



**European Cooperation
in Science and Technology
- COST -**

Brussels, 4 July 2012

Secretariat

COST 4129/12

MEMORANDUM OF UNDERSTANDING

Subject : Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action FA1204: Vegetable Grafting to Improve Yield and Fruit Quality under Biotic and Abiotic Stress Conditions

Delegations will find attached the Memorandum of Understanding for COST Action as approved by the COST Committee of Senior Officials (CSO) at its 185th meeting on 6 June 2012.

MEMORANDUM OF UNDERSTANDING
For the implementation of a European Concerted Research Action designated as
COST Action FA1204
VEGETABLE GRAFTING TO IMPROVE YIELD AND FRUIT QUALITY UNDER
BIOTIC AND ABIOTIC STRESS CONDITIONS

The Parties 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 4154/11 “Rules and Procedures for Implementing COST Actions”, or in any new document amending or replacing it, the contents of which the Parties are fully aware of.
2. The main objective of the Action is to understand the biological basis of rootstock-mediated improvement of Cucurbits and Solanaceous crops and their compatibility by combining already existing scientific information generated in several COST and non-COST countries as a basis for development and exploitation of new rootstocks.
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 EUR 48 million in 2012 prices.
4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.
5. The Memorandum of Understanding will remain in force for a period of 4 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 V of the document referred to in Point 1 above.

A. ABSTRACT AND KEYWORDS

Due to limited availability of arable land and water resources, the widespread use of fertilizers, and the great market demand for vegetables, cucurbits and solanaceous crops are frequently cultivated under unfavourable soil and environmental conditions. These include soilborne pathogens, salinity, thermal stress, drought, and high concentrations of heavy metals. These harmful conditions are magnified by the changes in climate and environmental conditions and the restrictive policies of agrochemical usage. One way to avoid or reduce loss in production caused by adverse conditions in vegetables would be to graft them onto rootstocks capable of alleviating the effect of external stresses on the shoot. This Action aims to stimulate cutting-edge multidisciplinary collaborations towards identifying and understanding how rootstock-mediated traits can improve vegetable crop yield and quality under adverse biotic and abiotic conditions. Shared knowledge and enhanced scientific and technical collaboration will surely fill knowledge gaps in the area of vegetable grafting. This Action can also stimulate a widespread commercial development and exploitation of this technique in Europe. The knowledge collected will be presented in a book as a final output of this Action. Moreover, all data and information of this Action will be made available to the public through a specific website.

Keywords: vegetable grafting, rootstock breeding and genetics, rootstock-scion interaction, biotic and abiotic stress resistance, fruit quality

B. BACKGROUND**B.1 General background**

Even though grafting has been practiced on fruit trees for thousands of years, the commercial use of vegetable grafting is a relatively recent innovation. After more than fifty years of crop improvement principally selecting for above-ground traits, scientists now consider root system engineering an opportunity to integrate new approaches for maintaining sustainable crop production under changing environmental conditions while minimizing the demand for new resources.

The introduction of excellent rootstocks possessing multiple resistances and characterized by high compatibility with the most common cultivars will greatly encourage the widespread use of grafted vegetables throughout the world. Even though the benefits of using grafted seedlings are now fully recognized worldwide, the need to understand the scientific basis of grafting-mediated crop improvement and systematically utilize the latest findings of research has prompted this COST Action. The development of a multidisciplinary network of partners targeted to the root system and rootstock breeding represents a major opportunity to understand the mechanisms behind rootstock-mediated crop improvement in order to enhance fruit quality, productivity and sustainability of vegetable crops under multiple and combined stress. Such expertise provides supporting information for European companies aspiring to develop and commercialize vegetable rootstocks and for vegetable farmers to facilitate them in the employment of grafted plants as a significant aid in the sustainable cultivation of vegetable crops.

Therefore, considering that the mission of the COST is to strengthen Europe in scientific and technical research through the support of cooperation and interaction between research communities, the implementation of this COST Action is an excellent instrument to stimulate a European-wide exchange of scientific information in order to improve the scientific and applied basic knowledge on vegetable grafting.

A large body of research data on vegetable grafting has been collected in many countries over the last 15 years. Many scientists have employed grafting between different genotypes of fruit bearing vegetables to (1) improve the understanding of how root-to-shoot signalling alters the shoot phenotype; (2) study specifically how the root system responds to different stresses, and how these responses affect plant adaptation; (3) gain expertise in using grafting to solve agronomic problems such as soilborne diseases or abiotic constraints. Today there is an urgent need to combine this scattered knowledge so as to build a European knowledge platform. This Action will also stimulate a more widespread commercial development and exploitation of this technique in Europe.

