

TECHNICAL SPECIFICATIONS DOCUMENT

Call for Research Innovation Development proposals as part of the “Action Plan against declining vineyards”

SUBJECT: the aim of this technical specifications document is to define the technical and scientific programmes that are envisioned as part of the call for proposals regarding the control of vine dieback.

This document is the counterpart of the FranceAgriMer technical specifications document **INTV-SANAEI-2018-34**.

1 - Context and objectives

“Vine dieback” refers to a year-on-year decrease in the vine’s productivity, which may be followed by an early, sudden or progressive death. These diebacks are linked to a host of biological or environmental factors, as well as agricultural practices, which contribute to the gradual weakening of the vine. In the absence of control measures, these may trigger an irreversible process.

To support the fight against this epidemic, a study has been carried out by FranceAgriMer and the Comité National des Interprofessions des Vins à appellation d’origine (CNIV) [National Committee of Inter-branch Organisations of Wines with Protected Designations of Origin and Geographical Indications]. The aim of this study was to conduct a critical review of the knowledge concerning vine dieback.

This study indicates that dieback should be regarded not as a simple “disease”, or group of diseases, but as a multifactorial issue, requiring a systemic approach. Furthermore, the review of scientific knowledge revealed that the role of pathogenic agents is fairly well studied, but that little to nothing is known about the effects linked to the soil and the root system, the climate, the physiology of the grafted plant, as well as the effects caused by the agricultural norms exacted by regional technical specifications. Finally, current knowledge is more focussed on yield than longevity.

A national multi-year strategy for controlling vine dieback has been implemented by the CNIV and the French Government. It is based on 4 complementary and interdependent ambitions:

1. Wine growers playing an integral role in the fight: the creation of a network of players, to promote training and transmission of good practices,
2. Supply of plant material: for the production of young plants in partnership with viticultural nurseries,
3. Vineyard observatory: the creation of coordinated networks for vineyard observation, in order to pre-empt crises and identify corrective actions,
4. Research Innovation Development: for research that meets the industry’s needs, in renewed partnership with the scientific community.

This call for proposals aims to mobilise the research, innovation and development community to together create the answers and solutions that are required by practitioners, as part of the national strategy for the control of vine dieback. These efforts must be designed with the goal of producing high-quality wines.

The selected projects will be co-financed by the French Government and the inter-branch organisations/CNIV.

The call for proposals also covers primary actions that may be implemented as part of the annual programme of the Institut Français de la Vigne et du Vin [French Institute of the Vine and Wine] for the control of vine dieback.

2 Topics of the call for proposals

Understanding vine dieback and the development of preventive or control methods, require a systemic, cross-disciplinary approach.

Pluri-disciplinary projects, with many different players, are also envisioned, as well as more targeted projects, on a specific question, which may be of a short duration. The short projects could, for example, be the result of previous projects which had produced interesting results (in such a case, the need for further work must be well-argued).

The projects must be within the framework of one or several of the 5 topics described below. The projects must be innovative and clearly contribute to improving the control of dieback.

The projects are expected to share knowledge in line with the goals of the national strategy for the control of vine dieback. Partnerships between research and development are encouraged. Projects will be obliged to share results and data with the tools created as part of the national strategy. Decision-making tools will be finalised each time the subject allows it.

The call for proposals relates to viticulture, however other sectors, such as forestry, have built up scientific expertise on the subject of dieback. A scientific dialogue with these fields is encouraged, in the form of collaborations for example. The project and its bibliographic analysis should thus treat the general issue of dieback for all different species.

The key topics of the **2019 call for proposals** will remain the same as in 2017 and 2018, and any project within this framework is eligible.

