# Control of potato purple top in Ecuador: Evaluation of CGIAR contributions to a policy outcome trajectory

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# Content

## Acronyms and abbreviations

| | |
|---|---|
| A4NH | CGIAR Research Program on Agriculture for Nutrition and Health |
| AECID | Spanish Agency for International Development Cooperation |
| CAN | Andean Community of Nations (Spanish acronym) |
| CGIAR | Consultative Group on Agricultural Research |
| CIP | International Potato Center (Spanish acronym) |
| CRP | CGIAR research program |
| DFID | Department for International Development (now known as FCDO) |
| EQ | Evaluation questions |
| FAO | Food and Agriculture Organization of the United Nations |
| FISH | Fluorescence in-situ hybridization |
| IICA | Inter-American Institute of Cooperation for Agriculture |
| ILCYM | Insect Life Cycle Modeling |
| INIA | National Institute of Agrarian Innovation (Peru, Spanish acronym) |
| INIAP | National Institute of Agricultural Research (Ecuador, Spanish acronym) |
| M&E | Monitoring and Evaluation |
| MAG | Ministry of Agriculture and Livestock (Ecuador, Spanish acronym) |
| MINAGRI | Ministry of Agriculture and Irrigation (Peru, Spanish acronym) |
| PCR | Polymerase Chain Reaction |
| PMP | Potato Purple top (Spanish acronym) |
| OIRSA | International Regional Organization for Agricultural Health (Spanish acronym) |
| RTB | CGIAR Research Program on Roots, Tubers and Bananas |
| SENASA | National Service of Agrarian Health (Peru, Spanish acronym) |
| SRF | Strategy and Results Framework |

## Glossary

**Champion:** Someone who sees value in an outcome trajectory and engages with decision-makers to strengthen it.

**Generic (policy) theory of change**: A theory of change that describes, from the peer-reviewed literature, in a general sense how the policy change process works.

**Initiative**: Coherent sets of activities such as breeding, dissemination, policy engagement and technical support that may or may not be project-related.

**Outcome:** A change in behavior (practices, relationships) or policies (that influence behavior) of individuals, groups, organizations or institutions.

**Outcome evidencing approach:** An adaptation of outcome harvesting in which a case is built and challenged as to whether a program has contributed to one or more outcome trajectories.

**Outcome trajectory:** The pattern of interactions and causal links between actors, technologies and institutions that maintain and scale a coherent set of outcomes over time, e.g., the control of PMP

**Specified (policy) theory of change**: The generic theory of change which is made specific to the instance of policy change being studied.

# Executive Summary

**Background and context.** Since their inception in 2012, the CGIAR research programs (CRPs) on Roots, Tubers and Bananas (RTB) and Agriculture for Nutrition and Health (A4NH) have been generating innovations, testing interventions, and providing science-based evidence and advice to policy- and decision-makers at local, national and international levels with the expectation that this advice will contribute to policy changes that help create an enabling environment for agri-food systems innovations. In 2019, the two CRP leadership teams commissioned a systematic assessment to validate four significant policy outcomes to which they had contributed.

The outcome that this report addresses relates to the control of the potato disease called purple top (PMP – Spanish acronym) in Ecuador, specifically the establishment of a national-level technical committee to, among other things, develop a coordinated national strategy. CIP and RTB supported research and a risk assessment to better understand the threat posed by PMP, which helped motivate the formation of the committee, in which CIP and RTB collaborate with national-level institutions to tackle plant pests and diseases.

**Purpose and scope.** The purpose of this case study is to generate evidence and lessons learned on the contributions of CGIAR to stimulate policy changes to create an enabling environment for agri-food systems innovation by pursuing four objectives:

1. To determine and document how and in what ways CGIAR interventions contributed to the control of PMP in Ecuador;
2. To identify other major actions/factors that contributed to PMP control trajectory;
3. To generate findings to strengthen CGIAR contributions to PMP control trajectory;
4. To contribute to a synthesis document that compares and contrasts the ways in which CGIAR actions have influenced policy in four cases.