B.2 Current state of knowledge

Vegetable crops are often exposed to biotic and abiotic stresses in the root zone, limiting crop productivity in many parts of the world. Overcoming stress problems would have a positive impact on agricultural production. Numerous attempts have been made to improve the crop resistance against biotic or abiotic stresses by traditional breeding programs and by the genetic transformation of plants. However, commercial success has been often limited because of the complexity of the traits. Farmers demand more efficient varieties of fruiting vegetables in terms of yield and quality, but varieties that are obtained from breeding programmes selecting for these traits, are generally sensitive to many biotic and abiotic stresses. Consequently, the search for strategies aimed at a better resistance to the deleterious effects of biotic and abiotic stresses in the plants continues to be an objective of great interest. As a rapid alternative to the relatively slow breeding methodology aimed at increasing vegetable crop tolerance to biotic and abiotic stress, grafting of high-yielding genotypes onto selected rootstocks is a promising method. Grafting is commonly applied to Solanaceous crops (tomato, eggplant, and pepper) and Cucurbits (watermelon, melon and cucumber) in Japan, Korea, China, Middle East Countries (eg. Israel, Turkey), and many European (eg. Spain, Italy, Greece, France, The Netherlands, Germany) and American countries (Lee et al., 2010). One of the main purposes of grafting is to control soil-borne diseases and nematodes and it is considered the most efficient alternative to the use of methyl bromide for soil disinfection (Louws et al., 2010). Indeed, grafting is mainly responsible for the recovery of soil as natural substrate in many horticultural areas, and its implementation is strongly increasing in many countries [eg. the production of grafted plants increased by 136% from 2005 (25 million plants) to 2010 (59 million plants) in Italy and by 44% from 2005 (90 million plants) to 2009 (130 million plants) in Spain]. Several studies have also indicated that some rootstocks are capable of enhancing the efficiency of water and nutrient use (Colla et al, 2011; Rouphael et al., 2008; Savvas et al., 2010). The higher efficiency of some graft combinations of fruit vegetables in the taking up and utilization of nutrients may mitigate yield loss owing to shortages of water and nutrients in the root environment of plants and restrict nutrient loss due to leaching. In addition grafting can increase plant vigour and yield, and improve tolerance to environmental stresses such as salinity, low and high temperatures, drought, flooding-induced hypoxia, alkalinity, and excessive amounts of heavy metals and trace elements (Colla et al., 2006; Edelstein et al., 2011, Yetisir et al., 2006; Martinez-Rodriguez et al., 2008; Otani and Seike, 2006, 2007; Schwarz et al., 2010).

In spite of its advantages, grafting also presents some problems. These include the additional cost and graft incompatibility that may occur in some cases causing physiological disorders, and possible reductions in yield and fruit quality.

Many research projects have been conducted on vegetable grafting to (1) improve the understanding of how root-to-shoot signalling alters shoot phenotype; (2) study specifically how the root system responds to different stresses, and how these responses affect plant adaptation; (3) gain expertise in using grafting to solve phytopathological and agronomic problems such as soilborne diseases or abiotic constraints. Summaries of research results on vegetable grafting have been given in several research papers and in a recent Special Issue on Vegetable Grafting of *Scientia Horticulturae* (volume n. 127; 2010). This information is obviously the starting point for this COST Action program. Since the main objective of the Action is to understand the biological basis of rootstock-mediated improvement of several vegetable crops and their compatibility, it will be an important basis for integrating the grafting technique as an effective tool for sustainable horticultural production and the selection of appropriate rootstock-scion combinations in each case. Therefore, it is fundamental to collect the scattered pre-existing information and link it to new genetic, physiological and agronomic information, thereby contributing to a better selection and exploitation of the available genetic variability in rootstocks, and the generation of new variability through genetic and biotechnological breeding approaches.

The members of the Action are not at present aware of other Network collaborations on vegetable grafting, similar to this COST Action under consideration in the EU Framework Program or in other European organizations, such as EUREKA, ESF, etc. A COST Action on this subject is therefore relevant and innovative, especially in the context of the growing interest within the COST countries in the cultivation and commercialization of rootstocks and vegetable grafted plants.

B.3 Reasons for the Action

An important reason for this Action is that grafting is a relatively underexploited resource in Europe. Most of the scarce public research on rootstock breeding is being done in Asia, especially China, Korea and Japan, where commercial exploitation, and appreciation of the benefits of using grafted plants, began much earlier than in Western countries. Nevertheless, utilization of grafted seedlings is expected to grow rapidly throughout the world. Until now, no scientific network exists on this topic at either European or international levels, although the number of groups and scientific publications in the last decade has shown exponential growth. Indeed, a Vegetable Grafting Working Group has been very recently (2010) created in the International Society for Horticultural Science (ISHS), although with a more application-oriented philosophy aimed at solving current problems for the farming community. Moreover, the great success of the first International Symposium on Vegetable Grafting which took place in October 2011 has proved there is a great interest in exchanging basic and applied knowledge on vegetable grafting.

