

COST

Domain Committee "Food & Agriculture"

COST Action (FA0906)

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UV4Growth

*UV-B radiation: A Specific Regulator of Plant Growth
and Food Quality in a Changing Climate*

FINAL EVALUATION REPORT

This Report stems from the relevant Domain Committee.
It contains four parts:

III. Evaluation Report prepared by the "ad hoc" Evaluation Panel, established by the Domain Committee, and edited by the COST Office.

1. Evaluation panel and evaluation procedures

This evaluation is based on reports and documents provided by the Action chair (draft final report including all Annexes) and the Action's website. Both evaluators attended the final conference in Bled and had a short evaluation meeting with Action chair, vice-chair and WG leaders. The rapporteur also attended the 2013 Annual Network Meeting in Mikulov.

2. Results versus objectives

The main objective of the UV4Growth COST Action "to bring together, coordinate, and enhance the performance of nationally-funded research activities by forming a coherent, interdisciplinary research & training Network that will develop an integrated vision on the regulatory role of UV-B in plant growth and development at cell, organism and ecosystem level" was ambitious both in scope and depth. The scientific programme focused on coordination and stimulation of research in four complementary themes, each represented by a Working Group (WG) and in addition 3 Technical Groups (TG) on UV technology, on dissemination and on training and education operating across the four WGs.

WG1: Nuclear regulation by UV-B radiation

WG2: UV-B-induced metabolic changes

WG3: Organismal responses to UV-B radiation

WG 4: UV-B and climate change

Based on the activities, publications, training programs and outreach efforts, the leadership, management committee, individual investigators, students and group leaders in this Action have met, and in some cases, exceeded their original stated objective (including the specific objectives outlined elsewhere). In addition, the network of researchers established by this COST Action has demonstrated a level of collegiality and common pursuits and willingness to consider and adopt experimental techniques used by the other sub-disciplines represents a significant accomplishment of this Action. The external evaluator described the final meeting as one of the most enjoyable and productive scientific meetings he ever attended. It is desirable that these collaborations developed over the past 4 years in this network will continue to grow over time and further enhance the community of UV researchers in the EU and to build on the momentum achieved over the past 4 years.

3. Innovative networking

The development of this network has produced new knowledge and significant scientific breakthroughs in a number of areas of UV photobiology, as evidenced by the group's recent publications in the scientific literature. Research resulting from this network has significantly enhanced our understanding of the regulatory role of UV in plant growth and development, and improved our understanding of the linkages between molecular events of UV signal perception and transduction relate to growth, physiological and biochemical changes at the level of the whole plant. Researchers in this network have significantly expanded our understanding of the role of UV in influencing plant chemistry and, in turn, the potential for utilizing UV exposure to modify food quality, nutrition, pest-pathogen resistance and overall "hardiness" of plants to tolerate multiple environmental stresses. These particular research findings represent a significant departure from traditional views of plant responses to UV and have resulted in a major "paradigm shift" with respect to the scientific view of plants and UV.

The publication of the handbook of "best practices" for conducting UV research has quickly become the standard reference for all those investigators and students entering the field. For the first time, this handbook provides information on a number of unique technical issues related to UV light sources, manipulation of UV exposures, the measurement of UV radiation and the use of biological weighting functions to determine appropriate UV exposures in a single book that is readily accessible.

The fundamental scientific findings produced by this network have further laid the groundwork for the application of UV in agriculture, viticulture and horticulture. In this regard, outreach efforts to the horticultural industry via stakeholder meetings are particularly noteworthy. Finally, the network has done a solid job in developing the next generation of scientists through their STSMs and training schools. Training students in an interdisciplinary context, such as this network, is absolutely essential but this would be impossible without a network such as this in place. The commitment of the leaders and individual investigators to the educational mission of this network is truly commendable.

COST UV4Growth has in addition produced an educational text and in order to enhance funding opportunities for plant UV-research in Europe, a summary text to lobby national and European funding bodies in a coordinated manner has been made available. In addition, members of this network have published layman's texts in multiple European languages in an effort to communicate their findings as broad as possible to producers and members of the horticultural industry.

4. Inter-disciplinary networking

Since its inception, the network has grown into a multidisciplinary network with new collaborations with agronomists, chemists, meteorologists, physicists, and food scientists. Two examples of the strong inter/multi-disciplinary aspect of this network include:

- 1) the establishment of the European Grapevine Ultraviolet Network (GUN) to examine relationships between wine grape chemistry, UV meteorology and cultivation practices, and
- 2) establishment of the Trans-European *Arabidopsis* experiment to explore latitudinal/geographic patterns in growth and chemistry in *Arabidopsis* plants differing in molecular UV signalling mechanisms. These two collaborative efforts go beyond the original set of goals and objectives of a COST Action. The research activities are still underway and most likely will have the potential to provide new, innovative insights into understanding the ecological role of the UV photoreceptor in modulating plant growth and chemistry and the importance of UV in viticulture. Hence, it is critical that the network can achieve sufficient funding to maintain and continue these studies after the COST Action has ended.

This network has also developed a strong connection between academic researchers and the horticultural industry through several stakeholder meetings. These meetings addressed how UV could be used as a tool to improve plant quality and resistance to pests and pathogens and enabled researchers to interact directly with industry personnel to discuss issues of concern to producers. There appears to be a strong interest among many in this network to further expand these interactions and relationships with industry, and this should be viewed as a very positive and significant outcome of this COST Action.

