



**European Cooperation
in the field of Scientific
and Technical Research
- COST -**

Secretariat

Brussels, 11 July 2006

COST 266/06

MEMORANDUM OF UNDERSTANDING

Subject : Memorandum of Understanding (MoU) for the implementation of a European Concerted Research Action designated as COST Action 873 'Bacterial diseases of stone fruits and nuts'

Delegations will find attached the Memorandum of Understanding for COST Action 873 as approved by the COST Committee of Senior Officials (CSO) at its 165th meeting on 27/28 June 2006.

**MEMORANDUM OF UNDERSTANDING
FOR THE IMPLEMENTATION OF A EUROPEAN CONCERTED RESEARCH ACTION
DESIGNATED AS**

COST ACTION 873

‘Bacterial diseases of stone fruits and nuts’

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’, or in any new document amending or replacing it, the contents of which the Signatories are fully aware of.
2. The main objective of the Action is to develop strategies to prevent biological invasion and spread of bacterial diseases of stone fruits and nuts that will be used for the design of integrated approaches for plant health management.
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 approximately 75 million EUR in 2006 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 five years, calculated from the date of the 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.

Bacterial diseases of stone fruits and nuts

A. ABSTRACT

Stone fruit and nut production in Europe is threatened by emerging and increasingly severe losses to bacterial diseases. This Action networks the major phytobacterial and tree-breeding labs throughout Europe in order to provide a proactive response to quarantine pathogens and a reactive response to pathogens already present. Ring-trials to validate diagnostic protocols, evaluate control options, optimise forecasting models and screen germplasm collections for resistance will be pursued. Within the four working groups (diagnostics/detection protocols; quarantine/eradication strategies; host resistance; chemical and biological control strategies) special task forces will address current and arising problems. A Standing Committee of Practitioners will facilitate the transfer of knowledge to key user groups such as national plant protection organisations, industry, and fruit and nut growers. Young scientists and scientists from developing regions in Europe, particularly those at the front-line of emerging diseases are encouraged to participate in lab exchanges. Bridging gaps in awareness of these diseases and control options is a central focus of this Action. The goal of this Action is to design integrated orchard management strategies for the sustainable production of high-quality stone fruits and nuts and to preserve the unique place these crops have in European cultural traditions.

Keywords: crop protection, plant pathology, quarantine pathogens, stone fruits, temperate nuts.

B. BACKGROUND

Stone fruit and nut production in Europe – economic, health and cultural value

Stone fruits (cherry, plum, prune, peach, nectarine, apricot) (1'289'500 ha/9'359'000 Mt) and nuts (walnut, hazelnut, almond, pecan, pistachio) (1'094'000 ha/955'600 Mt) are important in the agricultural sector across the EU sphere (here defined as EU members, associated/candidate states, Israel). European stone fruit and nut production is under **increasing economic pressure** from imports (e.g., Asia, the USA, and South America). Pressure on cherry and walnut production also competes with demands for quality wood. California is the world's largest almond exporter, and recent *Salmonella* outbreaks linked to their contaminated product, highlights the need to have an EU source of safe products for our consumers. The greatest potential advantage EU sphere producers have against aggressive imports is to promote the production of **superior quality, safety and nutritive value of our fruits and nuts produced in an ecologically sustainable manner**. Considerable progress was made in the 1960s-80s to improve productivity by innovations in orchard density, mechanisation, agrochemical inputs and variety selection but **innovations have lagged since the 1980s** and a new initiative is crucial to sustain and further expand productivity in Europe.

Fruits and nuts are **major sources of health-promoting compounds** (e.g., flavonoids, oils, vitamins, dietary fibre, protein) and contribute value and diversity to the European Code Against

Cancer ‘5-a-day’ marketing/health campaign. The value of stone fruit and nut trees to regional **cultural traditions** and to the **aesthetics of landscape and forests** across the EU sphere is often overlooked. Heritage varieties (or heirloom varieties) are integral in **special-use products** (e.g., fruit pastes, baking, oils, liquors). These trees dot the **rural landscape** providing **quality-of-life and tourism benefits**, as well as serving as **ecological islands for wildlife**.