This COST Action aims at developing a multidisciplinary network of partners targeted to the root system and rootstock breeding that represents a major opportunity for understanding the mechanisms behind rootstock-mediated crop improvement in order to enhance fruit quality, productivity and sustainability of vegetable crops under multiple and combined stress factors. Sharing knowledge and enhancing scientific and technical collaboration will assuredly fill knowledge gaps in the area of vegetable grafting. This will ultimately be useful for helping vegetable growers and breeders to deal with the predicted impact of climate change and to overcome the consequences of unsustainable agricultural practices that are causing soil degradation and depleting natural resources.

This Action is aimed both at European economic/societal needs and scientific/technological advance.

From an economical perspective, this Action will allow information exchanges contributing to a wider application of this technique in the agricultural industry of Europe. It's expected that this Action will promote the development of new rootstocks and their use in farming with the attendant economic benefits.

From the societal perspective, this Action will lead to the investigation and identification of the importance and utility of using vegetable grafted plants in different COST Countries, with a strong accent on how grafted plants could ameliorate resource use efficiency, and improve food safety and quality for the citizens. Moreover, this Action will allow a better understanding of how grafted plants improve the quality of rural life reducing the need of pesticide applications.

From a technical/scientific point of view, the Action will be aimed at understanding the biological basis of rootstock-mediated improvement of several vegetable crops and their compatibility. The expected scientific advances of the Action will be the identification of genetic/physiological markers for each species and target traits and the development and exploitation of new rootstocks based on the new interdisciplinary knowledge created.

The COST Action will produce important and useful information for breeding companies, nursery companies, and vegetable growers on the development and exploitation of new rootstocks, so as to minimize the negative impact of biotic/abiotic stresses on yield, to increase efficiency in the use of resources thus reducing agriculture's environmental footprint, and to significantly improve the commercial and nutritional quality of the product opening up new market opportunities. Because of the complexity of the study, several expertises are needed in different fields (eg. genetics, physiology, agronomy, plant pathology, food science) which can be obtained only by a network of experts such as this Action is. The creation of a pan-European network will also enable it to take advantage of Europe's geographical space and different agro-climatic conditions. This network will bridge the gap between the empirical and scientific knowledge underlying rootstock-mediated crop improvement, by linking knowhow and expertise from a wide body of researchers including growers, agronomists, plant physiologists, biochemists, molecular biologists, geneticists, and breeders, in order to integrate this modernized technology as an effective tool for producing high-quality vegetables.

B.4 Complementarity with other research programmes

This COST Action can have some links with the following research programs:

VEGRAFTABLE will share considerable expertise and will organise joint meetings with the following FP7 EU projects involved in root-targeted approaches.

ABSTRESS (EU) applies combined, integrated systems to biology and comparative genomics approaches so as to conduct a comprehensive study of the gene networks implicated in the interaction of drought stress and Fusarium infection in legumes.

EUROOT (EU) aims at enhancing the capability of cereal plants to acquire water and nutrients through their roots and maintain growth and performance under stress conditions making use of joint phenotyping and modelling platforms to approach the genetic and functional bases of root traits involved in soil exploration and resource uptake.

ROOTPOWER (EU) will analyze and exploit the natural genetic variability existing in a recombinant inbred line population (RIL) from a cross between *Solanum lycopersicum* and *S. pimpinellifolium* and other selected mutants and functional lines (used as rootstocks) for their performance under multiple abiotic stresses and for their biotic interaction with natural soil microorganisms (mycorrhiza and rhizobacteria).

It should be noted that none of the past and current COST Actions deals with vegetable grafting.

This Action will contribute to the understanding of the biological basis of rootstock-mediated improvement of several vegetable crops and their compatibility, and to identify important “knowledge gaps” that are currently not addressed and can be solved by new researches. New themes for research projects, which could be launched in the EU's Seventh Framework Programme, may be identified.

C. OBJECTIVES AND BENEFITS

C.1 Aim

The aim of the Action is to understand the biological basis of rootstock-mediated improvement of several vegetable crops (tomato, eggplant, pepper, watermelon, melon, and cucumber) and their compatibility by combining the already existing scientific information generated in several COST and non-COST countries as a basis for development and exploitation of new rootstocks.

C.2 Objectives

This Action will also translate into practice the advanced scientific understanding on vegetable grafting with the aim of promoting the integration of this modernized technique as an effective tool for sustainable production of vegetable crops.

Therefore, the secondary objectives are:

- to list the current genetic variability existing in each vegetable species as well as the current breeding programs in COST and no-COST countries (D1, D2, D3);
- to define major physiological and genetic determinants of root and shoot development and compatibility of rootstock-scion (D4);
- to determine the current status of knowledge about rootstock-mediated crop improvement so as to mitigate the impact of biotic, abiotic and combined stresses, thus improving resource use efficiency (D5, D6);
- to list the effects of rootstocks on fruit quality in order to define strategies for a better understanding and exploitation of the signalling processes involved (D7);
- to create an international database with the information generated by the COST Action (eg. disease resistance of rootstocks, abiotic stress tolerance of rootstocks, compatibility issues, sources of rootstocks, vigour effects on scion, grafting techniques, etc.) (D9);
- to define classical and biotechnological breeding strategies to prepare the generation of new rootstocks improving desirable traits in crop varieties of selected species (D8);

- to transfer available knowledge into the practice (D9, D11);
- to use all the information collected to identify particular topics which could be used to develop new research projects (D10).