**Methods for the review.** This case study has been carried out as a CRP-commissioned independent evaluation using a version of outcome harvesting called outcome evidencing. Outcome harvesting is 'backward looking' that starts with an achieved outcome and works backwards to identify and understand the outcome trajectory that generated the outcome. Outcome trajectories are understood as the patterns of interactions between people, institutions and technology that contributed to produce the outcome, over time. This approach seeks to identify the contribution made by CGIAR and other stakeholder institutions to the outcome trajectory.

This assessment is made by building a timeline of the outcome trajectory to help specify and test an existing theory – the Policy Window theory of change – that describes how policy changes may have happened. The timeline and theory of change are used to answer the evaluation questions agreed at the start of the evaluation, after first being validated in a virtual workshop by interviewees and other key stakeholders. The draft report then went through two rounds of review to check facts and inferences with stakeholders.

### Evaluation questions.

The evaluation questions are:

1. How can the Policy Window theory of change be made more specific to the PMP control trajectory?
2. What are the main outcomes resulting from the PMP control trajectory and how did CGIAR contribute to them?

3. Has CGIAR contributed to integration/consideration of gender in the PMP control trajectory and, if so, how?
4. Is the PMP control trajectory likely to be sustained and scaled over the long term?

## Findings

### *Findings relevant to Evaluation Question #1*

**Finding 1**: The PMP timeline shows that there has been a 'shift in social norms,' whereby greater understanding exists in 2020 as to causes of PMP, how to control it, and the economic and environmental threat that it poses. However, the causal agent(s), vector(s) and disease epidemiology are still under investigation. The understanding of the PMP threat has broadened from a simpler understanding of a disease caused by phytoplasmas and spread by the potato psyllid *B. cockerelli* to include apprehension of a new disease in potatoes called Zebra Chip caused by *Candidatus Liberibacter solanacearum (CaLSo)*, also believed to be spread by *B. cockerelli*. This broadened understanding is continuing with the addition of a leafhopper (*Aceratagallia* sp.) that may also spread phytoplasmas and cause damage to potato plants. While the expanded understanding advances our general knowledge, it has also made it difficult to establish a consensus on what is PMP and how best to control it.

**Finding 2**: There are some concerns that current 'best practices' to control PMP are overly reliant on spraying to control insect vectors. Some researchers would like to see a more holistic approach to the control of PMP based on a broader understanding of agroecology. While the disease most likely originated from farmers bringing seed from other countries, some are suspicious of clean seed produced by INIAP believing that this may have been the cause of the disease in the first place.

**Finding 3**: Research to establish the impact of PMP has not persuaded all respondents as to the seriousness of the economic, environmental and social threats. This may be partly due to the lack of a systematic approach to gathering data on the farm-level impacts of PMP. Up until September 2020, the Minister of Agriculture had not declared a national emergency over PMP, based on the phytosanitary, economic and social advice it received.[1] But there is an urgent need to establish baselines and monitor the effects of PMP at the farm level for a range of economic, environmental, and human health indicators. Findings need to be shared and communicated to help build a more complete and convincing picture of the impact of PMP.

**Finding 4**: The timeline shows that the primary development strategy has been to train farmers and technicians to control insect vectors using pesticides. Most of the training has been short (on average one day), reaching more than 10,000 of the estimated 90,000 potato farmers in Ecuador.[2] Smaller groups farmers have received more in-depth training through farmer field schools. Any advocacy has been informal, carried out by researchers who became concerned about the disease during their field work. Windows of opportunity to foster policy changes have included international conferences.

**Finding 5**: The main strategy to build the support base for PMP control has been to persuade the Ecuadorian government to give more serious consideration to PMP by declaring a state of emergency. Such a declaration would trigger the release of resources from the government and FAO. This strategy has not been successful, in part because there is a lack of agreement as to the scale of the problem and because government attention

[1] Agrocalidad review of draft report

[2] https://ipmil.cired.vt.edu/success-and-impact/success-stories/potatoes-undergrads-ecuador/#:~:text=Farmer%20on%20the%20slopes.,(or%20about%20148%2C000%20acres).

was diverted to combat a serious disease with bananas. A second strategy to build a regional response to PMP has worked better, with Peru setting up high-powered cross-cutting technical committee to monitor and prevent the spread of PMP after a regional workshop.