Bacterial disease threats to European stone fruit and nut production

Bacterial diseases are a major constraint on productivity. Yield losses reaching 50% and tree death result from established pathogens (e.g., blight on walnut, canker on almond and stone fruit caused by *Brenneria nigrifluens*, *Pseudomonas syringae* pv. *syringae*, pv. *morsprunorum*, *Pseudomonas amygdali*). Quarantine pathogens are spreading out of contained loci and present a long-term threat to other EU countries (e.g., *Xanthomonas arboricola* pv. *pruni* spreading out of France and Italy). Expansion is driven by evolution in pathogen populations for hyper-virulent strains and higher susceptibility in newer tree varieties. Other quarantine pathogens are at the EU doorstep (*Xylella fastidiosa*) and require proactive attention to prevent biological invasion. This Action considers all bacterial diseases of all stone fruits and temperate nuts grown in the EU sphere, caused by 15 pathogens including 4 quarantine pathogens. Quarantine pathogens are not only devastating because of their direct impact on tree health but also because single infections can lead to large-scale destruction of orchards from implementation of eradication and containment regulatory measures. Quarantine pathogens can potentially devastate heritage varieties in rural landscapes and native forest species of *Prunus* and nuts, as sadly has been shown with the invasion of fire blight on pome fruits over the past 30 years. Rural and forest trees also may provide a ‘toe hold for biological invasions’ or inoculum reservoirs and the threat to these from disease in nearby orchards has not been studied.

A focus group of pathogens that are the major threats to the EU sphere Agriculture-Food sector in terms of economic (most damaging) and regulatory (quarantine pathogens) impact will be considered in all aspects of the Action (i.e., *X. a.* pv. *pruni*, *X. a.* pv. *corylina*, *X. a.* pv. *juglandis*, *P. s.* pv. *persicae*, *B. nigrifluens*, *X. fastidiosa*). The complete panel of 15 pathogens will be considered in terms of integrated orchard management, and flexibility will be maintained to address changes in disease situations from any of the 15 diseases (e.g., new or severe outbreaks).

Current control options

Prevention is the primary control strategy for quarantine pathogens and pathogens that are regionally limited. Prevention consists of quarantine measures, eradication procedures, sanitation and hygiene in nursery propagation and orchard maintenance. Whereas much of this involves common sense precautions, data to develop agronomically relevant, science-based protocols for putting common sense into action is often lacking. Precise information is often lacking on the type and number of samples from individual plant lots, distribution of samples taken from orchards, when samples should be taken, which part of the plant should be sampled. Disease forecasting models are invaluable tools for prevention, and also decision-making when control options such as copper can be implemented. Currently, a model is available in the USA for walnut blight (Xanthocast; www.fieldwise.com) but it has not been customised for European growing conditions. Basic epidemiological data needed to develop forecasting models is incomplete for the other foliar diseases and this Action aims to fill this gap.

Host resistance offers the most durable and low input type of protection. Varieties vary greatly in resistance, or more properly tolerance, to bacterial diseases. In the absence of consistent disease pressure, varieties are more often selected for superior quality or growth traits and these varieties

frequently end up being susceptible to potentially devastating diseases. Indeed this has been the case in Europe where many of the commonly cultivated *Prunus* varieties were selected for quality and have low tolerance to emerging foliar diseases.

Chemical controls are available for many foliar bacterial diseases. Antibiotics, banned in the EU, are the main chemical option in the USA. The main alternative is copper-based bactericides, which present problems with pathogen resistance development and long-term environmental toxicity. The prevalence of copper resistance in Europe and mechanisms of resistance have not been systematically studied. This Action provides a network for mapping the current status, and predicting the evolution of resistance across all regions. New chemicals based on natural plant extracts and colloidal silver ions hold promise as low-toxicity, high-efficacy alternatives to copper and antibiotics but the state-of-the-art use is not yet at the point where these can reliably be used in orchard management. Plant growth regulators have been found to have significant non-target beneficial activity against bacterial diseases of trees, specifically prohexadione-Ca against fire blight on apple, but again have not been systematically evaluated for control of the diseases considered in this Action. The same holds true for chemical inducers of plant resistance that have been found to control bacterial diseases in other crops in the field but have not been systematically tested for the diseases covered in this Action. Preliminary work has begun in some labs participating in the preparation of this Action.

Biological control has been effectively used to control crown gall and *P. s. pv. syringae*, and commercial products are available. Studies on some of the foliar diseases covered by this Action have begun, but progress has been sporadic. Systematic evaluation of currently available commercial biocontrol formulations, formulations in the pipeline and the isolation and screening of novel antagonists has not been done. This Action provides a forum for ring-trials to kick-start the incorporation of biocontrol in bacterial disease management in stone fruits and nuts. Efficacy data from this Action will be useful for the registration process in individual countries.