The list of the deliverables (D) is reported in PART D.2.

The final outcome of the COST Action will be a book which will report the state of the art of knowledge and research on vegetable grafting with suggestions on how to develop and exploit new rootstocks considering their impact on biotic/abiotic stress resistance, resource use efficiency (eg. water, nutrients), and product quality of different vegetable crops.

C.3 How networking within the Action will yield the objectives?

The achievement of the objectives is guaranteed by the expertise of the participants in the network. This assures the complete integration between the knowledge in vegetable grafting research and the application of this knowledge to develop new rootstocks and to facilitate the integration of grafted plants as a significant tool in vegetable crop production. In addition, to better pursue and fulfil the objectives the Action intends to organize:

- Working Groups to develop the scientific part and divulgation activities;
- Short-Term Scientific Missions (STSMs) and Training Schools;
- Workshops at the national/international level;
- Annual conferences presenting the COST activities/results;
- website and divulgation activities;
- publication in international peer-reviewed journals;
- publication of a scientific book.

The scientific and divulgation activities can be easily monitored by the deliverables and milestones of the project. Several “management structures” (eg. Steering Group), which support the Management Committee, will be created for internal monitoring and to cope promptly with any issue arising during the project (Part E), and to assure the achievement of the objectives.

C.4 Potential impact of the Action

Besides the obvious immediate benefits in collecting knowledge on vegetable grafting, the collaboration between the scientific parties will decrease fragmentation of research groups and enhance cooperation within Europe to build a basis for collaborative teamwork. Moreover, the Action will increase the sustainability and competitiveness of seed companies, nursery companies and vegetable growers.

This Action can be considered highly innovative and strategically important for the future development of vegetable grafting techniques, as no such Action or similar projects are currently in progress.

Expected benefits at the scientific level are:

- identification of the current genetic variability in each vegetable species, as well as the existing programs for selection and breeding of rootstocks;
- definition of the major physiological and genetic determinants of root and shoot development and compatibility of rootstock-scion;
- improvement of the knowledge about rootstock mediated crop improvement for reducing the impact of biotic, abiotic and combined stresses, thus improving resource use efficiency;
- identification of rootstock effects on product quality with particular emphasis on nutritional quality;
- definition of classical and biotechnological breeding strategies for the generation of new rootstocks to improve desirable traits in crop varieties of selected species;
- centralising data collected from different countries, enabling researchers to make a comparative analysis of the response of grafted plants in different environmental conditions;
- enhancement of the international status of European research and consolidation of Europe's role in international research on vegetable grafting;
- promoting the involvement of researchers in new European initiatives, such as FP7.

Economic and society benefits are:

- establishment of collaboration between public research institutions and the private sector (seed companies, nursery companies, vegetable growers);
- recognition and listing of the R&D efforts for the development of the vegetable grafting sector in COST countries;
- extending availability of resources for professionals and practitioners (eg. website);
- identification of the utility of grafted plants in different European vegetable production areas with particular emphasis on how grafted plants can ameliorate the efficiency of resource use and the quality of rural life by reducing the need of chemical applications (eg. pesticides), and improve the quality and safety of food for the consumers;
- development of new rootstocks capable of minimizing the negative impact of biotic/abiotic stresses on yield by increasing resource use efficiency, thereby reducing the environmental footprint of agriculture, and significantly improving the commercial and nutritional quality of the product, thus opening new market opportunities.

C.5 Target groups/end users

The research groups participating in the Action will be continuously in contact with end users (seed companies, nursery companies, vegetable farmers, and other institutions).

The continual interaction with the end-users is also ensured by the fact that some of them (eg. seed companies and nursery companies) have already supported this COST Action. Potential target groups of the COST Action are:

- research institutes working in the field of vegetable grafting and in related fields such as genetics, biochemistry, physiology, agronomy, plant pathology, food science, and rootstock breeding;
- private companies producing seeds, grafting nurseries, machinery for grafting automation;

- vegetable farmers;
- National Ministries of Agriculture and local agricultural extension agencies;
- European regional authorities;
- European Commission services (particularly DG AGRI).

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus

The scientific focus of the Action is targeted to improve the knowledge underlying rootstock-mediated crop improvement, by linking knowhow and expertise from a wide body of researchers including agronomists, plant physiologists, biochemists, molecular biologists, geneticists, breeders, nurseries and growers, in order to integrate this modernized technology as an efficient tool for the sustainable production of high-quality vegetables.

