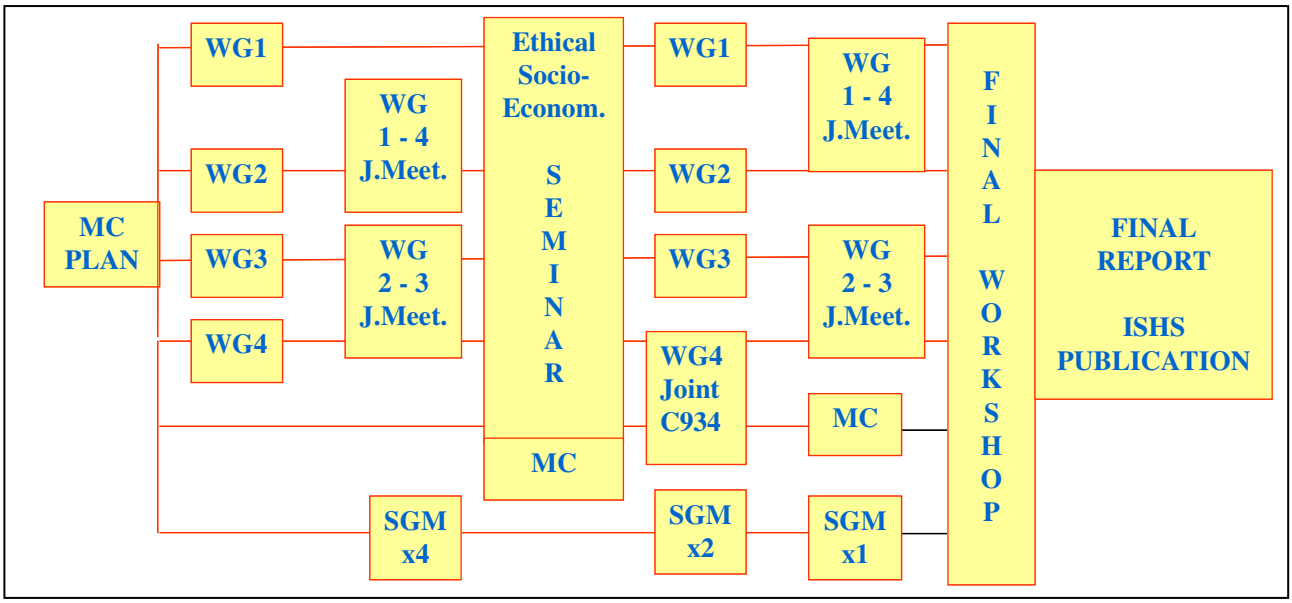
- Implementation of new advanced technologies in berry research programmes.
- Promotion of scientific exchange and improvement of the scientific level of European berry research.

- Technology transfer to production and quality control systems.
- Improved knowledge on the health benefit for the consumer.
- Establishment of a stable organisation in berry research and production system.

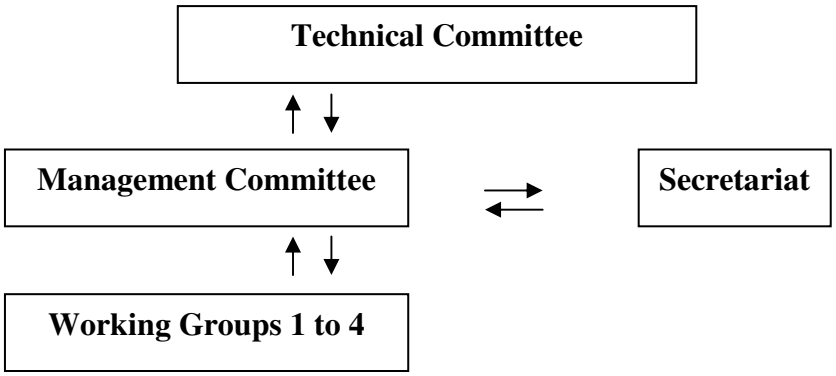
E. TIMETABLE

The Action will last four years, during which time there will be annual meetings of each WG, SGMs, STSMs, a seminar and a Final Workshop near the end of the Action. Initially the MC will meet to decide on the management structure and appoint the Chair and Vice-Chair of the Action, WG co-ordinators and STSM programme co-ordinator. At this first meeting the topics and timetable for WG meetings in year 1 will be defined. In subsequent years MC meetings will be organised as joint meetings, each year with a different WG. It is anticipated that there will be a need for SGMs on specific topics, particularly for WG1 and WG3. The timetable and work programme for these will be defined by the WG for approval by the MC. A seminar will be organised in year 2 or 3 that will encompass topics of interest across the WGs and also include broader issues, such as ethical and socio-economic factors. The precise timing and programme for the seminar will be decided at the second meeting of the MC. After all the WG meetings have been completed, there will be a final workshop, which will bring together the results and achievements of the four WGs.

The Action work programme will have the following organisational structure and the timetable:



Year 1 1 MC + 4 WGs	Year 2 1 MC –Seminar 2 JM + 4 SGMS	Year 3 1 MC + 1 JM + 3 WGs + 2SGM	Year 4 1 MC + 1SGM 2 JM + FW



Timetable of the action work programme:

Year 1	Year 2	Year 3	Year 4
MC meeting. Elect Chair ,vice-chair and WG coordinators			
WG and SGM meetings programme — — — — — — — — — — — — — — — — — — →			
STSM programme — →			
MC meeting. Plan Seminar			
Intermediate Report			
Seminar			
		MC meeting. Elect Chair	
		Intermediate Report	
			Start evaluation of results
			MC mtg. Plan Workshop
			Workshop
			Final report

F. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: Austria, Belgium, Bulgaria, Cyprus, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Macedonia, the Netherlands, Norway, Poland, Portugal, Romania, Serbia and Montenegro, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.

From these 30 countries expected to sign the MoU, it is estimated that a total of 170 career scientists are spending their time on research related to this action. Over 200 technicians and postgraduate students support them. On the basis of national estimates provided by representatives from the 30 countries, the economic dimension of the activities to be carried out under the Action has been estimated, at 2004 prices, at roughly Euro 130 million in total over the four years. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

G. DISSEMINATION PLAN

A specific dissemination plan will be defined to demonstrate in the different countries the progress and results achieved during the four years of the Action. One major target for dissemination will be the collaborating scientists involved in basic to applied research on the major berry crops. It is also essential to inform the end-users of the berry research and, near to the end of the Action, information and knowledge will be disseminated by creating a **European Forum**, including scientists, socio-economic experts, representatives of the European growers' associations, the

European Consumers' associations, industries and marketing groups. This will ensure that all groups involved in the production chain for berries in Europe have the opportunity to receive information about progress made during the Action and express their opinions.

A variety of tools will be used for dissemination, some targeted and some aimed at a wide audience. A public website, specifically dedicated to the Action, will have a continuous update of the planned programme of activities. A password-protected website will be used to post documents and data related to the collaborative research projects. An e-mail network will be established to disseminate information between scientists in each WG and the MC, while an e-mail information desk will be opened to the public.