Why a COST Action?

Bacterial diseases that constitute biological invasion threats recognise no borders and have the potential to rapidly spread across regions unless proactive and coordinated international defences are prepared. The European experience with fire blight, a devastating disease of pome fruits that entered Europe in the 1950s from the USA and went unchecked for far too long, was an event from which lessons should be learned. The bacterial diseases, particularly those caused by the focus group of quarantine pathogens and pathogens limited to confined loci in Europe, require proactive international attention. International coordination will serve to arm scientists at the front-line of disease invasions with the tools to rapidly detect and implement control/eradication strategies. Management of diseases that cause severe crop losses and are present in many countries, requires the consolidation of national resources to screen available germplasm (commercial and heritage varieties) and to develop valid forecasting models that can be used across Europe (fine-tuned for local climatic conditions) to predict disease and make informed decisions for implementation of control measures.

Every country in Europe has national programmes for preparing extension materials (fact-sheets) and has germplasm collections of commercial and heritage varieties. This Action aims to consolidate scarce national resources and minimise redundancy via coordinated screening of resistance and exchange of timely and user-friendly information to prevent disease encroachment and to minimise damage.

Training is a cornerstone for proactive disease prevention and this Action emphasises the transfer-of-knowledge from countries and scientists having experience with bacterial diseases of stone fruits and nuts to those that are not yet exposed. Better to have critical information and know-how sooner than later is the motto for effective prevention. This lack of timely international coordination has been a major reason for the expansion of bacterial diseases in the past (i.e., fire blight) and should be avoided in relation to bacterial diseases of other tree crops vital to regional traditions, quality-of-life and economic competitiveness in Europe. This COST Action will provide the knowledge-transfer platform to bridge gaps across Europe.

This Action will emphasise the validation of forecasting models and of commercial products developed by participating SMEs across the entire range of regional conditions in Europe thus ensuring the widest user pool. This can be only achieved through a non-competitive, international platform such as COST.

C. OBJECTIVES AND BENEFITS

The main objective of this Action is to develop strategies to prevent biological invasion and the spread of bacterial diseases of stone fruits and nuts that will be used for the design of integrated approaches for plant health management.

The Action will strengthen existing European networks and develop new multidisciplinary networks for reactive and proactive response to bacterial diseases of plants.

Specific objectives include (in addition to tasks defined in Section D):

- Optimise and develop novel **diagnostic strategies/protocols** essential for managing bacterial diseases of stone fruit and nut species in the EU sphere that can also be applied to pathogen monitoring in disease-forecasting models.
- Optimise and develop **disease-forecasting models** to predict disease outbreaks.
- Screen germplasm collections for redundancy of accessions (molecular markers for variety pedigree) and for **disease resistance/tolerance**.
- **Exchange of germplasm varieties** for evaluation of performance and resistance in diverse regions in Europe.
- Develop **molecular markers for streamlining classical breeding** for host resistance.
- Evaluate efficacy and compatibility of **biocontrol and antibacterial compounds**.
- Design **integrated orchard management strategies** for sustainable disease control.
- Promote **proactive international response to disease threats** by networking countries on the front-line of disease outbreaks with vulnerable but disease-free countries.
- Support national plant protection organisations and European organisations (e.g., the European and Mediterranean Plant Protection Organisation, EPPO) by **providing data and extension materials** on bacterial diseases.
- Establish **core collections of pathogen strains** for use in rapid diagnosis of disease encroachment.
- **Transfer innovations rapidly to end-user groups** (i.e., SMEs, plant protection organisations, grower groups) as facilitated by a Committee of Practitioners.
- **Train young scientists and scientists from less developed regions** of the EU sphere via a mentoring programme, training workshops, on-line courses and STSMs targeted at high-impact topics.

- Provide **proactive training to plant protection officers** in countries threatened by biological invasion by diseases (including diagnostic, monitoring and quarantine procedures).
- Disseminate results via publication of all meeting proceedings, a web site with bibliography, new alerts and job announcements to foster long-term networking.
- Work with EPPO and national plant protection organisations to provide graphic **fact-sheets** describing diseases and control/prevention options.
- Produce a **synthesis handbook** of *Stone Fruit and Nut Health Management* for international publication.