### *Findings relevant to Evaluation Question #2*

**Finding 6**: The generic Policy Window theory of change was made more specific and relevant to our concerns by identifying and describing what strategies contributed in practice to the model's three main outcomes: 1) shift in social norms; 2) change in capacity; and 3) strengthened support base. These three main outcomes are linked to each other and form a self-reinforcing loop that drives the outcome trajectory.

**Finding 7**: The main outcome of the PMP control trajectory is the establishment of a national-level technical committee that includes Agrocalidad, INIAP and MAG. One of the committee's tasks has been to develop a coordinated national strategy (and, to date, a draft is now available). CIP and RTB have supported research and a risk assessment to better understand the threat posed by PMP, which helped motivate the formation of the committee in the first place. CIP and RTB have also been asked by INIAP to play a stronger role in convening and leading the policy process, but they have been unable to do so because of limited funding. CIP and RTB have supported a call for PMP to be declared a national emergency as this would release funding, but this has not yet happened. Work to combat PMP nationally only began in earnest in 2018, so it may be premature to expect a national strategy to be already in place and implemented.

**Finding 8**: A second important outcome is progress toward establishing consensus about the scope of PMP's threat to potato production in Ecuador. The Policy Window theory of change suggests that agreement and clearer messaging is needed before a national PMP control strategy can be properly designed and effectively implemented. Clarity is needed as to whether the national strategy should control only for PMP or for PMP and Zebra Chip disease, which is spread by the same vector.

### *Findings relevant to Evaluation Question #3*

**Finding 9**: CIP and RTB have not yet contributed to the integration of gender in the PMP control trajectory, although research is being conducted that can be used for that purpose.

### *Findings relevant to Evaluation Question #4*

**Finding 10**: Sustaining a coordinated response to control PMP in Ecuador will require resources for a strong national technical committee, tasked with developing a control strategy, to continue its work. A much greater level of resources will be needed to implement the strategy. Provision of necessary resources will be successful if we can establish a common understanding of PMP's threat to potato production in the country, and how to tackle its various manifestations. Clearer messaging will help PMP compete politically against other calls for limited government resources (e.g., the powerful Fusarium TR4 lobby that has so far been more successful in mobilizing funds).

## Conclusions

**Conclusion 1**: Good progress has been made to develop, agree upon, and implement a coordinated national response to PMP; however, much work remains. This is should not be surprising given that the first outbreaks occurred less than ten years ago and have proven difficult to diagnose and combat, and given that the spread by two insect vectors and by phytoplasmas that are difficult to detect.

**Conclusion 2**: The Opportunity Window theory of change suggests that further progress will depend on better agreement and clearer communication of the causes and impact of PMP, as well as the best ways to counter the disease in different localities and different altitudes. More research is needed to develop improved means for diagnosing PMP in the field. Decisions need to be made as to whether the national-level responses should be simple or holistic, that is, based primarily on using pesticides to control the insect vectors or a more integrated approach based on agroecological principles.

**Conclusion 3:** The theory of change also suggests that clearer messaging will need to be accompanied by closer coordination between the organizations responsible for combating PMP. In this regard, CIP and RTB are being asked to play a stronger role in convening and coordinating efforts.

**Conclusion 4**: Overall, CIP and RTB have played a key part in the progress to date despite operating on low levels of funding. Some of this support has been 'behind the scenes' as motivated CIP and RTB staff have supported similarly-motivated colleagues to keep momentum going, despite lack of funding and institutional instability manifest in frequent staff turnover. CIP and RTB staff have carried out doctoral research, proposed and participated in successful projects and pushed for and supported a PMP risk assessment. CIP and RTB also convened a regional-level workshop to build a broader coalition of researchers and government representatives working to combat PMP while advocating that the outcome trajectory deserves being taken more seriously and given more resources. Building a regional response to PMP is clearly a priority for future work.

**Conclusion 5**: Urging the Ecuador government to declare a phytosanitary emergency to activate funds to combat PMP has not yet worked. Lack of clarity and agreement on the causes, symptoms, impact and control measures for PMP have worked against the strategy, as have competing claims for resources to combat another crop disease. The large companies concerned about Fusarium TR4, for example, have been able to lobby more effectively and are benefiting from a government-backed response.