From each MC, WG, SGM and STSM there will be reports prepared after meetings/missions and these will contribute to the interim and final reports for the Action. All reports will be available via the website. A booklet containing abstracts of presentations will be prepared for each WG meeting and distributed to delegates. Where appropriate, WGs will prepare and distribute guidelines and manuals for specific topics such as experimental protocols. Proceedings from the seminars and workshop will be printed. Chair and delegates of the different WGs will report on the activities of the Action when participating in other national and international conferences and symposia. Specific articles related to co-ordinated research started within the Action will be published in scientific and technical journals. All these publications will be in the English language. To reach a larger audience within COST countries, non-technical publications, prepared by the delegates of the different countries in their own languages, will be published in national journals and the trade press. The dissemination plan will be reviewed at each MC meeting and updated as necessary during the course of the Action.

COST 863
‘EUROBERRY RESEARCH:
FROM GENOMICS TO SUSTAINABLE PRODUCTION, QUALITY AND HEALTH’

ADDITIONAL INFORMATION
NOT PART OF THE MOU

ADDITIONAL INFORMATION

History of the Action

The idea for this Action arose from COST Action 836, the structure and achievements of which have already been described in Part 1 Section A, Background.

COST Action 836 ended in October 2003 but there is a strong feeling among the MC that there is much more that can be achieved by continuing the co-ordination of European berry research in a Concerted Action. However, the new Action is not simply a continuation of COST Action 836. There is much novelty in the new Action. The successful model developed for strawberry will be extended to the other berry crops and for strawberry the co-ordination will be more focussed on research addressing the key problems that are facing European producers. Furthermore, the quality and nutritional value of berry fruits has been identified as a new specific topic of great importance in all berries. Research in this area is currently not well integrated with other research disciplines and the Action will bring together scientists involved in research in berry improvement and production systems (breeders, plant physiologists, etc.) with those studying berry quality and nutritional value (biochemists, plant and human cell biologists).

Preliminary work programme

At the first MC meeting the framework for the Action will be presented to the national delegates and there will follow an election of the Chair, vice-chair and WG coordinators. There will then be a discussion to define the priorities for the first round of WG meetings and agree the first year date, venue and organisers for each WG meeting. It is intended that every year there will be a meeting for each of the four WGs. At the end of each meeting the WG will decide on a topic, venue and date for their next meeting, which will then be considered by the MC. In years 2, 3 and 4 the MC meetings will be organised as Joint Meetings, each year with a different WG. There will be a need for SGMs to discuss specific topics and the MC will propose these from WGs for approval. To encourage the maximum amount of scientific exchange between disciplines, the MC will propose joint meetings between two WGs at different times during the Action. It will be particularly important to integrate fully the activities of WG4 with the other WGs.

At the second meeting of the MC there will be discussion and a decision on the topic for the Seminar, to take place at the end of year 2 or thereabouts. This event will focus on a topic not specifically covered within one of the WGs, for example socio-economic aspects of berry production.

Each year the WGs Chairmen will produce annual reports and their programme of future activities, both to be presented to the MC for approval. All the reports and the complete programme of activities will by published on the website. At the end of the Action the MC will organise a final Workshop to present the major achievements of the different WGs.

Economic importance berry production

Table 1 illustrates the socio-economic importance of berries in Europe. Strawberry is the most important berry crop, with production exceeding 1.31 million tons per year. Raspberries and currants are also widely grown in significant quantities and the former is more valuable due to a much higher proportion being sold for the high-value fresh market, as opposed to use for processing. Currants and blueberries are particularly important in Poland and Germany. Production of raspberries and blueberries, in particular, is increasing in the EU countries.

All the COST countries with significant berry production also support their industries with national research programmes, covering the spectrum from basic research to applied experimental trials

The largest contributors of research funds are currently France, Spain, Italy, UK, Netherlands and Finland. Most of the research, in both universities and Research Institutes is publicly funded but there is also, on average, 30% private funding and considerable more in some EU countries, such as

the Netherlands. The four scientific themes of this COST Action reflect the research topics having the highest priority in the different national research projects.

Table 1. Total Berry Production in COST countries (2003) interested to the new Action.

		Strawberry		Raspberry		Blackberry		Currants		Blueberries	
COST countries		Ton	Ha	Ton	Ha	Ton	Ha	Tons	Ha	Tons	Ha
1	**Austria**	11200	1220	400	140	160	20	1165	220	120	20
2	**Belgium**	43000	2470	190	21	300	79	300	34	300	79
3	**Bulgaria**	32300	3800	620	53	80	10	52	8		
4	**Cyprus**	1750	95								
5	**Croatia**	4900	1000	300	120	650	180	150	30	0	0
6	**Czech Rep.**	10 407	2 162	481	215			13 487	1 558		
7	**Denmark**	6000	1000	100	50			12000	2000		
8	**Finland**	11816	4838	457	383			2324	2480		30
9	**France**	65000	4500	7000	1200	600		10000	2500	1500	200
10	**Germany**	104276	9619	30000				136000		800	8000
11	**Greece**	8300	365	540	50						
12	**Hungary**	6000	720	13000	200	6000	400	9000	1300		
13	**Ireland**										
14	**Italy**	102859	4089	1356	182	0		606	55		
15	**Latvia**	3870	920	390	160			4100	950		46
16	**Lithuania**	3050	610	120	40			10320	2580	6	2
17	**Macedonia**										
18	**Netherlands**	32000	2000	390	46	100	25	2000	174	1050	198
19	**Norway**	18000	1800	1800	270			1850	320	100	20
20	**Poland**	240000	60000	46000	12600			180000	39400	2000	8000
21	**Portugal**	21000	600	600	60	50	5	7	1	300	40
22	**Romania**	16000	2000	75	30	15	3	410	230	90	40
23	**Serbia**	39900	10500	15000	79300	1450	15000				
24	**Slovak Rep.**	4638	1352	36	66			368	853	4638	1352
25	**Slovenia**	1252	78	20	2	30	2	30	5	200	19
26	**Spain**	350000	10700	2000	500					300	
27	**Sweden**	12500	2707	120	120			500	415		
28	**Switzerland**	7000	410	2000	150	450	30	950	65	350	25
29	**Turkey**	130.000	9500								
30	**UK**	36800	3400	11600	2100	1000	250	14300	1600		
	Total 2003	1313411	140293	134595	98058	10885	16004	386432	55220	11754	18071

List of Experts

Representatives of 26 COST countries have been consulted during the preparation of this Action and have confirmed their interest to participate.