Ring-trials and coordinated labs will be a key to realising the Action objectives.

Emphasis will be placed on working with end-user groups to develop and validate **plant protection products from-lab-to-market**.

Emphasis will be placed on evaluating prevention (quarantine, eradication, forecasting) and intervention (host resistance, alternative chemicals, biocontrol) methods for **compatibility in the context of integrated orchard management** at the level of commercial conventional and organic systems but also in **low-input traditional systems** and in native plant alternate hosts (e.g., forest species).

Emphasis will be placed on **filling gaps in national awareness of bacterial disease threats and procedures to rapidly detect and combat invasions**

D. SCIENTIFIC PROGRAMME

The Action is organised with four working groups (WGs) that build upon each other to develop strategies of integrated orchard management for managing bacterial diseases and advancing sustainable stone fruit and nut production across diverse regions in Europe.

WG1. Diagnostics and Early Detection

The ability to detect pathogens and diagnose disease early and sensitively is the cornerstone for effective prevention strategies. The main objectives of WG1 are to compare diagnostic procedures available for most of the pathogens in real-life situations. Most procedures are published with a limited pool of strains and other species tested for specificity, and sensitivity can differ greatly between artificially inoculated test plants and field samples taken throughout the season. Moreover, protocols for applying diagnostic procedures for early detection and monitoring in orchards are seldom considered in depth. WG1 will evaluate classical plating methods (cheap, simple), published molecular methods (PCR), and optimise these or develop novel methods. The second task of WG1 will be to integrate these methods into sensitive and simple early detection protocols suitable for monitoring orchards and for screening import/export plant material in plant-inspection services. The final task will assess the population diversity across Europe of those pathogens for which such information is lacking. Diversity of pathogens (including arising hyper-virulent genotypes) can have a significant impact on the durability of control strategies and decision making for the deployment of host resistance.

- *Task 1* is to **validate and optimise detection assays** currently available or newly developed as needed for all pathogens of this Action. Focus will be placed on high sensitivity and simplicity and will take advantage of advances in molecular diagnostics (nested PCR, diagnostic microarrays, immunological lateral flow strips and magnetic separation).
- *Task 2* will apply the diagnostic methods to develop **standardised protocols** for sampling plant material (e.g., orchards, import/export nursery material) that can be used by national plant protection organisations for implementing quarantine and eradication measures. Focus will be concentrated on early detection methods that can also be applied in forecasting models.
- *Task 3* is to **establish core collections of bacterial isolates**. A central strain bank will be established at the Collection Française des Bactéries Phytopathogènes, CFBP, Beaucouzé, France). Core collection of strains will be established in biosafety-approved national labs for the long-term benefit of having standards to use for diagnostic purposes.
- *Task 4* is to apply these collections for **coordinated studies of pathogen diversity** using cutting-edge molecular techniques (e.g., rep-PCR, AFLP, DNA sequence analysis, MLST).

WG2. Epidemiology and Prevention

Basic epidemiological information is lacking for most of the focus pathogens in this Action. Such information (prevalence of latent infections; inoculum thresholds; survival/persistence; seasonal dynamics in spring and autumn pathogen populations; role of climatic factors in disease development; dispersal modes; progress of infection in hosts) is critical for the first line of defence; namely, prevention. Prevention entails adequate phytosanitary procedures for inspection to preclude the introduction of pathogens and/or high-threat genotypes into protected zones and eradication measures (e.g., how extensive does pruning need to be for effective removal of infected tissues; or how much orchard needs to be cleared around infection loci). Epidemiological information is also essential for developing reliable prediction or forecasting models to anticipate disease risk. Epidemiologists and national plant protection organisations (NPPO) from across Europe constitute a core of Action participants involved in WG2.

- *Task 5* is to establish **harmonised protocols** for gathering epidemiological data.
- *Task 6* is to transfer diagnostic innovations to NPPO for drafting reliable and realistic phytosanitary inspection and eradication strategies in coordination with EPPO.
- *Task 7* is to compile basic epidemiological data (e.g., latent infection prevalence, dispersal mode, dissemination rate, climatic influence) from all regions.
- *Task 8* is to elucidate the **aetiology of an emerging walnut disease, brown apical necrosis (BAN)** and then develop diagnostic procedures with WG1. Molecular ecology tools such as DGGE will be applied.
- *Task 9* is to lay the foundation to **develop forecasting models** for the focus pathogens and pooling resources to **customise existing forecasting models** (e.g., Xanthocast) for European conditions.