This Action is organized in four main tasks to implement the collaboration of scientists, addressed to:

- characterize the genetic resources available in each vegetable species and define classical and biotechnological breeding strategies to generate new rootstocks;
- study the rootstock-scion interactions and graft compatibility;
- identify the rootstock-mediated resistance to biotic and abiotic stresses;
- study the rootstock-mediated improvement of fruit quality.

Each task will be organized in Working Groups (WGs) to facilitate the coordination and exchange between and within each task.

D.2 Scientific work plan methods and means

To achieve the objectives of the Action the work plan is subdivided into four WGs each producing its deliverables for monitoring the progress of the Action.

For each WG the methodology used will be desk research utilising PC to collect information from specific websites and specialized technical and scientific journals. Moreover, all participants are asked to provide existing data from their own research activities financed through their own national/international funding. In addition, a questionnaire will be developed and sent to public institutions and private companies to collect data on germplasm availability and its characteristics and current breeding programs for each selected vegetable crop (tomato, eggplant, pepper, watermelon, melon and cucumber).

The activities will focus on 11 expected deliverables (D) as follows:

D1 – Information about the current status of vegetable grafting in Europe compared with other non-COST countries.

D2 – Information about potentially interesting germplasm for developing new rootstocks.

D3 – Information about current rootstock breeding activities.

D4 – Identification of the major physiological and genetic determinants of root and shoot development and compatibility.

D5 – Identification of the main factors limiting vegetable crop productivity.

D6 – Information about rootstock effects on biotic/abiotic stress resistance and resource use efficiency.

D7 – Information about the rootstock effects on fruit quality with particular emphasis on nutritional quality.

D8 – Identification of further rootstock breeding strategies to generate new rootstocks and to improve desirable traits in crop varieties of selected species.

D9 - Creation of a database containing the main information about vegetable grafting, available to the scientific community, private companies, vegetable growers, and other institutions.

D10 - Providing opportunities for research groups to develop joint research programmes.

D11 - Information sharing through workshops and meetings, internet, scientific publications in journals and books.

WG1 - Genetic resources and rootstock breeding

The task will define the current genetic variability existing in each vegetable species, as well as the existing breeding programs.

Specifically, this WG will collect:

- information about germplasm available for each selected vegetable species;
- information about commercial rootstocks used in COST and non-COST countries;
- information about current breeding programs for developing new rootstocks.

This information can be easily collected from books and articles already published and through an interview questionnaire to seed companies, nursery companies, vegetable grower associations, and institutions.

The results of this work will enable the participants and end users to develop a clear overview of the status of vegetable grafting in some COST and non-COST countries, and the information provided will be useful to identify bottlenecks, limitations and requirements for different species, and to evaluate the potential of new rootstocks and graftable species.

Moreover, starting from the agronomic, physiological and genetic information available and generated in WGs1-4, this WG will also identify classical and biotechnological breeding strategies to generate new rootstocks and to improve desirable traits in crop varieties of selected species. Efforts will be focused on individual rootstocks that are graft-compatible with two or more different species.

Deliverables: D1, D2, D3, D8, D9, D10, D11

WG2 - Rootstock-scion interactions and graft compatibility

This WG will deal with chemical compounds (e.g. hormones, nutrients, proteins, RNAs) and hydraulic signalling between root and shoots.

Specifically, this WG will collect:

- information about the molecular, biochemical and physiological studies related to root-shoot communication;
- information about the factors affecting grafting compatibility.

This information can easily be collected from books and articles already published and from seed companies and nursery companies. Moreover, information can be obtained through the current research activities carried out by WG members.

The WG will be able to define major physiological and genetic determinants of root and shoot development and compatibility of rootstock-scion for each vegetable species. Integrating the information provided by the WG1 with the activity of the WG2 it will be possible to identify the best genetic resources to be used for developing new rootstocks having a high grafting compatibility with the most widely spread cultivars of selected vegetable crops. Thus, the results of this WG will be useful for future breeding programs for the development of new rootstocks (WG1).

Deliverables: D4, D9, D10, D11

WG3 – Rootstock-mediated resistance to biotic and abiotic stresses

This WG will define the current status of knowledge about rootstock-mediated crop improvement to attenuate the impact of biotic, abiotic and combined stresses, and about the improvement of resource use efficiency (eg. water, nutrients) by grafting.

Specifically, this WG will collect:

- information about the main biotic and abiotic stresses for the selected vegetable crops in different countries;
- information about research activities studying the rootstock responses to biotic and/or abiotic stresses and providing insight into the mechanisms underlying these responses;
- information about research activities on the effects of rootstocks on resource use efficiency (e.g. water use efficiency, nutrient use efficiency).

This information can easily be collected from books and articles already published. Moreover, information can be obtained from the current research activities carried out by WG members.

The WG will develop strategies and collaborations with other Working Groups (WG1 and WG2) to gain new insights into the physiological, molecular and genetic mechanisms involved in biotic and abiotic stress resistance.