(in red and with * : contributed actively to the Action)

N.1	**Austria**	
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WG2	**Robert Steffek *** Austrian Agency for Health and Food Safety, Institute for Plant Health A-1210 Vienna, Spargelfeldstr.191 Robert.steffek@ages.at www.ages.at *Diagnostic of soft fruit diseases*	**Karl Stich** Technical University of Vienna Institute of Technical BioScience, Plant biochemistry kstich@mail.zserv.tuwien.ac.at *Resistant varieties, flavonoids, strawberry, blueberry, raspberry*
WG3	**Andreas Spornberger** University of Natural Resources and Applied Life Sciences, Department of Applied Plant Sciences and Plant Biotechnology, Institute of Horticulture, Fruit Growing and Viticulture, Gregor Mendel Strasse 33; A-1180 Vienna / Austria / EU andreas.spornberger@boku.ac, www.boku.ac.at/iog *Organic growing, variety testing*	**Robert Steffek** Austrian Agency for Health and Food Safety, Institute for Plant Health A-1210 Vienna, Spargelfeldstr.191 Robert.steffek@ages.at www.ages.at *Management of soft fruit diseases*
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N.2	**Belgium**	
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	Lieven Denruyter Proefcentrum voor Fruitteelt Proeftuin Aardbeien en Houtig kleinfruit Sint-Truidersteenweg 321 3700 Tongeren - Belgium tel : ++32 (0) 12 39 87 90 fax : ++32 (0) 12 39 87 99 e-mail : lieven.denruyter@pcfruit.be website : www.pcfruit.be *Strawberries variety evaluation*	
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WG3	**Sergio Mauro** Centre wallon de Recherches agronomiques, CRAW-D1 Biotechnologie (www.Cra.wallonie.be) *Strawberry, proteomics flowering.* **Monique BODSON** Laboratoire de Physiologie Vegetale a finalite Horticole. Faculte Universitaire des Sciences Agronomiques de Gembloux Avenue de la Faculte, 2 B-5030 Gembloux Belgique Email : bodson.m@fsagx.ac.be www.fsagx.ac.be	**Philip Lieten *** National Research Centre for Strawberries Proefbedrijf der Noorderkempen Voort 71, 2328 Meerle, Belgium filip.lieten@proeftuin.be www. proeftuin.be **Fanny Pitsioudis** Proeftuin voor aardbeien en kleinfruit- PCF St. Truidersteenweg 321, Tongeren 3700 dbt@pophost.eunet.be
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	E-mail: hasard2@unl.edu	

N.3	**Bulgaria**	
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WG2	**Raina Boicheva** Experimental station for small fruits, Kostinbrod 2230 *Classic breeder, plant development, differentiation*	**Eleonora Hristova,** Agrobioinstitute, Minister of Agriculture *Plant health, diagnostics.*
WG3		**Deniza Domosetova** Experimental station for small fruits, Kostinbrod 2230 *Plant productivity, berry quality*
WG4	**Vassya Bankova** Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences Acad. G. Bonchev str., bl 9 1113 Sofia bankova@srv.orgchm.bas.bg iochem@orgchm.bas.bg http://www.orgchm.bas.bg *Fruit, phytochemical, nutrition*	**Maria Krachanova** Head of Lab Biologically Active Compounds, *Acad. G. Bonchev" Str., Bl .9, 1113 Sofia, BULGARIA* iochem@orgchm.bas.bg http://www.orgchm.bas.bg *Fruit, phytochemical, nutrition*

N.4	**Cyprus**	
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WG3	**Damianos Neocleous *** Agricultural Research Institute P.O.Box 22016 1516 Nicosia, Cyprus d.neocleous@arinet.ari.gov.cy *Raspberry, plant nutrition, physiology, cultivation*	**Ioannis Papadopoulos** Agricultural Research Institute P.O.Box 22016 1516 Nicosia, Cyprus papado@arinet.ari.gov.cy *http://www.ari.gov.cy* *Fertigation, irrigation, water quality*
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		http://www.ari.gov.cy *Food safety*

N.5	**Croatia**	
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WG3	**Tihomir Milicevic** Department of Plant Pathology, Faculty of Agriculture, University of Zagreb Svetosimunska 25 10000 Zagreb, Croatia tmilicevic@agr.hr www.agr.hr *Botrytis, IPM of strawberries, plant diseases*	**Mario Njavro** Department of Farm Managment, Faculty of Agriculture, University of Zagreb Svetosimunska 25 10000 Zagreb, Croatia mnjavro@agr.hr www.agr.hr *Horticultural farm management*
WG4	**Sandra Voca** Department of Agricultural Technology, Storage and Transport, Faculty of Agriculture, University of Zagreb Svetosimunska 25 10000 Zagreb, Croatia svoca@agr.hr www.agr.hr *Fruit processing, analysis of quality*	**Tomislav Jemric** Department of Pomology, Faculty of Agriculture, University of Zagreb Svetosimunska 25 10000 Zagreb, Croatia tjemric@agr.hr www.agr.hr *Postharvest, heat tretmants, fruit quality*

N.6	**Czech Republic**	
WG1		
WG2	**Josef Spak** Institute of Plant Molecular Biology, AS CR, České Budejovice, Czech Republic spak@umbr.cas.cz *Virus, phytoplasma, diagnostics*	
WG3	**Radomira Vankova *** Institute of Experimental Botany, AS CR, Prague, Czech Republic vankova@ueb.cas.cz *Plant hormone metabolism, cytokinin, abscisic acid*	
WG4		

N.7	**Denmark**	
WG1	**Hanne Lindhard ***	**Holger Daugaard**

	Senior scientist, Ph.D. Department of Horticulture, Research Centre Aarslev Kirstinebjergvej 10 DK-5792 Aarslev. Phone: +45 63904343 fax:+45 63904396 hanne.lindhard@agrsci.dk *Black currants, variety testing*.	Senior scientist Department of Horticulture, Research Centre Aarslev Kirstinebjergvej 10 DK-5792 Aarslev. Phone: +45 63904343 Fax: +45 63904396 *Strawberries, variety testing.*
WG2	**Torben Toldam-Andersen *** Associate professor, PhD. Fruit and berries, physiology and growing. Department of Agricultural Sciences The Royal Vet. and Agric. University Hoejbakkegaardsalle 21 DK- 2630 Taastrup, Denmark tbta@kvl.dk, : www.horticulture.dk *Physiological quality and dormancy*	
WG3	**Lis Sørensen** Danish Institute of Agrcultural Sciences Department of Horticulture, Denmark. *Plant development and cultivation factors in Strawberry.*	**Hanne Lindhard Pedersen** Danish Institute of Agricultural Sciences Department of Horticulture, Research Centre Aarslev Kirstinebjergvej 10, DK-5792 Aarslev. Denmark. E-mail: hanne.lindhard@agrsci.dk *Plant development with relation to pest and disease damage in Black currants. Cultivation factors.*
WG4	**Lars Porskjær Christensen.** Senior scientist, Ph.D. Department of Horticulture, Research Centre Aarslev Kirstinebjergvej 10 K-5792 Aarslev. Phone: +45 63904343 Fax: +45 63904396 E-mail: Larsp.Christensen@agrsci.dk *Flavonoids in berries, bioactive compounds*	