WG 3. Host Resistance and Breeding

This WG covers all areas of host tree resistance and will consider both scion and rootstock genotypes. Emphasis will be placed on screening existing varieties (commercial and heritage varieties) and on breeding for new lines with improved natural disease resistance. Novel molecular markers will be delivered which can be applied for high-throughput screening for newly identified resistance (e.g., new QTLs). This will greatly streamline the classical breeding process, which can

take several years and offer little guarantee of having successfully introduced relevant resistance genes. Molecular markers will also be developed for verifying the identity of accessions in various national germplasm collections. This will limit redundancy in variety resistance testing during this Action and provide a long-lasting database for other variety trait studies in the future (e.g., fungal/viral disease resistance, fruit/nut quality, environmental hardiness, growth character). The networking aspects of WG3 will be modelled after those successfully used for breeding of quality traits and fungal disease resistance in previous EU projects such as for pome fruits in Durable Apple Resistance in Europe, DARE, where Action participants were active.

- *Task 10* is to **exchange host germplasm material** for performance and disease susceptibility evaluation in different regions. **Standardised protocols for resistance testing** will be developed and used in ring-trials. Innovations will be studied for conserving germplasm collections (e.g., cryopreservation, bud banks).
- *Task 11* is to **develop/strengthen breeder networks** and **exchange insights** on heredity, pedigree and strategies for breeding disease resistance in the broad spectrum of stone fruit and nut trees.
- *Task 12* is to identify molecular resistance markers (e.g., **QTLs**) and apply these for **marker-assisted selection** to streamline classical breeding to take less than 8 years from crossing to market compared with the more than 20 years that is currently the norm.
- *Task 13* is to **develop molecular markers for the identification and verification of varieties** held in germplasm collections so that a **high rate of redundancy and misidentification** can be avoided and only the essential genotypes are conserved. Cutting-edge molecular markers (e.g., RFLPs, RAPDs, microsatellites, intersample sequence repeat markers, SCAR markers) will be made available to all partners.

WG4. Integrated Control Strategies

The end-goal of this Action is to design control strategies for **sustainable production** of stone fruits and nuts **across the EU sphere**. WG4 plays a central role in accomplishing this goal. Specific tasks of WG4 focus on the evaluation and development of **environmentally friendly, alternative additive-plant-protection compounds** such as biocontrol agents, synthetic and natural antibacterial compounds and compounds that indirectly reduce disease severity by mediating host resistance. WG4 is also charged with steering the synthesis of results from all WGs for enhancement of integrated orchard management strategies suitable for the diverse regions represented in this Action. Industry will play a key role both as a recipient of results generated and as a transfer to the producers, and this sector is well represented in WG4; e.g., International Biocontrol Manufacturers Association (www.ibma.ch).

- *Task 14* is to **evaluate the efficacy of commercial and novel biocontrol agents**. Ring-trials will **harmonise screening protocols** for control compounds.
- *Task 15* is to evaluate the **biosafety of biocontrol agents** such as *P. agglomerans*, which are among the most common and effective antagonists but also contain clinical isolates. Strain relatedness of such ‘Jekyll-and-Hyde’ agents will be studied.
- *Task 16* is to **determine and map the occurrence of copper resistance** in the pathogen populations across Europe. Copper is the most effective antibacterial compound currently available and studies will focus on ways to **limit resistance development** and **reduce doses of copper applications in orchards**.
- *Task 17* is to **evaluate alternative chemicals** (e.g., colloidal silver, plant extracts) for efficacy, risk of pathogen resistance development and phytotoxicity.

- *Task 18* is to **evaluate plant growth regulators (PGR) and chemical inducers of resistance** (e.g., prohexadione-Ca, acylbenzolar-S-methyl) for efficacy.
- *Task 19* is to **synthesise all WG activities for enhancement of integrated orchard management**. Focus will be placed on compatibility of prevention, host resistance, biocontrol and chemicals with conventional, organic and low input production systems.