Deliverables: D5, D6, D9, D10, D11

WG4 – Rootstock-mediated improvement of fruit quality

This WG will compile the information about rootstock effects on the commercial quality of fruits, and will define strategies for a better understanding and exploitation of the processes involved.

Specifically, this WG will collect:

- information about the most important commercial and nutritional quality traits of the selected vegetable crops with particular emphasis on health-promoting compounds;
- information about research activities to study the influence of rootstock on the qualitative traits of products.

This information can easily be collected from books and articles already published. Moreover, information can be obtained from the current research activities carried out by WG members.

The WG will develop strategies and collaborations with other Working Groups (WG1 and WG2) to gain new insights into the physiological, molecular and genetic mechanisms contributing to the determinants of product quality derived from rootstock.

Deliverables: D7, D9, D10, D11

The following actions will be performed to monitor and evaluate the achievement of the objectives:

1) a specific monitoring protocol, 2) monitoring indicators and 3) sources of verification.

The monitoring protocol will be defined by the Management Committee (MC) at the beginning of the Action. It will include the assessment of a set of monitoring indicators on a six-monthly or annual basis, generally shortly before reporting activities to the COST Office.

The monitoring indicators consist in the:

- number of meetings organized;
- amount of communication material produced;
- quantity of items uploaded to the website;
- number of scientific publications in international and national journals produced;
- observance of the timeline for any activity.

Sources of verification are:

- material produced, deliverables and milestones.

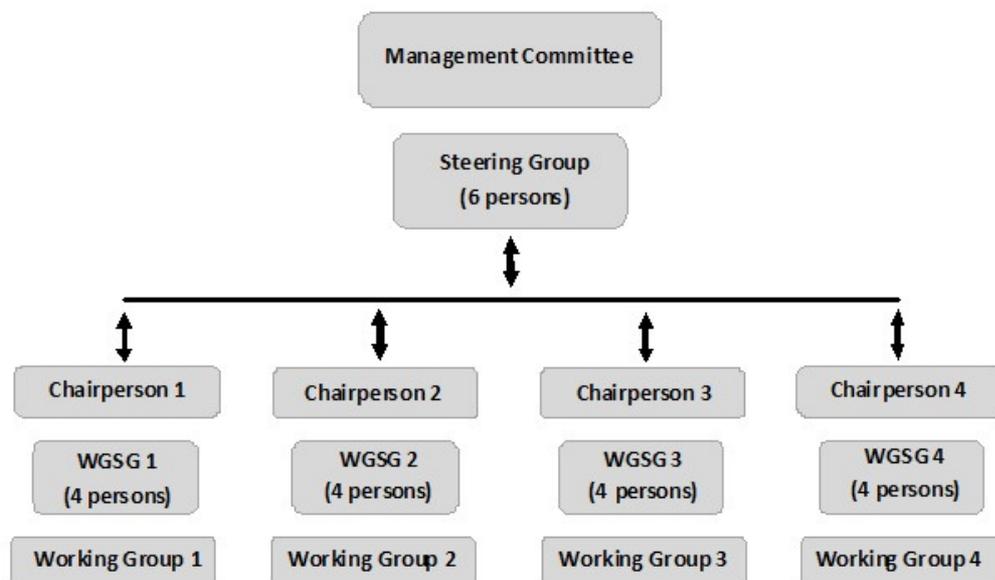
In PART E are reported the milestones useful for monitoring activities and the management structures of the Action.

E. ORGANISATION

E.1 Coordination and organisation

The Action will be coordinated by a Management Committee (MC) and it will establish its operational rules at the first formal meeting (kick-off meeting) in accordance with COST Guidelines. Four Working Groups (WGs) will be established, following COST Rules, to carry out the scientific operations according to the programme set out. In order to reduce overall costs, a Steering Group of the MC (MCSG) will be established. The MCSG to be composed of four members elected by the MC plus the Chairman and the Vice-Chairman of the MC. The MCSG will coordinate the work of the WGs and other elements of the programme. The MC will meet in the opening stages of the Action to plan the initial programme and to elect the chairperson, the Steering Group (MCSG) and other officers. Similarly, in the first WG meeting, the members of each WG will elect a Steering Group (WGSG) of four persons who will coordinate the work within each WG.

Subsequently, the MCSG and WGSG will meet at least twice yearly to oversee the activities and the effectiveness of the 'sub-instruments'. The full MC and the full WGs will meet at least once a year.



The MC will:

- be responsible for the development of the activities of the WGs and the coordination of the different activities;
- facilitate communication among the different partners and modules;
- supervise the development of the project, analyze its results and propose new directions or activities in agreement with the four WGs;
- coordinate the timetable of activities, decide on any modifications and assist the coordinator in the allocation of financial resources;
- supervise the preparation of the general reports of the WGs, and approve the technical reports on the different activities;
- prepare the general reports on activities and other deliverables to be submitted to the COST Commission.