N.8	**Finland**	
WG1	**Timo Hytönen** Dept. of Applied Biology, Horticulture, University of Helsinki, PL 27, FIN-00014 University of Helsinki; Finland timo.hytonen@helsinki.fi *Strawberry, genomics*	**Soile Prokkola** MTT Agrifood Research Finland, North Ostrobotnia Research Station, Tutkimusasemantie 15, FIN-92400 Ruukki, Finland, soile.prokkola@mtt.fi *Sea buckthorn, variety evaluation, breeding*
WG2	**Päivi Parikka *** MTT Agrifood Research Finland, Plant Protection, FIN-31600 Jokioinen, Finland; paivi.parikka@mtt.fi *Fungal diseases, quarantine, berry crops*	**Saila Karhu *** MTT Agrifood Research Finland, Horticulture, FIN-21500 Piikkiö, Finland; saila.karhu@mtt.fi *Berry crops, plant propagation*
WG3	**Pauliina Palonen** Dept. of Applied Biology, Horticulture, University of Helsinki, PL 27, FIN-00014	**Tuomo Tuovinen** MTT Agrifood Research Finland, Plant Protection, FIN-31600 Jokioinen, Finland;

	University of Helsinki, Finalnd Pauliina.palonen@helsinki.fi *Raspberry, cultivation*	tuomo.tuovinen@mtt.fi *Pests, biological control, berry crops*
WG4	**Riitta Törrönen** University of Kuopio, Food and Health Research Centre, P.O.Box 1627, FIN-70211 Kuopio, Finland riitta.torronen@uku.fi http://www.uku.fi/ettk *Polyphenols, bioactivity, processing*	**Heikki Kallio** Dept. of Biochemistry and Food Chemistry, University of Turku, FIN-20014 Turku; Finland heikki.kallio@utu.fi *Bioactive compounds, human nutrition*

N.9	**France**	
WG1	**Béatrice Dénoyes-Rothan *** UREFV-INRA BP 81 Villenave D'Ornon Cedex , France denoyes@bordeaux.inra.fr *Genomic, breeding, molecular methods (Strawberry)* **Laurence Bourrain** Ctifl – Centre de Balandran, BP 32 30127 Bellegarde-France bourrain@ctifl.fr *Variety evaluation (Strawberry*) **Michel Edin** La Morinière, 42 rue Geqrges Morel 49070 Beaucouzé – France Ctifl-edin@wanadoo.fr *Variety evaluation (Black currant)*	**Marie-Noëlle Demène** CIREF Lanxade-24130 Prigonrieux –France demene@ciref.asso.fr *Genomic, breeding* (*Strawberry Raspberry)* **Marie-Claude Lemoine** INRA-Agri-Obtention, UP Vitro, 17 rue Sully BP 86510 21065 Dijon Cedex-France *Genomic, breeding,* (*Raspberry*) Marie-claude.lemoine@dijon.inra.fr **Jean-Claude Navatel *** Centre de Balandran, BP 32 30127 Bellegarde-France navatel@ctifl.fr *Variety evaluation (Raspberry)* **Christian Perrier** ENITA Site de Marmilhat- 63370 Lempdes-France sciortin@gentiane.enitac.fr *Variety evaluation (Vaccinium)*
WG2	**Alain Baudry** LNPV, Domaine de la grande ferrade, 33883 Villenave D'Ornon Cedex , France alain.baudry@agriculture.gouv.fr *Propagation, nursery plant management, (strawberry and raspberry)*	**Frédéric Maillard** Ctifl BP 32 30127 Bellegarde- France maillard@ctifl.fr *Propagation, nursery plant management, certification (raspberry)*
WG3	**Christiane Raynal** Ctifl Centre de Lanxade, 24130 Prigonrieux-France raynal@ctifl.fr *Plant development and differentiation, cultivation and berry quality (strawberry and raspberry)* **Yannie Trottin** Ctifl Centre de Balandran, BP 32, 30127	**Jacques Longuesserre** Ciref, Domaine de la Lande, 47110 Sainte-Livrade- France longuesserre@ciref.asso.fr *Plant development and differentiation, cultivation and berry quality (strawberry)* **Jean-Jacques Pommier** Ciref, Maison Jeannette, 24140 Douville-France, pommier@ciref.asso.fr

	Bellegarde-France, trottiny@ctifl.fr *Pest and disease management*	*Pest and disease management*
WG4	**Harri Vainio** Unit of Chemoprevention International Agency for Research on Cancer. 150 cours Albert Thomas, 69372 Lyon cedex 08, France Professor, Insitute of Occupational Health, IARC, Lyon, France	**Marc Beverini** Head of fruit product research, Danone, Paris France. www.vitapole.com

N.10	**Germany**	
WG1	**Detlef Ulrich** Federal Centre for Breeding Research on Cultivated Plants, Institute of Plant Analysis, Quedlinburg Germany D.Ulbrich@bafz.de *Aroma analysis, rapid methods, metabolomics*	**Klaus Olbricht** Federal Centre for Breeding Research on Cultivated; Plants Institute for Fruit Breeding. Dresden. Germany K.Olbricht@bafz.de *Resistance breeding of strawberry, cross-breeding of strawberry with wild species*
WG2	**Erik Schulte** Fed. Office of Plant Varieties, Wurzen, Germany Erik.Schulte@Bundessortenamt.de *Plant breeders right, variety evaluation*	
WG3	**Gunhild Muster** Staatliche Lehr- und Versuchsanstalt für Wein- und Obstbau Weinsberg, Germany Gunhild.Muster@lvwo.bwl.de *Cultivation techniques of raspberries, crumply fruits in raspberries*	**Rudolf Faby *** Versuchs- und Beratungsstation für Obst- und Gemüsebau Langförden, Vechta, Germany, Spredaer Straße 2, 49377 Vechta-Langförden, vbog@lwk-we.de *Integrated pest management, fertilizing of strawberries, cultivation methods*
WG4	**C.-D. Patz** The Geisenheim Research Institute Department of Beverage Technology von Lade-Strasse 1, 65366 Geisenheim, Germany Patz@fa-gm.de *Technology and chemical analysis of berry fruits processing, determination of secondary plant*	**Erika Krüger** * The Geisenheim Research Institute Department of Fruit Growing, Geisenheim, Germany Krueger@fa-gm.de *Quality of berry fruits, factors affecting quality of berry fruits, variety evaluation*