E. ORGANISATION

The Action will facilitate multidisciplinary interaction through the following instruments:

- *Management Committee (MC)* will consist of national delegates and convene annually in conjunction with another scheduled Action meeting (e.g., WG meeting, training workshop). Besides its normal duties, a unique duty of the MC in this Action will be to establish a **mentoring programme** (see below) for the advancement of young scientists and scientists from underdeveloped regions of the EU sphere.
- *Steering Committee (SC)* will consist of the Action chairperson, vice-chairperson and the WG leaders. The SC will be charged with initiating activities and proposals for the MC to decide concerning any other project proposals and Action-sponsored publications, approval of short-term scientific missions, STSMs, and budget allocations. A major focus of the SC will be the **generation of external funding** for research and training activities from the briefing stage (e.g., expression of interest statements) to appointing task forces for project preparation. The SC will also take the lead in **coordinating ring-trials and inter-lab consortia**.
- *Committee of Practicioners (CoP)* will be established by the SC as a standing panel consisting of plant protection officers and representatives of grower groups and SMEs with the express aim of overseeing a **seamless transfer of knowledge to end-users**.
- *Issue-driven task forces* established by the SC as **ad hoc expert panels to tackle multidisciplinary and pressing issues** (e.g., developing a forecasting model, evaluating a new commercial diagnostic or control product, preparing EU framework/Marie Curie proposals). Task forces may include external experts (e.g., COST Action 864: ‘Combining traditional and advanced strategies for plant protection in pome fruit growing’ relating to pome fruit health) as appropriate to accomplish their mission. Targeted meetings, telephone conferencing and targeted STSMs will facilitate completing task force assignments.
- *National delegates* will be charged with providing an annually updated list of WG participants to the SC, communicating Action activities at home (i.e., national COST days), communicating national activities and needs to the SC (e.g., changes in national quarantine regulations, needs of local growers).

This Action is structured to ensure tight interaction and synergy between WGs necessary to accomplish tasks as shown in Figure 1. For example, the results of diagnostic and sampling protocols from WG1 will be essential for completing epidemiological studies and developing forecasting models in WG2. Diversity studies from WG1 will be essential to assessing the stability of host resistance found in WG3 and antibacterial/biocontrol compounds in WG4. All WGs will contribute expertise to accomplish the final task steered by WG4; namely designing integrated orchard management strategies. WG4 will steer this task synthesising the results of all WGs. For example, application of pathogen detection and forecasting models from WG1 and WG2 to assess orchard vulnerability, selection of resistant/tolerant host varieties from WG3 for compatibility with grower preferences in different regions, and compatibility of biocontrol agents/antibacterials from WG4 with other compounds used in stone fruit and nut production.