# Introduction to the case study and broader evaluation

Since their inception in 2012, the CGIAR research programs (CRPs) on Roots, Tubers and Bananas (RTB) and Agriculture for Nutrition and Health (A4NH) have been generating innovations, testing interventions, and providing science-based evidence and advice to policy and decision makers at local, national and supra-national levels with the expectation that this advice will contribute to policy change that in turn helps create an enabling environment for agri-food systems innovation.

CGIAR is a global research partnership for a food secure future dedicated to reducing poverty, enhancing food and nutrition security, and improving natural resources. Fifteen research centers are part of this global network and work together towards the achievement of a common Strategy and Results Framework (SRF). The CGIAR works through CGIAR Research Programs (CRPs) and Research Support Platforms. CRPs are led by CGIAR Centers, some of which have been operating for more than 50 years.

This case study is one of four jointly commissioned by RTB and A4NH to understand how the respective program's research has contributed to policy change. The four cases were chosen in a consultation process prior to the start of the evaluation based on the information, documentation and interest of country teams that the case be documented and analyzed. The four cases are on RTB and/or A4NH contributions to four outcome trajectories:

1. Mainstreaming of Biofortification in the African Union: evaluation of CGIAR contributions to a policy outcome trajectory
2. Control of potato purple top in Ecuador: evaluation of CGIAR contributions to a policy outcome trajectory
3. Development of a cassava seed certification system in Tanzania: evaluation of CGIAR contributions to a policy outcome trajectory
4. Development of a cassava seed certification system in Rwanda: evaluation of CGIAR contributions to a policy outcome trajectory

RTB's contribution to the outcome trajectories is considered together with the center that leads it – the International Potato Center (CIP – Spanish acronym).

This case study is on the second outcome trajectory, called the Potato Purple Top (PMP – Spanish acronym) trajectory. PMP is a new potato disease to the Andean region, first reported in Ecuador in 2014. The case was chosen by RTB leadership because it represents a significant and on-going policy outcome to which RTB/CIP staff believe they have contributed and who want the claim to be independently described and verified. Specifically, staff believe that they have contributed to raising awareness of the severity of the disease and developing a coordinated national management response to control it.

The objectives of this case study are:

1. To determine and document how and in what ways CIP and RTB interventions contributed to a coordinated national management response to the potato disease;
2. To identify other major actions/factors that contributed to the PMP control trajectory;
3. To generate findings to strengthen CIP and RTB contribution to the trajectory;
4. To contribute to a synthesis document that compares and contrasts the ways in which CGIAR actions have influenced policy in four cases.

The primary intended users are decision-makers in the CGIAR, particularly respective CRP management units and committees, Flagship Project leaders, Cluster Leaders and Project Leaders and the CGIAR System Organization. Secondary intended users are donors; other CRPs or research for development programs working to improve the enabling environment for agri-food systems and/or wanting to assess/evaluate their role in changing the enabling environment; national partners and stakeholders. It is hoped that the findings and conclusions will help key stakeholders in Ecuador and the Andes to better manage the disease and prevent its spread.