N.11	**Greece**	
WG1	**Giorgia Paroussi *** NAGREF/ ARCMT	

Additional Information

	paroussi@otenet.gr *Breeding and cultivation techniques*	
WG2		
WG3		
WG4		

N.12	**Hungary**	
WG1	**Ferenc Dénes *** Research Institute for Fruit Growing, Fertőd, Hungary. fkut@axelero.hu *Raspberry breeding, cultivation techniques of small fruits, testing of varieties*	
WG2	**Klara Nyerges *** Plant Protection and Soil Conservation Service of County Fejer Hungary nyergesk@hotmail.com *Plant sanitation control*	
WG3	**Veronika Zarka** Research Institute for Fruit Growing, Fertőd, Hungary. zarkaveronika@yahoo.com *Antioxidant capacity, flavonoids, importance of nourishment*	
WG4		

N.13	**Ireland**	
WG1	**Michael J. Hennerty *** Department of Crop Science, Horticulture and Forestry, University College Dublin Belfield, Dublin 4 Ireland. michael.hennerty@ucd.ie www.ucd.ie/ *Fruit production systems, Postharvest physiology, Fruit biotechnology*	
WG2	**Eamonn Kehoe** Teagasc Soft Fruit , Dublin Road, Enniscorthy, Co.Wexford Ireland e.kehoe@wexford.teagasc.ie *Plant propagation and quality*	
WG3	**Eamonn Kehoe** Teagasc Soft Fruit, Dublin Road, Enniscorthy, Co.Wexford Ireland e.kehoe@wexford.teagasc.ie *Plant productionand quality*	
WG4		

N.14	**Italy**	
WG1	**Bruno Mezzetti *** Department of Environmental and Crop Science - Marche Polytechnic University 60100 Ancona – IT b.mezzetti@univpm.it http://www.agr.univpm.it/strutture/ *Breeding and biotech in berries* **Livio Trainotti** Department of Biology, University of Padova, Viale G. Colombo, 3 35121 PADOVA - IT livio.trainotti@unipd.it *Gene cloning and expression in strawberry*	**Walther Faedi *** MIPAF – Fruit culture Institute ISF – Forlì Via Punta di Ferro, 2 c.p. 7178 47100 Forlì – IT faedi.isf@agraria.it http: www.agraria.it/isf.htm *Breeding and variety evaluation*
WG2	**PierLuigi Lucchi** CAV Regione Emilia Romagna Faenza IT *Plant Certification and sanitay control* **Simona Monticelli** MIPAF – Fruit culture Institute Rome, Via Fioranello, Ciampino – IT *Strawberry in vitro stability*	**Neri Davide** Department of Energetic - Marche Polytechnic University 60100 Ancona – IT d.neri@univpm.it, www.univpm.it, *Plant physiology and management*
WG3	**Giancarlo Bounous** Dipartimento di Colture Arboree Via Leonardo Da Vinci, 44 - 10095 Grugliasco (TO) giancarlo.bounous@unito.it *Berry cultivation techniques, variety evaluation and antioxidants* **Massimo Tagliavini** Dipartimento Colture Arboree University of Bologna Via Fani, Bologna - IT mtaglia@pop.agrsci.unibo.it *Berry nutrition management*	**Gianluca Baruzzi** MIPAF – Fruit culture Institute ISF – Forlì Via Punta di Ferro, 2 c.p. 7178 47100 Forlì – ITALY *Strawberry cultivation Techniques* **Elisa Conte** MiPAF - Plant Pathology Institute ISPaVe – Rome, Via C. G. Bertero 22, 00156 – IT Email: e.conte@ispave.it *Berry fruit sanitary control*
WG4	**Maurizio BATTINO** Institute of Biochemistry Faculty of Medicine - Marche Polytechnic University 60100 Ancona - IT www.univpm.it m.a.battino@univpm.it *TEAC, antioxidants, human health*	**Carlo Rosati *** ENEA Trisaia Research Center 75026 Rotondella (MT) - IT www.trisaia.enea.it carlo.rosati@trisaia.enea.it *Functional genomics, molecular breeding, molecular analyses*

N.15	**Latvia**	
WG1	**Sarmite Strautina *** State Dobele Horticultural Plant Breeding	**Silvija Ruisa** State Dobele Horticultural Plant Breeding

	Experimental Station, Graudu str.-1, Dobele, LV-3701 , LATVIA dobelesdsis@latent.lv Website: http://www.ltn.lv/~ddsis/ *Blackcurrant, red currant, raspberry, strawberry breeding, cultivar evaluation, genetic resources*	Experimental Station, Graudu str.-1, Dobele, LV-3701 , LATVIA dobelesdsis@latent.lv *Sea buckthorn, variety evaluation, breeding*
WG2	-	
WG3	**Valentina Surikova** State Dobele Horticultural Plant Breeding Experimental Station, Graudu str.-1, Dobele, LV-3701 , LATVIA dobelesdsis@latent.lv *Pest and disease management, chemical pesticides, pest identification*	
WG4	**Dalia Seglina** State Dobele Horticultural Plant Breeding Experimental Station, Graudu str.-1, Dobele, LV-3701 , LATVIA dobelesdsis@latent.lv *Fruit storage conditions, food technology*	**Baiba Skrebele** State Dobele Horticultural Plant Breeding Experimental Station, Graudu str.-1, Dobele, LV-3701 , LATVIA dobelesdsis@latent.lv *Fruit biochemistry, screening of bioactive compound*

N.16	**Lithuania**	
WG1	**Audrius Sasnauskas** * Lithuanian Institute of Horticulture, LT-54333 Babtai, Kaunas district, Lithuania a.sasnauskas@lsdi.lt, http://www.lsdi.lt *Blackcurrant breeding, cultivar evaluation, genetic resources*	**Rytis Rugienius *** Lithuanian Institute of Horticulture, LT-54333 Babtai, Kaunas district, Lithuania r.rugienius@lsdi.lt, http://www.lsdi.lt *Strawberry breeding, cultivar evaluation, genetic resources*
WG2	**Jurate Stankiene** Lithuanian Institute of Horticulture, LT-54333 Babtai, Kaunas district, Lithuania j.stankiene@lsdi.lt, http://www.lsdi.lt *Variety identification, plant quality, disease diagnostic*	**Darius Kviklys** Lithuanian Institute of Horticulture, LT-54333 Babtai, Kaunas district, Lithuania sodai@lsdi.lt, http://www.lsdi.lt *Variety identification, nursery plant management, propagation*
WG3	**Laimutis Raudonis** Lithuanian Institute of Horticulture, LT-54333 Babtai, Kaunas district, Lithuania laimis@lsdi.lt, http://www.lsdi.lt *Pest and disease management, chemical pesticides, pest identification*	**Ausra Brazaityte** Lithuanian Institute of Horticulture, LT-54333 Babtai, Kaunas district, Lithuania ausra@lsdi.lt, http://www.lsdi.lt *Plant physiology, development, photosynthesis*
WG4	**Pranas Viskelis** Lithuanian Institute of Horticulture, LT-54333 Babtai, Kaunas district, Lithuania biochem@lsdi.lt, http://www.lsdi.lt *Screening of phytochemicals in berry, bioactive compound, food technology*	**Marina Rubinskiene** Lithuanian Institute of Horticulture, LT-54333 Babtai, Kaunas district, Lithuania biochem@lsdi.lt, http://www.lsdi.lt *Fruit biochemistry, flavonoids, storage conditions*