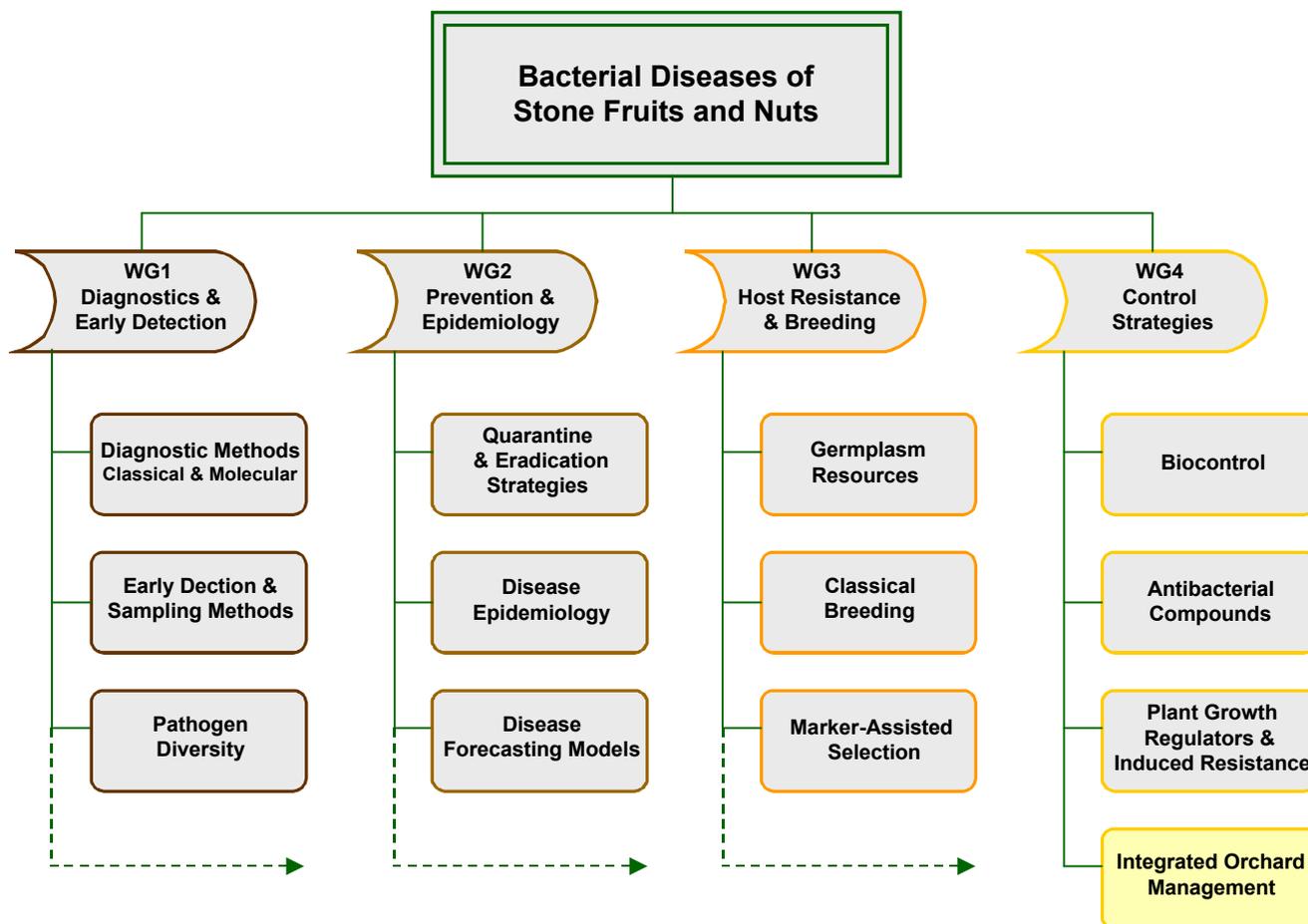


Figure 1. Structure of the Action.

F. TIMETABLE

The Action will last for five years. Table 1 shows a timeline for the Action.

The justification for this extended period is that the crops to be considered are all long-growing perennial trees that require several years to reach production stage. Three years are required to establish new ring-trials and at least two years of data are required thereafter to gather data for disease evaluations and performance in different countries. Development and optimisation of forecasting models require multiple years of field data which will be gathered from these ring trials and supplemented with data from recently planted orchards in participating research centres. It takes over 20 years to develop new stone fruit and nut varieties by classical breeding. Production of crosses to be used in developing molecular markers for streamlining breeding and then validating markers will require several years. All work with these long-growing trees is possible only during the vegetative period, which constitutes five growing seasons in this Action period.

Timeline for Action Plan	Pre-planning	Year 1	Year 2	Year 3	Year 4	Year 5
Management Coordination						
Action kick-off		★				
Management Committee established with Executive Committee elected		●				
Internet web site established incl. secure portal for members		●				
Web site updates		●	●	●	●	●
MC or EC meetings		★	★	★	★	
Action wrap-up						★
Working Group Programme						
Experiment planning	—	—	—	—	—	—
WG scientific meetings		★ ★	★	★	★	
Synthesis conference with all WGs – <i>Integrated Orchard Management</i>						★
Pathogen strain collections established		—	—	—		
Pathogen diversity analysis and aetiological studies			—	—		
Ring-trials of diagnostic/monitoring protocols and tree variety evaluations		—	—	—	—	—
Ring-trials for control compounds and <i>IOM</i>			—	—	—	—
Experimentation in lab consortia to complete WG tasks		—	—	—	—	—
Training and Mobility Module						
Training workshops			★		★	
On-line training courses		●	●	●	●	
STSMs		—	—	—	—	—
Technology and Know-how Transfer						
Workshops targeted to trade-groups, grower unions, plant inspectors				★	★	
Delegations to intl. conferences		—	—	—	—	—
Fact-sheets and advisory bulletins		—	—	—	—	—
Handbook publication for stone fruit/nuts health management						●
Dissemination Plan						
Local COST days with local growers/trade groups & plant protection officers		—	—	—	—	—
Publications stemming from WG meetings		● ●	●	●	●	
Reports to COST Brussels and national COST offices		●	●	●	●	●

G. ECONOMIC DIMENSION

The following 24 COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: Austria, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Israel, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Serbia and Montenegro, Slovenia, Spain, Sweden, Switzerland, Turkey. United Kingdom.

