Science diplomacy for plant health

The battle between humans and plant pests is as old as agriculture, but the movement of pests as a consequence of human activities has been exacerbated only recently. International research collaboration is increasingly important to tackle pests causing serious damage to economies.

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Global food security is one of the main societal challenges of the twenty-first century that can only be addressed if we consider its complexity: an increased human population with changing dietary habits[1] will have to produce more on degraded land[2], with plant varieties whose yield can barely be increased[3], under changing climatic conditions[4] while facing the loss of biodiversity[5] and the threats posed by crop pests[6].

The battle between humans and plant pests is as old as agriculture, but the movement of pests as a consequence of human activities has been exacerbated only recently[7,8]. Increased trade and tourism contribute to the global movement of pests that emerge in unexpected places and at a previously unforeseen pace; plant pests introduced into one country spread naturally, or move through trade, to another country. But international trade has also been suggested to provide part of the solution to meet future global food demands[9]. Balancing these issues requires a multi-actor, well-coordinated response. Partnerships are key to deliver technical support to countries, including forecasting and early warning followed by enhancing preparedness as well as implementing preventive measures and outbreak response. In this context, science can provide technical solutions but can also build bridges between national and international communities: science diplomacy allows countries to address challenges that cannot be handled through national activities only. This Comment provides a vision of a global network whose objective is to facilitate international research collaboration and coordination on regulated and emerging pests in order to help overcome some of the limitations of the phytosanitary systems currently in place and to better protect countries and their agriculture, environment and trade activities. As international research collaboration feeds on the dialogue of national communities, the establishment of a global network will also aim to strengthen national communication between different plant health stakeholders and coordinate their activities.

A network to catalyse international collaboration

The entry into force of the International Plant Protection Convention (IPPC) in 1952 represented a historical milestone towards the optimization of strategies to address (regulatory) plant health threats through cooperation between countries[10]. One of the IPPC's key activities is to develop and promote the implementation of internationally agreed, science-based standards in the regulation of plants and plant products as they move across international boundaries. But the attempts to rationalize efforts have been fragilized by the inefficient and often neglected communication between plant health authorities and the other national, regional and international players: research funders, policymakers, scientists, industries and professional operators. Moreover, scientists working on regulated pests have traditionally worked in isolation, as plant health issues and their trade sensitive impacts have largely been seen through national prisms. The 1995 Agreement on the Application of Sanitary and Phytosanitary Measures of the World Trade Organization (SPS Agreement)[11] as well as the revision of the IPPC have established international accountability for, and harmonization of, national phytosanitary actions. International research collaboration brings many benefits. Coordination of national efforts would benefit countries that focus on the same problem at the same time. Finding synergies and complementarities among national activities avoids duplication of efforts and enables the more efficient use of national resources. Sharing of information, knowledge and infrastructure would benefit those countries that face the emergence of a pest that may already be routinely managed in another region. Collaboration promotes harmonization of scientific practices and, eventually, of pest regulation policies.

A network to enhance collaboration of national communities

International collaboration is underpinned by the efficient communication among national communities (for example, customs, producers, inspectors, scientists and so on) who share an interest in plant health research because they co-produce or use scientific evidence and knowledge. As an example, national surveillance and monitoring activities can be used to inform priorities and provide early signals for the research activities. Where there is still a tendency to not share information widely from national surveys and monitoring activities, the need to overcome this limitation has been identified. The benefits to channel information from local to global scales and vice versa have recently been presented by Carvajal-Yepes et al.[12]. The need to more efficiently coordinate activities that capture, evaluate, assess and disseminate information on potential and emerging pest threats (horizon scanning) was also discussed at the recent workshop of the G20 Agricultural Chief Scientists (MACS) held in Tsukuba, Japan. Plant diagnostic laboratories can use the methods and information generated from the research activities.

Some examples of multi-actor national research networks already exist, such as the Better Border Biosecurity (B3, New Zealand) and the Plant Biosecurity Research Initiative (PBRI, Australia). However, these are exceptions rather than the rule. National systems should be developed to link the research to the end-users of information and to provide a collaborative space for plant health stakeholders to work together. Linking national disciplinary networks will allow them to expand their scope and scale their research activities. Collaboration allows the creation of a more diverse and critical mass of expertise by linking the challenges faced by countries to the problem-solving capabilities of research organizations, connecting different players and supporting multi-disciplinary approaches.