5. *New networking*

The UV4Growth network comprises 255 participants from 28 countries. Early Stage Researchers are well represented in all scientific and management fields. Training of ESR was a key priority for UV4Growth, the Action also produced a regular newsletter for ESRs.

The network has reached out to involve several UV researchers in non-COST countries, including New Zealand, Australia and Ukraine. These actions have strengthened the scientific expertise in a number of areas, particularly the horticultural sciences and development biology (one of these participants is the current co-chair of the UNEP-Environmental Effects Assessment Panel). The scientific findings from this network can also play a substantial role in the development of the UNEP report.

The organizers of the final meeting invited also speakers from a number of other countries (e.g., USA, Argentina, Israel) that further established the international reputation and reach of this network. These scientists not only participated in the meeting but developed new collaborative research project with network members. As a result of these activities, this network has now grown into a global network of UV researchers that is profoundly influencing research activities around the world.

Participants of this network have also made substantial efforts to reach out to the broader community through a number of outreach activities. These include an educational text targeting secondary school children, stakeholder meetings involving individuals in the horticultural industry culminating in a layman's text on UV-applications, the publication of the UV handbook of best practices (described previously), the development and maintenance of a network website, and the publication of a substantial number of scientific papers in international journals.

6. *Coordination and management*

The success of any large organization, such as this network, ultimately hinges on the quality of the leadership, which provides the vision for the group's activities, coordinates the various events and activities, manages the budget and develops a working administrative structure. It would therefore seem obvious that the huge success of this network must, to a significant degree, be attributable to the strong leadership qualities of the Chair and Vice Chair. Both have proven themselves to be effective and well-respected leaders of this network. Their ability to work together and clearly articulate a vision for this network is notable. Both of these individuals have also worked unselfishly to facilitate the work and activities of others in the network, to encourage the development of the next generation of scientific investigators, and to push the boundaries of this network to include others outside of academia and the EU. Their efforts are commendable and have provided the critical "glue" that holds this network together.

The administrative structure of this network, which includes the Management Committee (MC) and several working groups (WG) and technical groups (TG) has also proven to be effective in organizing and mobilizing activities within the network. The sheer number of meetings held, the quantity and quality of the products resulting from these activities, and the degree of cooperation of individuals within the network attest to the effectiveness of the MC and the leaders in the various working and technical groups. Importantly, the various WGs and TGs have not operated in isolation of one another such that considerable "cross-talk" exists among the various groups, which further fosters the networks strong interdisciplinary nature and collegiality.

7. Strengths and weaknesses

Strengths:

- The UV4Growth network has shown itself to be a model program for scientific collaboration, community building, student training and outreach to the general public. This network has even exceeded initial expectations and objectives, and has obtained high visibility outside the EU. As a result of this COST Action, the community of UV researchers in the EU has positioned itself as the global leader of UV research and this group is largely setting the agenda for scientific inquiry in this discipline. Scientists from around the world are now looking to EU scientists for novel contributions to the field, new collaborations, technical innovations and policy-relevant research. In short, there is no such vibrant community of UV researchers in any other place at the present time.
- The strengths of this network also go beyond the scientific community. As a result of this COST Action, this network has advanced the linkages between fundamental science and applied scientific fields of horticulture, viticulture and sustainable agriculture. These connections are of considerable economic and social importance and can well result in future collaborations with industry that result in the incorporation of basic scientific principles of UV effects on plant growth, development and chemistry into practices that improve food quantity and quality, reduce the dependence upon pesticides for pest and pathogen control, and provide for greater food security in the face of global climate change. Future efforts should consider strengthening these connections with industry.
- Another notable strength of this network is the high degree of collegiality and cooperation among investigators and students. There is a commitment to studying and understanding UV biological processes across scales (molecules to ecosystems) that is rarely observed in the scientific community. This, in significant measure, reflects the commitment and passion of the leadership, who envisioned a community of scholars working towards this goal from the beginning.
- The GUN network and the Trans-European *Arabidopsis* study – these collaborative efforts go beyond the original set of goals and objectives of a COST network and have the potential to provide new, innovative insights into understanding the ecological role of the UV photoreceptor in modulating plant growth and chemistry and the importance of UV in viticulture.
- COST UV4Growth has given high emphasis to training/exchanges (training schools and STSMs); it is however unclear if efforts have been made to assess the long-term significance of these educational opportunities for the future career paths of students. The maintenance of the program's website with specific opportunities to stay connected with students and alumni of the program over time could provide some of this information.
- There are strong efforts and commitment from the group to continue the collaborations after the COST Action has ended (maintaining the network as international association or society)

Weaknesses:

- An enhanced emphasis on ecosystem science, modelling and explicit linkages with climate change would be a positive endeavour that would enhance integration and scaling efforts. There appears to be limited mathematical modelling involved in this network that would serve to integrate findings across scales of organization.
- Stronger linkages with the meteorological community to provide short- and long-term UV climatological data should be considered a priority for future
- A key difficulty for the Action concerned the administrative support within the grant holder institution and the lack of compliance between funding rules of COST and the grant-holder institution resulting in an underspending of available budget and limitations in making full use of a budget year for the planning of activities
- The Actions' website could contain more updated information on recent activities and it is suggested to maintain the Action's website after the COST Action has ended.