Topic 1: Yield and longevity, on the vine or at parcel level, in conjunction with the physiological processes involved in the creation of components of the production and their determinants:

We wish to build up academic and operational knowledge on the physiological determinants of the plant's condition, its longevity, and the creation of yield. The causal link between dieback and, in particular, the interactions with its pathological determinants (topic 3) should be taken into account. In general terms, it is essential to consider these from the perspective of dynamic processes and taking place over a long period of time. The proposed solutions must respect the quality of the finished product. Projects will address the following questions, which are not exhaustive:

- Definition of quantitative and qualitative criteria and methods for dieback observation in the vineyard:

Examples of this are studies that measure the condition of the vine's defence, the development or transposition of methods to monitor the dynamics of the processes, the development of non-

destructive techniques to evaluate the vine's vigour and the condition of its reserves (even retrospectively), as well as any objective measurement of growth which may indicate dieback. Inspiration may be taken from models that have been developed on other perennial plants, such as the Manion model, that include the effect of predisposing, triggering and aggravating factors.

- Understanding the allocation of resources and the impact of stress:

This may involve studies on the growth process, the constitution and remobilisation of reserves, and the creation of yield. In particular, concepts of biotic and abiotic stress should be included in order to understand the disturbance caused, as well as the effect of agricultural practices over a period of several years. The specificities of a grafted plant should be taken into account. The use of knowledge gained on other biological systems is essential here, in order to make faster progress on the vine.

- Modelling the plant's physiological condition:

Approaches that use modelling are encouraged, especially to create a comprehensive and integrated vision of how dieback functions on the plant or at parcel level (without forgetting the root system). Modelling may also be used to develop decision-making tools (for example for selecting technical itineraries). We are looking for models that integrate a dynamic, multi-year vision of the processes. Some examples of the elements that should be taken into account are: the creation and mobilisation of reserves, the effect of agricultural practices (including fertilisation, pruning, yield management, and also the frequent and continuous use of phytosanitary products, etc.), and the interactions with biological attacks. Any type of model is eligible, whether it be systemic or focussed on one particular process, so long as it contributes to the understanding of dieback and its impact on the yield and longevity of the vine or parcel, in line with a "sustainably productive vine" approach.

Topic 2: The root ecosystem and the interaction between the plant and the soil, especially its biotic component; effects of agricultural practices on these interactions:

This topic involves advancing the knowledge on the link between the vine's health and the soil's physical, chemical and biological quality. We are seeking answers on the long-term impact of certain practices. Projects that propose solutions to restore deteriorated soils will be of particular interest.

Improving knowledge of soil quality and development soil quality indicators. Projects should address the potential relationships between the soil structure, soil preparation before plantation, previous crops, the method for establishing or managing the vineyard (crop cover, ploughing, chemical weed-removal, fertilisation, irrigation, etc.) and vine dieback. They will address the effects of these practices on the soil's physico-chemical and biological functioning, and ideally of the consequences on root development and the physiological condition of the vine. We looking for the development of indicators of the physical, chemical and biological quality of the soil. These should be adapted to the vine and its environment, and help to improve our understanding of how the plant functions when suffering from dieback. These indicators should not be limited to the surface horizon, but should take into account the deeper horizons which interact with the vine's root system.

Interactions between the vine and the associated organisms

The vine's physiology influences the structure and composition of the community of associated organisms, as well as the ecological and trophic interactions between the organisms found in the different habitats of the plant (root system, trunk, leaf area). We are looking for projects which help to understand the link between the composition and the functioning of the microbial

communities and the vine's health and physiological condition. They may also address more specific effects of certain microorganisms (symbiotic partners, growth promoters, those that elicit defence mechanisms) in the context of vine dieback. Projects that address the link between the growth restart of the young plant, or the functioning of the rootstock (see topic 4), and the composition and functioning of associated microorganisms, will be of particular interest.

Topic 3: The prevention and control of biological risks in order to combat dieback:

This involves better understanding and characterising the risk linked to biological agents and to propose preventive means for their control. The biology of the pathogenic fungi responsible for "trunk diseases" is a well-studied field, with a well-established body of knowledge. If there are further advances to be made in this field, the challenge will be to establish more systemic approaches, which combine the impact of associated microorganisms, and their interactions with the plant's physiology, with a vision of the dynamics over long time periods, etc. The role of other pathogenic organisms and emerging pathologies (particularly viruses and phytoplasmas) in dieback remains to be explored. We envision that this topic may help to develop models of the vine's functioning, as described in topic 1.