Global phytosanitary research coordination

International fora that aim to facilitate exchange of information on plant health research activities do exist, such as the International Forestry Quarantine Research Working Group (IFQRG) and the International Pest Risk Research Group (IPRRG). Fora have also been established between governments, such as the Plant Health Quadrilaterals (Quads)[13] or the European Joint Programming Initiatives (JPI), which bring together national research programme owners and managers[14]. Nevertheless, these initiatives, while recommendable, are 'specialized' in terms of the themes they cover or the professionals (scientists, policymakers or research funders) they include. This specialization may limit the visibility of their decisions and actions, and hence awareness of the knowledge produced, and may result in an inefficient uptake by the various stakeholders. Furthermore, the groups mainly discuss, rather than collaborate in, research activities.

As a singularity, the Euphresco network was developed to play the role of a platform for international coordination of phytosanitary research and funding, aimed at reducing the fragmentation and minimizing duplication of national and regional research activities. Euphresco's main aim is to build synergies by identifying complementarities and coordinating activities. The network is a model for effective collaboration and communication between all plant health research players and has contributed to strengthen the links between science as well as decision- and policy-making in a unique way. As Euphresco has largely been seen as a European coordination structure with a few non-European members included, the need for a global research coordination network has been identified by the phytosanitary authorities in many countries. The issue has been prominently addressed in the draft IPPC Strategic Framework for 2020–2030 (ref. [15]), which is expected to be presented for adoption at the fifteenth session of the Commission on Phytosanitary Measures. Such a global network should bring together and facilitate collaboration between national and regional research programme owners and managers interested in addressing issues of agriculture, food safety and biodiversity. It should include authorities such as National Plant Protection Organizations (NPPOs), Regional Plant Protection Organizations (RPPOs) and ministries, as well as representatives from academic, public and private research institutes, industries and professional operators in developed and developing countries.

Steps towards global phytosanitary research coordination

For such a network to be successful, trust must be built between organizations that have different missions, reporting structures and mandates, and that operate in different countries and continents. The establishment of such a global research coordination network will take time and resources, but these resource requirements could be reduced by building on the regional experience gained and possibly integrating existing networks into a global structure. Policymakers, regulators and funders would together identify which plant health challenges to address on the basis of scientific evidence; funders would secure investments and allocate funds for ad hoc research activities to tackle these challenges; and scientists from public and private organizations would plan and execute the work and deliver results. All players would raise awareness among the various stakeholders and end users, and use research evidence to inform national and international actions. The proximity and continuous interaction between actors would improve the dialogue at national and international levels and focus the research community to deliver practical solutions for the plant health challenges faced by countries. A high level of representation (in particular, from policymakers and research funders), comprehensive governance and solid decision-making procedures will ensure the credibility and acceptability of network decisions. The Global Research Council, a virtual organization comprised of the heads of science and engineering funding agencies, could provide models for robust practices adapted to multi-country initiatives. The decision-making body of the global network would be composed of representatives from each member organization. This Governing Board would be responsible for the overall strategy, oversight of the budget and members' contributions, the direction of all activities (such as research collaboration, research funding and outreach) and their re-orientation whenever necessary. A decision-implementing body would be in charge of the ongoing management of the network. The composition of such a Network Management Group shall reflect the diversity of the mandate of network members (for example, research programme owners, research programme managers, national plant protection organizations and research organizations) and the geographical coverage of the network.

Collaboration is most beneficial when there is mutual interest and alignment of goals. However, reaching consensus on topics and priorities is not an easy task because plant health problems are addressed locally, and regulations and policies are set at national or regional levels. The task is complicated by the great diversity and complexity of plant pests under scrutiny by official authorities compared to important animal and human pathogens. For example, more than 1,000 pests are listed in the UK Plant Health Risk Register alone. Global coordination should not neglect regional approaches to plant health and should not aim solely at prioritizing but also at identifying commonalities to frame the dialogue and operations. The funding strategy should be adapted to this diversity: rather than allocating limited funds to a few large projects, it should favour small- to medium-sized projects able to produce scientific evidence in a short period of time (that is, 12–24 months) to support practical activities of plant health stakeholders. The strategy to commission agile research projects has already been adopted; for example, by Euphresco and the European Food Safety Authority (EFSA). Funding focused on small- to medium-sized projects also promotes the participation of organizations with limited resources that would otherwise be excluded from international collaboration. Plant health research should not be an elitist endeavour if knowledge sharing, optimization of resources and harmonization of practices are among the objectives.