N.17	**Macedonia Rep.**	
WG1	**Victor Gamovski** Agriculture Institute, Skopje, Rep. Macedonia vgamo@yahoo.com *Cultivar evaluation, production techniques*	
WG2	**Toso Arsov** Agriculture Institute, Skopje, Rep. Macedonia arsovtose@ukim.edu.mk *Plant material, cultivar evaluation*	
WG3	**Marjan Kiprijanovski *** Faculty of Agriculture science and food Skopje, Rep. Macedonia kmarjan@zf.ukim.edu.mk *Cultivation, variety evaluation, production of plant material*	**Stanislava Lazarevska** Faculty of Agriculture science and food Skopje, Rep. Macedonia stanislava@zf.ukim.edu.mk *Pest management*
WG4		

N.18	**The Netherlands**	
WG1	**Elma Salentijn** Plant Research International, Wageningen University and Research Centre Email: elma.salentijn@wur.nl Website: http://www.wur.nl *Strawberry, gene function analysis, cell wall related genes*	**Jan Schaart *** Plant Research International, Wageningen University and Research Centre jan.schaart@wur.nl Website: http://www.wur.nl *Strawberry, molecular breeding, trans-formation*
WG2	**Bert van Duijn** TNO-Applied Plant Sciences P.O. Box 2215, Leiden Email: b.vanduijn@voeding.tno.nl. Website: http://www.voeding.tno.nl *Root environment control, oxygen supply to roots, doubled haploids, microspore regeneration, tissue culture*	**Jacinta Balkhoven** Applied Plant Research, dept. Fruit Research Randwijk, Wageningen UR Email: jacinta.balkhoven@wur.nl Website: http://www.ppo.dlo.nl *Quality of berry fruits; cultivar evaluation*
WG3	**Johan Wander** Applied Plant Research, location Lelystad, Wageningen UR johan.wander@wur.nl Website: http://www.ppo.dlo.nl *Phytopathology, Decision Support Systems, Botrytis*	**Gijs van Kruistum *** Applied Plant Research, location Lelystad, Wageningen UR gijs.vankruistum@wur.nl Website: http://www.ppo.dlo.nl *Integrated pest management, control of mites, Thrips tabaci*
WG4	**Jules Beekwilder** Plant Research International, Wageningen University and Research Centre jules.beekwilder@wur.nl Website: http://www.wur.nl *secondary metabolites, flavonoids, antioxidants, flavour*	**Guido R. M. M. Haenen** Department of Pharmacology and Toxicology, Faculty of Medicine Maastricht University G.Haenen@FARMACO.unimaas.nl Website: http://www.farmaco.unimaas.nl *flavonoids, antioxidants, beneficial health*

		effects, sreening.

N.19	**Norway**	
WG1	**Jahn Davik** The Norwegian Crop Research Institute. Kvithamar Research Centre. Planteforsk. NO jahn.davik@planteforsk.no www:planteforsk.no *Breeding, germplasm, strawberry*	**Dag Røen** Graminor. Graminor.NO dag.roen@planteforsk.no www:planteforsk.no *Rubus, germplasm, breeding.*
WG2	**Arne Stensvand** The Norwegian Crop Research Institute. Planteforsk NO arne.stensvand@planteforsk.no www:planteforsk.no *Cultivation, .disease management, physiological quality.*	**Arnfinn Nes** * The Norwegian Crop Research Institute, division Kise. Planteforsk.NO arnfinn.nes@planteforsk.no www:planteforsk.no *Ribes, strawberry, cultivar evaluation.*
WG3	**Nina Heiberg** The Norwegian Crop Research Institute, division Njøs. Planteforsk. NO nina.heiberg@planteforsk.no www:planteforsk.no *Rubus, physiology, cultivation.*	**Anita Sønsteby** The Norwegian Crop Research Institute, division Kise. Planteforsk. NO anita.sonsteby@planteforsk.no www:planteforsk.no *Flower inititiation, physiological quality, plant management.*
WG4	**Karin Haffner** The Norwegian Agricultural University. nlh. NO karin.haffner@ipm.nlh.no www:nlh.no *Quality factors, bioactivity, cultivation. Bioactivity, aroma.*	**Rolf Nestby *** The Norwegian Crop Research Institute. Kvithamar Research Centre. Planteforsk. NO rolf.nestby@planteforsk.no www:planteforsk.no *Cultivation, quality, quality factors.*

N.20	**Poland**	
WG1	**Malgorzata Korbin** * Research Institute of Pomology and Floriculture, Skierniewice, mkorbin@insad.pl *Biotechnology & molecular biology in breeding*.	**Edward Zurawicz *** Research Institute of Pomology and Floriculture, Skierniewice E.Zurawicz@insad.pl *Fruit plant breeding, cultivar evaluation* **Jerzy, Adam HORTYNSKI** University of Agriculture in Lublin, Dep.of Genetics and Horticulture Breeding. Akademicka 15 St.20-950 Lublin, PO. HORTGEN@agros.ar.lublin.pl *Strawberry, genetics, molecular markers.*
WG2	**Jacek Zandarski** Central Inspection for Plant Protection and Seeds, Torun *Plant certification & protection*	**Waldemar Treder** Research Institute of Pomology and Floriculture, Skierniewice *Analysis of cultivation conditions*
WG3	**Bozena Borkowska ***	**Anna Bielenin**

	Research Institute of Pomology and Floriculture, Skierniewice, bborkow@insad.pl *Photosynthetic activity, stress physiology, bio-organisms*	Research Institute of Pomology and Floriculture, Skierniewice, *Pest & disease management*
WG4	**Danuta Solecka** Institute of Plant Experimental Biology, Faculty of Biology, Warsaw University, *Acclimation, anthocyanins, phenolics, phenylpropanoids, proteins*	**Andrzej Podstolski** Institute of Plant Experimental Biology, Faculty of Biology, Warsaw University *Phenylpropanoids, phenolics, polyphenol oxidases, salicylic acid, stress*

N.21	**Portugal**	
WG1	**Pedro Brás de Oliveira *** Estação Agronómica Nacional, Dept. Produção Agrícola, Av. República, Nova Oeiras, 2784-505 Oeiras, Portugal pnbo@mail.telepac.pt *Raspberry variety evaluation*	**Luís Lopes da Fonseca** Estação Agronómica Nacional, Dept. Produção Agrícola, Av. República, Nova Oeiras, 2784-505 Oeiras, Portugal *Vaccinum variety evaluation*
WG2	**Ana Paula Nunes** Estação Agronómica Nacional, Dept. Produção Agrícola, Av. República, Nova Oeiras, 2784-505 Oeiras, Portugal	
WG3	**Maria da Graça Palha** Estação Agronómica Nacional, Dept. Produção Agrícola, Av. República, Nova Oeiras, 2784-505 Oeiras, Portugal gracapalha@mail.telepac.pt	
WG4		