- Understanding the role played by pathogenic agents in triggering, predisposing or aggravating dieback

There are several complex pathologies linked directly or indirectly to dieback. The presence of potentially pathogenic agents does not necessarily cause symptoms or damage. The factors that cause them to transition towards pathogenic behaviour are not understood. An understanding of the exact role of potentially pathogenic organisms in the onset of dieback is still lacking. This understanding requires knowledge of the interactions between these organisms' biology, the plant's physiology, and the effects of the environment when a vine goes from non-symptomatic to a state of dieback.

- Epidemiological approach to dieback:

It is necessary to develop an epidemiological approach, on the scale of the parcel and bigger, in order to understand dieback and to assess the relative importance of the risks. One challenge will be to create long-term, multifactorial data records, which integrate the plant and the environmental conditions, agricultural practices, and particularly the repeated, long-term use of phytosanitary products. The implementation of an observatory of dieback phenomena (ambition 3 of the strategy) should contribute to, and benefit from, the studies undertaken in this context. The quality of the statistical analysis of the data and their general usage will be of particular interest. Finally, for certain diseases, the biology of the vectors may be a factor to be taken into account.

- Continuation of research on control methods:

We are looking for projects that lead to innovations in the control of the pathogenic agents involved in dieback. These may be based on the understanding and manipulation of the molecular dialogue with the plant, on the development of biocontrol or defence stimulation agents, or on the creation of less sensitive varieties, along with specific practices (pruning methods, vigour/yield management, etc.), amongst other factors.

Topic 4: Controlling the creation of young vines and their establishment in the vineyard:

Topic 4 is aimed at questions relating to the grafting process, the relationship between the grafted plant and the rootstock, as well as the quality of the young plant and the plantation.

- The production and quality of the young plant:

This involves studies on the preparation of cuttings and the production of young plants, with the aim of improving their physiology and health, as well as their capacity to restart growth. This also involves nurseries' growing practices and their influence on the future quality of the young plants and on the adult plants' physiology and health.

Projects on the conditions of vineyard establishment and improving the success rate of plant regrowth will be of particular interest. We are particularly interested in indicators of the young plant's quality at the time of regrowth, the first harvest and over the long term.

- The relationship between the grafted plant and the rootstock:

The establishment of the graft and the relationships between the two plant components are probably factors that explain certain dieback phenomena. It is important to improve the knowledge of grafting physiology, and the interaction between the grafted plant and the biotic and abiotic environmental factors. The type of graft and the genotypes used should be considered. Lastly, there is the question of the health of the grafted material. Quality indicators should be established.

Topic 5: Socio-economic levers for the control of dieback:

We are looking for projects that make use of the social sciences and the analysis of socio-technical systems in order to:

- Understand how economic, organisational and cultural constraints influence the risk associated with dieback, and how these constraints limit the adoption of more sound practices. Economic or organisational levers which might influence high-risk practices should also be identified.
- Implement procedures for intervention/action research or participatory research to support changes in practices and organisational methods.

For example, projects may relate to:

- The perception that the wine growers and, more broadly, all those involved in wine production, have of vine dieback. In particular, the influence of the operational procedures (marketing and/or production methods, size, structure, etc.) on this perception may be explored and, conversely, the influence of vineyard dieback on these operations.
- The analysis of the influences and constraints exerted by the structure of the industry, the markets, and the public or private regulations on viticultural practice, and whether these facilitate or inhibit certain technical decisions.
- Access to information and advice, according to the wine grower's professional organisation (cooperative, independent winery, *negociant*, etc.). Attention should be paid to the role of continuing education in building knowledge and implementing innovative methods and tools against dieback.