A global network would require IT infrastructure to ensure that information is accessible to all members. This infrastructure would include databases to share information (such as reports, recommendations, guidelines and data)

from national and transnational research projects to communicate the research capacity (scientists and their expertise) available in the various countries and to facilitate discussion of research topics to be addressed through transnational collaboration.

Processes and schedules should be flexible enough to accommodate for the constraints of members and the heterogeneity of national research systems in both developing and developed countries. In Euphresco, it takes approximately 12 months from an initial suggestion or idea to commission a research project. This time allows organizations to position themselves while respecting national schedules and decision-making processes. Research funding organizations can use non-competitive or competitive funding mechanisms: that is, scientists can be identified directly or through open calls, receive funds, align pre-existing activities for which they have received funds or work with in-kind contributions. This flexibility maximizes the collaboration of communities that use different funding mechanisms to implement national activities (calls, grants and so on). Moreover, involvement of less research-and-development-intense countries would be promoted and encouraged to harness specialized expertise that could be critical for the challenges. Processes should also ensure rapid and regular identification of common priorities, allocation of funds and commissioning of projects, especially when emergencies occur.

Coordination of the network activities should be ensured through a neutral structure. Ideally, they should benefit from the reputation of a United Nations mandate convention, such as the IPPC and its associated Regional Plant Protection Organizations (RPPOs). RPPOs have historically been in charge of the regional coordination of plant health efforts; although, until now, only a few (for example, the European and Mediterranean Plant Protection Organization) have been officially mandated to facilitate cooperation in research and the exchange of relevant scientific information. Thus, a global research coordination network represents an opportunity for greater involvement of RPPOs in collaborative research activities.

The sustainability of structures that facilitate complex collaboration is a challenge, particularly in respect to long-term funding commitments. However, recent and successful examples exist today: the Euphresco Secretariat's activities are supported only by an annual contribution of its members in contrast to other networks which are additionally supported by external funds (for example, STAR-IDAZ International Research Consortium on Animal Health, funded by the European Commission).

Conclusions

Recent actions by the Commission on Phytosanitary Measures can greatly support IPPC Contracting Parties to face plant health challenges. Beyond the IPPC-centred action, however, a research coordination and collaboration network would help identify important plant health problems and form the basis for generating more attention (and hopefully resources) for keeping plants healthy. Emerging plant health threats and increased epidemiological knowledge to support pest risk analysis, validation and acceptance of new technologies (such as high-throughput sequencing as a diagnostic method) in a context of differing technical capacities are just a few examples of the questions that the global network may be mandated to address.

A global network for phytosanitary research coordination that can shape research agendas across countries and accelerate the development of science to support regulatory phytosanitary activities has the potential to benefit all stakeholders but especially phytosanitary decision-makers. It can provide a means to empower national organizations and funding systems by taking advantage of transnational and global research on regulated plant pests. Such a network would narrow the divide between high- and low-income countries with regards to research investments and allow them to optimize the use of resources to tackle increasing plant health risks. The close collaboration of various players will break national isolation and reduce the discipline boundaries that have traditionally dominated the plant health sector.

Global phytosanitary research coordination is one of the priorities that the Commission on Phytosanitary Measures and its main constituents, the IPPC Contracting Parties' NPPOs and RPPOs, will have to address in the next decade. Future steps towards a global network may include mapping of existing sustainable national and international networks to understand their focus and scope; assessment of their impact to better rationalize and prioritize the commitment and investment of research funders, policymakers, regulators and research organizations; and identification of 'champions' to work on how to bundle the relevant initiatives and agree on policies and structures. The challenge is great, but science diplomacy is the smartest approach to build a constructive international partnership by engaging governments at all levels, increasing mutual understanding, catalysing harmonization and favouring international impactful actions on both well-known and newly emerging global plant health issues. ❐

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Competing interests

The authors declare no competing interests.