Since an important aspect of the Action is the creation of a website the MC will appoint an Editorial Committee (EC) who will be responsible for the presentation of the outputs from the Action. The EC to be chaired by the ‘Editor’ who will be responsible for the maintenance of the website, hosted by an appropriate institution, and allocating tasks to members of the EC. In the final year of the Action, the EC will work closely with the MC to develop the editorial strategy and the planned deliverables.

Short-Term Scientific Missions (STSMS) and Training Schools will be promoted within this COST Action to implement the exchange and interaction between participants and will favour young scientists (PhD students or Post-docs preferably with less than 8 years of research experience).

The MC will discuss in detail the issue of Training Schools on vegetable grafting at the first meeting of the Action and the MCSG will be involved in the organization of the Training Schools (programme development, selection of trainers, recruitment and selection procedure of trainees). Moreover, the MCSG will be also involved in the STSMS programme and candidate evaluation and selection.

The schedule of the principal activities to be carried out within the Action is:

- a) a kick-off meeting in which the MC will nominate: Chair, Vice-Chair, MCSG, and WG Chairpersons. Each WG will nominate the members of WGSG. The activities of the first year will be planned at this first meeting;
- b) 1 yearly meeting of the MC in conjunction with the WGs, and if necessary one additional meeting per year for the WGs;
- c) 2 meetings per year of the MCSG and WGSGs;
- d) 4 annual Conferences;
- e) STSMSs every year;
- f) 2 Training Schools (probably during the 2nd and 4th year);
- g) six-monthly progress reports (internal monitoring);

- h) annual progress reports to COST Office;
- i) database;
- k) publication of a book reporting the final results of the Action;
- l) Final Report to COST Office.

The milestones are:

MILESTONES	WG	TIME (months)	Means of verification
M1: Decision-making management (MCSG, MCWG, etc.)	1, 2, 3, 4	1	General COST Agenda available
M2: Website set up	1, 2, 3, 4	6	Website available for each participant
M3: Website available	1, 2, 3, 4	12	Website available for public interest
M4: MC and WG activities	1, 2, 3, 4	6, 18, 30, 42	Six-monthly Internal progress report available
M5: MC and WG activities	1, 2, 3, 4	12, 24, 36, 46	Annual report available
M6: Annual Conferences	1, 2, 3, 4	12, 24, 36, 48	Conference report available
M7: STSMS completed	1, 2, 3, 4	12, 24, 36, 48	STSMS internal report available
M8: Training School completed	1, 2, 3, 4	24, 42	Training School internal report available
M9: Genetic resource data and rootstock breeding recommendations	1	44	Internal report and data set available on website
M10: Physiological and genetic determinants of root and shoot development and compatibility of rootstock-scion	2	44	Internal report and data set available on website

M11: Rootstock effects on biotic/abiotic stress resistance and resource use efficiency	3	44	Internal report and data set available on website
M12: Rootstock effects on fruit quality	4	44	Internal report and data set available on website
M13: Final draft of the book	1, 2, 3, 4	46	COST data collected and analysed
M14: COST BOOK	1, 2, 3, 4	48	Book published

The WGs will present their findings at the annual Conferences and their scientific progress will be utilised by the Training Schools and by researchers undertaking STSMs (in laboratories and at the WG meetings). The WG meetings will be an opportunity to present research findings and plan for the future.

In general the WG meetings will be held in conjunction with the meeting of the other Committees. When possible, these meetings should be scheduled with relevant international conferences so as to benefit as much as possible from the opportunity of exchanging knowledge.

Between meetings, the website collaboration platform (with restricted access) will be used. After each meeting, the website open-access section will be updated, publishing the WG's scientific findings and practical recommendations.

Each WG Chairperson will provide a six-monthly internal report to the MC Chairperson on the work carried out which will be distributed to the participant institutions as confidential. This report will be used in preparing the annual report.

E.3 Liaison and interaction with other research programmes

Particular liaison could be with COST Actions FA1105, FA0905, and FA0605.

Consequently, the Chair and/or representative of the WGs will be invited to join the second meeting of this COST Action so as to organise the exchange and integration among these COST Actions. In addition, part of the website will be also dedicated to a continuous interchange of information between these COST Actions.

Moreover, interaction with the current project ‘Development of grafting technology to improve sustainability and competitiveness of the U.S. fruiting vegetable industry’ (Director: Prof. Frank Louws from North Carolina State University) will contribute to raise the European network’s international status.

E.4 Gender balance and involvement of early-stage researchers

“This COST Action will respect an appropriate gender balance in all its activities and the Management Committee (MC) will place this as a standard item on all its MC agendas. The Action will also be committed to considerably involve early-stage researchers. This item will also be placed as a standard item on all MC agendas.”