On the basis of national estimates provided by the representatives of these countries, the economic dimension of the activities to be carried out under the Action has been estimated, in 2006 prices, at approximately 75 million EUR.

This estimate is valid on 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.

H. DISSEMINATION PLAN

Publications

Information gained during this Action will be disseminated in timely publications stemming from ring-trials and special task forces to address multidisciplinary problems, and proceedings from each WG meeting. In addition, fact-sheets and bulletins will be produced for providing up-to-date information describing specific diseases, forecasting models, control options and tree varieties to end-user groups (i.e., national plant protection officers, growers, scientists) who are on the front-line of disease control. These user-friendly illustrated publications will further the Action's role as an information-exchange platform to support national plant protection officers and European panels in production of up-to-date outreach materials. Exchange of templates prepared by Action partners for translation into multiple languages will represent considerable European added-value. A synthesis *Stone Fruit and Nut Health Management Handbook* will be published that takes a holistic approach to integrated orchard management drawing on Action results and other expertise of WG participants.

Web site

An Action web site updated bi-annually will serve as an open-portal for all Action activities and as a one-stop information source on bacterial diseases of stone fruits and nuts. Information made available includes:

- General information about COST and this Action
- National portals highlighting activities in individual Signatory countries
- On-line courses, proceedings of meetings, talks and posters from meetings
- Disease bulletins/alerts, other news
- STSM Calls and Reports
- Extension and teaching (e.g., slides, course notes, protocols)
- Job announcements to encourage the long-term exchange of participants
- Publications and contact information for Action participants
- Links to institutes, labs and organisations with Action participants
- Helpful links with information on plant protection, stone fruit and nut production, phytobacteriology.

Training

Training is a major focus of this Action. **Short-Term Scientific Missions (STSMs)** will be offered to young scientists and scientists from developing regions. STSMs will facilitate transfer-of-knowledge and training in new techniques or shared use of critical equipment or field sites. STSM topics that link with issue-driven task forces will be given priority in order to position participants in topics with highest impact.

A cornerstone of the Action training plan is the **mentoring programme**, which will pair established scientists (long-experience; internationally connected) with young scientists and scientists from developing regions in mentoring relationships. The aim is to foster personal connections that will bridge gaps in know-how and open doors for future career development on the world stage.

Training workshops with hands-on training of participants will be designed to provide young scientists and target groups (e.g., plant protection officers) with essential skills to identify, monitor and control bacterial diseases of stone fruits and nuts. Training workshops will be organised at well-equipped and advanced laboratories participating in this Action and will emphasise WG interaction (e.g., training in diagnostic methods and application for monitoring or plant protection protocols).

On-line training courses that incorporate material from training workshops will be available to all participants via the Action web site. Additional on-line courses emphasising training in new techniques/protocols, disease epidemiology, host responses, use and biological activity of control compounds and integrated orchard management will be offered.

Biosafety guidelines will be established at the start of this Action to provide a standardised training of all participants in the appropriate handling infectious agents and particularly work with quarantine pathogens. Observation of these guidelines and of regulations for the EU and individual countries will be obligatory. This will further efforts at harmonisation of procedures throughout Europe.

Meetings

WG meetings combined with MC meetings will be organised by geographic representation and nearby research and breeding institutes to allow participants from all regions to gain a first-hand appreciation of the available resources in Europe. Strategic joint WG meetings will be encouraged.

Technology-transfer workshops will be organised that cross WG missions and have the objective of innovation transfer to target groups of industry, grower unions and plant protection officers. Several Action participants serve in organisations relevant to these target groups and these participants will be asked to plan such workshops. This will ensure that information relevant to current needs is presented in a useable format. An example of such a transfer-of-knowledge workshop may focus on innovative diagnostic procedures and application in disease monitoring, disease exclusion and disease eradication strategies with the target groups of national plant protection officers and growers. This Action is uniquely poised to accomplish effective know-how transfer owing to the breadth of expertise among Action participants and their many cross-links in all aspects of stone fruit and nut production/protection.

Local COST Days organised by national delegates will be encouraged for the dissemination of Action activities and for gathering insights from a broad spectrum of participants that may not otherwise be involved in Action meetings.