N.22	**Romania**	
WG1	**Mihail Coman *** Fruit Research Institute Pitesti, 117450 Maracineni, Arges, e-mail icpp_mar@geostar.ro *Strawberry breeding, evaluation, germplasm.*	**Paulina Mladin *** Fruit Research Institute Pitesti, 117450 Maracineni, Arges, e-mail icpp_mar@geostar.ro *Cane-bush fruits breeding, evaluation germplasm.*
WG2	**Camelia Mutafa** Regional Inspectorate for Seeds and Planting Material Quality – Arges Bd. Republicii No. 22, Pitesti, Arges itcsms-ag@geostar.ro *Virus Testing.*	
WG3	**Sebastian Cracea** Fruit Research Station Cluj-Napoca, 400457 Cluj-Napoca, Horticultorilor st. 5. scpp@mail.dncj.ro *Strawberry cane-bush cultivation.*	**Aurel Popescu** Department of Biology and Horticulture, Faculty of Sciences, Pitesti, Arges. aurel_n_popescu@yahoo.com *Bioactivity quality factors.*
WG4	**Eliza Oprea** University of Bucharest Dept. of Organic Chemistry	**Harsan Eugenia** Fruit Research Station Cluj-Napoca 400457 Cluj-Napoca, Horticultorilor st. 5

	Sos. Panduri, no. 90-92, sect. 5 Bucharest, 050663 eliza_oprea2003@yahoo.com *Antioxidants, organic compounds with therapeutic activity, essential oils.*	harsane@yahoo.com *Plant biochemistry, fruit quality management, biologically active compounds.*

N.23	**Serbia**	
WG1	**Cerović Radosav** ARI SERBIA, Zeleni venac 2/III, 11000 Belgrade, SCG aiserbia@eunet.yu, rcerovic@eunet.yu www.institut-ca.org.yu *Pomology, cytogenetics, biology of fertilization*	**Leposavić Aleksandar** ARI SERBIA, Fruit and Grape Research Centre, Kralja Petra I 9, 32000 Čačak, SCG centarca@eunet.yu www.institut-ca.org.yu *Small fruit, pomology, breeding*
WG2	**Ružić Đurđina *** ARI SERBIA, Fruit and Grape Research Centre, Kralja Petra I 9, 32000 Čačak, SCG jugvocca@yu1.net, ruzicdj@eunet.yu www.institut-ca.org.yu *Fruit trees, tissue culture, micropropagation*	**Paunović Svetlana** ARI SERBIA, Fruit and Grape Research Centre, Kralja Petra I 9, 32000 Čačak, SCG centarca@eunet.yu, romo@ptt.yu www.institut-ca.org.yu *Virus detection, elimination, virus-free material*
WG3	**Milenković Slobodan,** ARI SERBIA, Fruit and Grape Research Centre, Kralja Petra I 9, 32000 Čačak, SCG centarca@eunet.yu, sloboento@yahoo.com www.institut-ca.org.yu *Small fruit pests, diseases, integrated production*	**Blagojević Miladin,** ARI SERBIA, Fruit and Grape Research Centre, Kralja Petra I 9, 32000 Čačak, SCG centarca@eunet.yu www.institut-ca.org.yu *Fruit nutrition, growth habits, fertilization*
WG4	**Slađana Marić (Nidžović)** ARI SERBIA, Fruit and Grape Research Centre, Kralja Petra I 9, 32000 Čačak, SCG centarca@eunet.yu www.institut-ca.org.yu *Fruits, chemoprevention, anthocyanins*	**Zorica Juranić** Department for Experimental Oncology Institute for Oncology and Radiology of Serbia, Belgrade, SCG *Chemoprevention, ellagic acid, neoplastic cells*

N.24	**Slovak Republic**	
WG1	**Gabriela Libiakova *** Institute of Plant Genetics and Biotechnology SAS, Akademicka 2, P.O.Box 39A, 950 07 Nitra, Slovak Rep. nrgrlibi@nic.savba.sk http://www.pribina.savba.sk *Rubus, biotechnology, molecular biology*	**Irena Caganova** Research Institute of Fruit and Decorative Trees, Prievidzska 53, 972 01 Bojnice, Slovak Republic *Rubus sp., breeding*
WG2	**Alena Gajdosova** Institute of Plant Genetics and Biotechnology SAS, Akademicka 2, P.O.Box 39A, 950 07 Nitra, Slovak	**Daniel Simala** Research station, 027 55 Kriva na Orave, Slovak Republic *Vaccinium sp. , propagation, nursery*

	Republic http://www.pribina.savba.sk *In vitro propagation, clonal fidelity*	*management*
WG3	**Martin Pavlik** Technical University in Zvolen, T.G.Masaryka 2117/24 , 960 53 Zvolen, Slovak Republic.	
WG4		

N.25	**Slovenia**	
WG1		
WG2	**Irena Mavric** Agricultural Institute of Slovenia, Ljubljana, Slovenia *Plant virology, diagnostics, molecular biology*	
WG3	**Darinka Koron *** Agricultural Institute of Slovenia, Ljubljana, Slovenia Darinka.Koron@kis.si *Cultivation, mycorrhiza, biofumigation*	
WG4	**Urska Vrhovsek** Agricultural Institute of Slovenia, Ljubljana, Slovenia *Berry fruit, quality, flavonoids*	**Marjan Simcic** Biotechnical Faculty, Department of Food Science and Technology, Jamnikarjeva 101, 1000 Ljubljana, Slovenia *Fruit quality, storage, human nutrition*

N.26	**Spain**	
WG1	**José F. Sánchez-Sevilla** IFAPA - CIFA Málaga, Spain. Genomic, SSR, Genetic resources **Dra. Carmen Soria** IFAPA - CIFA Málaga, Spain. *Breeding, varieties, European network*	**Amparo Monfort** Dpto Genetica vegetal IRTA, Centre Cabrils Barcelona Spain *Genetic Map, SSR, candidate genes, comparison between Fragaria genomes*
WG2	**José M. López Aranda *** IFAPA. CIFA Malaga laranda@olinet.es *Metil bromide alternatives. Nursering.*	**Manuel Avilés** University of Seville *Plant pathologist, Suppresivity, Substrates*
WG3	**José López-Medina** University of Huelva, Spain *Soil-less, deformations,*	**Carmen Barrau** IFAPA. CIFA-Seville carmen.barrau.ext@juntadeandalucia.es *Plant pathologist, other berries* **Marta Ciordia** SERIDA, Asturias *Plant Nutrition*
WG4	**José L. Quiles** Institute of Nutrition and Food Technology, University of Granada	**Lluis Serra-Majem** Catedra de Medicina Preventiva y salud Publica, Depto de Ciencias Clinicas