Gender balance and the involvement of early-stage researchers will be observed at all levels. The MC and MCSG are required to respect the gender balance following the European Community indications in:

- the assignation of responsibilities within the Action;
- the selection procedure for the STSMs;
- the selection procedure for the Training Schools.

In recruitment, constant efforts will be made to achieve a gender balance. In addition, the MC and MCSG will advertise in organizations open to equal opportunity recruitment. MCSG will specify on the application form that it is an equal opportunity employer, and professors will be asked to encourage female students to apply.

The MCSG will advertise the STSMs and Training Schools internationally using the website of this Action, the CORDIS server of the European Community (European Mobility Portal), the internet home page of each participant organization, the website of national scientific organizations related to the project subject, mailing-lists of the scientists, posters at Conferences and Meetings, etc.

The MCSG supervises the STSMs assignation and the participants to the Training School, encouraging the recruitment, in observance of the gender balance, of early stage researchers.

Depending on each host or student expertise, the selection criteria for STSMs and Training Schools will be based on the Degree and Curriculum Vitae of each candidate, considering his/her affinity to the Action activity (students in the fields of horticulture, plant physiology, agronomy, molecular biology, genetics and breeding could be the target groups).

The COST rules will be at the base of the STSMs and Training Schools appointment.

F. TIMETABLE

The Action will operate for four years. The calendar of events and meetings will be as follows:

Activity	Year 1		Year 2		Year 3		Year 4	
	1-6	7-12	13-18	19-24	25-30	31-36	37-42	43-48
Kick-off meeting	X							
MC meeting	X			X		X		X
MCSG meeting	X	X	X	X	X	X	X	X
WG meeting	X	X		X		X		X
WGSg meeting	X	X	X	X	X	X	X	X
STSMS		X	X	X	X	X	X	X
Training School				X			X	
Website and dissemination		X	X	X	X	X	X	X
Annual Conference		X		X		X		X
Final Book								X

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or have otherwise indicated their interest: DE, EL, ES, FR, HR, HU, IL, IT, NL, PT, TR, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 48 Million € for the total duration of the Action. This estimate is valid assuming that all the above mentioned countries but no others will participate in the Action. Any variation in the participating countries will modify the total cost.

H. DISSEMINATION PLAN

H.1 Who?

The target audiences for the dissemination are:

- members of University and Research Institutions who are involved in horticulture, agronomy, plant genetics and breeding, plant molecular biology, plant nutrition, plant physiology and biochemistry, plant pathology, and food science;
- vegetable farmers;
- farm advisers and professional associations;
- seed and plant breeding companies;
- nursery companies producing vegetable grafted plants;
- private companies producing machines for grafting automation;
- regional, national and European organisations involved in policy-making.

H.2 What?

For members of Universities and Research Institutions, the output of the Action will be disseminated by posting general information (including downloadable files) on the Action's website, limiting the access to some documents in a password protected area of the site. An internet discussion forum will be available, and extensive use will be made of e-mail. The available information will include publications, WG reports, a final report, and the final book. There will be links from other websites (e.g. other current projects related to vegetable grafting) and from the websites of the participants.

The same sources will be available to other intended recipients of the deliverables from the Action: vegetable farmers, breeders, nursery workers, farm advisers, etc. In addition, participants to the Action will provide articles for national magazines, whose circulation includes these groups. The attention of decision makers, columnists and opinion makers, will be caught by personal communications and press releases by the participating organizations. The Action will create:

- a website in which the proceedings of the meetings and workshops will be posted;

- an electronic database with the data provided by the WGs (eg. available germplasm, available rootstocks and their characteristics, grafting compatibility, scion-rootstock interactions), and the publications generated during the Action;
- an expert network recommending the scion-rootstock combinations most appropriate for use under specific environmental conditions;
- a scientific book on vegetable grafting;
- articles published in refereed journals;
- articles published in proceedings of national/international conferences;
- a final report with suggestions for future coordinated research.

H.3 How?

In order to obtain the most significant impact from the Action and facilitate dissemination it is planned that the results will be disseminated locally or internationally by:

- oral and poster presentations at meetings or congresses;
- interviews released to local newspapers or TV;
- internet website;
- teaching activities;
- exchanges of students and researchers;
- technical articles in peer-reviewed scientific journals;
- publication of a book reporting the final results.

All possible representatives of the different target audiences (see H1) will be invited to the annual conferences in order to encourage multi-disciplinarity on vegetable grafting. In addition, journalists will be invited to the final meeting so as to communicate the results of the Action to the public.

Since all the results achieved in the course of the Action will be made public (mostly available through the website) no specific provision is made to protect intellectual property.

It is understood that researchers from Universities and Research Institutes will use the output from the project to further their research and to back up the application for funding of new research ideas. It is also to be anticipated that parties concerned with vegetable grafting (e.g. vegetable growers, nurseries) will use the information for practical purposes – either directly or more likely through the actions of advisers. The book and the final report will provide a valuable resource for the activities of planners and decision makers.