- The change process, and the organisational methods that facilitates this.

3 – General characteristics of the project

3.1 Working within the framework of the Research, Innovation and Development Strategy for the National Strategy against Vine Dieback

The projects will encompass studies and experiments, knowledge acquisition or enhancement, innovation in terms of technical itineraries, creation of tools and methods, as well as proposals for recommendations and rules for decision-making.

Their desired results and how the projects will contribute to the fight against vine dieback should be very explicit. They should prioritise a transversal approach to the Strategy's themes, with interdisciplinary project teams, which draw on knowledge obtained from research and development on the subject of dieback control in other fields.

3.2 Innovation and partnership:

The innovative nature of the project will be an essential evaluation criterion, whether this concerns methods and techniques, or the ability to improve our knowledge on the control of vine dieback.

Close attention should be paid to the bibliography, incorporating French and international publications on the vine and other perennial plants affected by dieback. The various national strategy documents should be consulted when drawing up the project, and the links between the strategy's goals and the project's aims should be set out. An indicative list of these publications can be found in this technical specifications document. It should be noted that bibliography and prior research are not included in the scope of project financing.

The quality and relevance of partnerships will be examined. It would be of great advantage to collaborate with one or several agricultural education bodies specialised in viticulture, given their impact on experimentation and the dissemination of innovative agricultural practices.

Projects submitted as part of this call for proposals may be part of a larger project, with components that have been submitted for calls for proposals not financed by programme 776 of the CAS DAR.

Partnerships with development agencies or European research centres are accepted and encouraged, as part of bilateral cooperations or European programmes. In these cases, each foreign partner should ensure its own financing in the project, or may be associated as a service provider.

3.3 Results and knowledge sharing:

The expected results should be defined for the scientific aspects, as well as on an organisational, methodological, or educational level. The innovation in control methods, the creation of sustainable viticultural systems, or models of the functioning of plants or parcels suffering from dieback are of particular interest; these may help to better integrate knowledge or be part of a complete decision-making tool.

Particular attention will be paid to the dissemination of the results and their sharing with practitioners within the viticulture industry.

The projects' results and raw data should be available and directly accessible. They should be able to feed into the national observatory's database, established as part of the Dieback strategy (ambition 3), and the collaborative platform www.plan-deperissement-vigne.fr (ambition 1).

Other means of results sharing, beyond the project's partner organisations, should be planned and described according to the target audiences.

Project leaders should ensure that the project's methods are in line with the actions of objective 3 of PNDAR 2014-2020 (please see CAB/2013-2003 bulletin of 20 June 2013). This concerns the optimisation of production, capitalisation, sharing and use of data (references), methods, tools and results, by focussing on interoperability.

When the project has restrictions on the access to, or sharing of, results, due to intellectual property rights or confidentiality clauses with certain partners, these must be stated. In this case, a consortium agreement must be established between the project partners prior to the start of the project. This agreement should precisely set out the intellectual property clauses.

3.4 Length of projects:

The maximum time frame for projects is 42 months. A project can be planned for a shorter length (short projects on a specific topic are welcome). The pertinence of the actions involved, the results to be achieved and the length of the project is examined by the scientific council responsible for the evaluation and scientific approval of projects submitted as part of this call for proposals.

The length of the project includes the technical and scientific process, as well as the transfer, use and sharing of results.

3.5 Funding and application submission process

The funding and application submission process is set out by FranceAgriMer in INTV-SANAEI-2018-34.

4 – Documentary sources and reference documents

<http://www.franceagrimer.fr/filiere-vin-et-cidriculture/Vin/Aides/Appel-a-propositions-du-Plan-National-Deperissement-du-Vignoble>
<https://www.plan-deperissement-vigne.fr>

Launch of the national strategy for the control of vine dieback

- final report by the BIPE consulting firm
- vineyard dieback strategy pamphlet
- proceedings from the conference of 9 September 2016
- Dieback factors information sheet
- 2017 and 2018 winning projects information sheet