	Ramón y Cajal 4 (Edif. Fray Luis de Granada) 18071 Granada SPAIN Tel. +34 958248324 Fax. + 34 958248326 jlquiles@ugr.es *Nutrition, Antioxidants, Aging, DNA damages*	Facultad de Medicina, Universidad Las Palmas de Gran Canaria, Apartado de Correos 550. 35080 Las Palmas de Gran Canaria SPAIN, Tel. +34 928453476 Fax +34 928453475, lserra@dcc.ulpgc.es *Human health, Nutrition, Epidemiology*

N.27	**Sweden**	
WG1	**Inger Hjalmarsson *** Swedish Pomological Science Center, Kågeröd *inger@ngb.se* *Field genebanks, morphologic descriptors, quality descriptors*	**Viktor Trajkovski** Nordic Genebank, Alnarp *viktor.trajkovski@telia.com* http://www.ngb.se *Field genebanks, breeding, hardiness evaluation*
WG2	**Elisabeth Nilsson** The Foundation of the Swedish Horticultural Elite Plant Station, Sweden elisabet.nilsson@elitplantstationen.se *Certified plant material, propagation*	**Christer Olsson** Plant Pathologist, PhD GU, Dept of Cell and Molecular Biology Box 462, E-405 30 Göteborg, Sweden chb.olsson@telia.com Tel: (home) +46 31 69 07 53 Fax: +46 31 773 38 01 *Plant pathology, biocontrol, Phytophthora*
WG3	**Birgitta Svensson *** Department of Crop Science, Rånna, Swedish University of Agriculture birgitta.svensson@vv.slu.se http://www.rfs.slu.se/ *Sustainable and organic production, pest and disease control*	**Sven Hellqvist** Department of Agricultural Research for Northern Sweden, Swedish University of Agriculture http://www.njv.slu.se/ *Berry crops, pest and disease control*
WG4	**Marie Olsson** Department of Crop Science, Alnarp, Swedish University of Agriculture Email: marie.olsson@vv.slu.se http://www.vv.slu.se/ *Antioxidants, post harvest, fruit quality*	**Lars Björk** Department of Bioorganic chemistry, University of Lund, Email: bjork.lars@swipnet.se http://www.lu.se/ *Phytochemistry, functional foods, antioxidantia* **Cecilia Sundby Emanuelsson** Department of Biochemistry, University of Lund *http://www.lu.se* *Allergy, protein genomic, berry quality*

N.28	**Switzerland**	
WG1	**André Ançay *** Swiss Federal Agricultural Research Station Changins Centre for Fruit-Growing and Horticulture of Fougères CH-1964 Conthey, Switzerland andre.ancay@rac.admin.ch	

	www.racchangins.ch *Cultivar evaluation, production systems, weed control*	
WG2	not represented	not represented
WG3	**Christoph Carlen *** Swiss Federal Agricultural Research Station Changins Centre for Fruit-Growing and Horticulture of Fougères CH-1964 Conthey, Switzerland christoph.carlen@rac.admin.ch www.racchangins.ch *Berry fruit quality, pest management, physiology,*	**Vincent Michel** Swiss Federal Agricultural Research Station Changins Centre for Fruit-Growing and Horticulture of Fougères CH-1964 Conthey, Switzerland vincent.michel@rac.admin.ch www.racchangins.ch *Crop protection, pathology*
WG4	**Wilfried Andlauer (Priv.-Doz.)** Haute Ecole Valaisanne (HEVs) Foodchemistery and Foodtechnology Route du Rawyl 47, CH-1950 Sion 2, Switzerland, anw@hevs.ch, www.hevs.edu *Absorption of phenolic phytochemicals, bioactive compounds of plants, flavonoid, metabolism of phenolic phytochemicals*	**Gary Williamson** Nestle Research Center Lausanne, Switzerland *Polyphenol Metabolism and Bioavailability.* www.nestle.com *Polyphenol Metabolism and Bioavailability absorption and metabolism in vivo and in vitro'*

N.29	**Turkey**	
WG1	**Sedat SERCE *** M.K.Univ., Dept Horticulture, ANTAKYA/TURKEY sserce@mku.edu.tr *Day-neutral strawberry breeding*	**Sezai Ercisli** Department of Horticulture , Ataturk University Agricultural Faculty , 25240 Erzurum , Turkey sercisli@hotmail.com *Variety evaluation of rose hip, blackberry, raspberry, strawberry, germplasm resources.*
WG2	**Nurettin KASKA** Univ. Cukurova, Dept Horticulture, 01300 ADANA/TURKEY nkaska@mail.cu.edu.tr *Strawberry variety evaluation, quality of runner plants*	
WG3		
WG4	**Sevgi PAYDAS *** Univ. Cukurova, Dept Horticulture, 01300 ADANA/TURKEY *sevpay@mail.cu.edu.tr* *Aroma analysis, cross-breeding of strawberry*	

N.30	**United Kingdom**	
WG1	**Rex Brennan** Genome Dynamics Programme Scottish Crop Research Institute	**David Simpson *** Research Leader - Strawberry Breeding East Malling Research, East Malling, Kent,

	Dundee, DD2 5DA Scotland, UK Email: r.brennan@scri.sari.ac.uk www.scri.sari.ac.uk *Breeding, biotechnology, cultivar evaluation, raspberry*	ME19 6BJ. UK david.simpson@emr.ac.uk www.eastmallingresearch.com *Breeding, biotechnology, cultivar evaluation, strawberry*
WG2	**Angela BERRIE** East Malling Research, East Malling, Kent, ME19 6BJ. UK angela.berrie@emr.ac.uk www.eastmallingresearch.com *Plant nursery production*	**Nicholas BATTEY** University of Reading, School of Plant Sciences, Whiteknights, PO Box 22, Reading, Berkshire RG6 6AS. UK n.h.battey@reading.ac.uk www.plantsci.rdg.ac.uk *Nursery plant physiology*
WG3	**Stuart GORDON *** Host Parasite Co-evolution Scottish Crop Research Institute Dundee, DD2 5DA Scotland, UK sc.gordon@scri.sari.ac.uk www.scri.sari.ac.uk *Pest and disease management*	**Jean FITZGERALD** East Malling Research, East Malling, Kent, ME19 6BJ. UK jean.fitzgerald@emr.ac.uk www.eastmallingresearch.com *Berry plant production systems*
WG4	**Derek STEWART** Quality Health and Nutrition Programme Scottish Crop Research Institute Dundee, DD2 5DA Scotland, UK d.stewart@scri.sari.ac.uk www.scri.sari.ac.uk *Antioxidant metabolic-profiling, bioefficacy*	**Richard MITHEN** Institute of Food Research, Norwich Research Park, Colney, Norwich NR4 7UA, UK richard.mithen@bbsrc.ac.uk www.ifr.ac.uk *Glucosinolates, human foods*