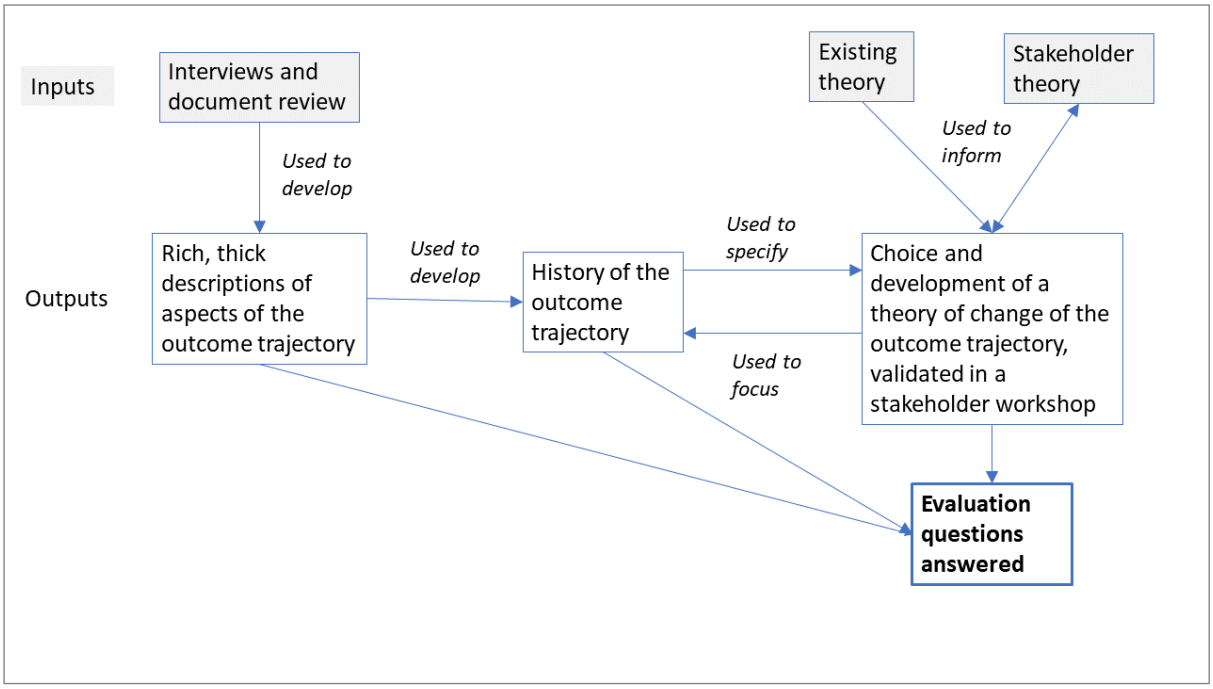
# Methodology

This case study and the overall evaluation uses a version of outcome harvesting called outcome evidencing (Paz and Douthwaite, 2017). Outcome harvesting is 'backward looking' in that it starts with an outcome and works backwards to identify and understand the patterns of interactions between people, institutions and technology that contributed to it, over time. This slow-changing pattern is called an 'outcome trajectory.' The approach then seeks to identify the contribution made by CIP and RTB to the outcome trajectory. In contrast, most program evaluations model how program activity and outputs are contributing to outcomes. They do not acknowledge an outcome trajectory as a mediating mechanism and as a result tend to over emphasize the role of the program, and underplay the role of other actors and on-going processes, from local to global level.

The study was carried out between April and October 2020 and followed a series of steps shown in Figure 1. The people interviewed and who participated in a virtual validation workshop are listed in Appendix 2.

Three methods were used to develop the outputs: document review, interviews, and a verification workshop. The theory of change of the PMP control trajectory is based on a 'formal' theory from the literature selected to be the best fit to participants' understanding of how change happened in the first case study carried out – on biofortification – and then applied to the other three. The theory is used to help focus the development of a timeline of key processes, activities and events that constitute the trajectory. The material the timeline draws upon is the rich, thick descriptions of aspects of the PMP control trajectory captured in interviews, and available documentation. The first evaluation question is how the theory of change is manifest in the historical timeline. The answer is used to make the formal theory of change, which is necessarily generic, specific to the PMP control case. The specified theory of change is then checked with stakeholders in a virtual workshop before being used to help answer the remaining evaluation questions.

**Figure 1: Flow diagram of the evaluation approach used**



The evaluation questions are:

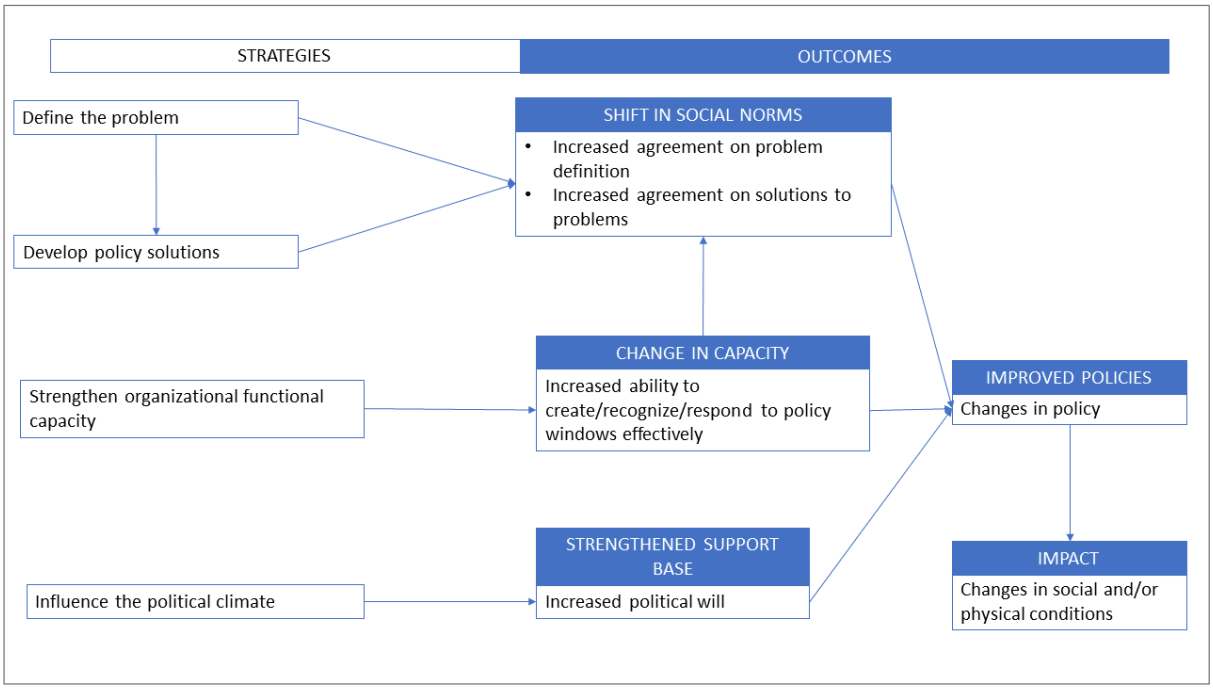
1. How can the chosen generic theory of change be made more specific to the PMP control trajectory?
2. What are the main outcomes resulting from the PMP control trajectory and how did the CGIAR contribute to them?
3. Has the CGIAR contributed to integration/consideration of gender in the PMP control trajectory and how?
4. Is the PMP control trajectory likely to be sustained and scale over the long term?

The outcome claim that this case study explores is that CIP and RTB contributed to raising awareness of the severity of PMP and developing a coordinated national management response to control it.

## Description of the generic theory of change chosen

The generic theory of change chosen is the Policy Windows theory that comes from Political Science, developed by Kingdon (1995). The model proposes that policy changes during *windows of opportunity* which help advocates successfully connect two or more components of the policy process. The components are: the way a *problem* is defined; the *policy solution* to the problem; and, the *politics* surrounding the issue (Stachowiak, 2013; Sabatier and Weible, 2007). Windows of opportunity are moments when progress can be made. They can be created by natural events such as pandemics, droughts or earthquakes, for example, the latter is an opportunity to change building regulations. They can be man-made events like spikes in air pollution that lead to changes in clean air regulations. They can also be changes in government, budget cycles or landmark meetings and summits held as part of on-going national, regional and global processes. Policy windows are often short in duration and may be predictable or unpredictable.

**Figure 2: Policy window theory chosen as the best fit to describe how policy changes are happening (redrawn from Stachowiak, 2013)**



Stachowaik (2013: 7) made a number of qualifying statements with respect to the theory of change:

- Often there are many competing ideas on how to address problems. To receive serious consideration, policy solutions need to be seen as technically feasible and consistent with policy maker and public values;
- The way a problem is defined makes a difference as to whether and where the problem is placed on the agenda. Problem definition also has a value or emotional component; values and beliefs guide decisions about which conditions are perceived as problems;
- Advocates can attach their solution to an existing problem that has gained prominence on the agenda, even if that prominence is independent of their efforts;
- To effectively recognize and take advantage of open policy windows, advocates must possess knowledge, time, relationships and good reputations;
- Policy is translated into action plans and implemented.

The main limitation to this evaluation is that it is being carried out relatively early in the outcome trajectory compared to the other cases. Also, the investment in carrying out the case is relatively small with limited time allocated to carry it out. COVID-19 has prevented any field visits or face to face interviews – all the interaction with key informants has been virtual.

Finally, given that this is a learning-focused evaluation, and the assumption that the change process is complex, the evaluation does not attempt to value contributions made. Systems theory suggests that when outcomes are driven by interactions of people, institutions and knowledge, one is dealing with a non-linear phenomenon for which it is not possible to know the exact worth of one entity's action compared to another. [3] For example, how does one value the expensive actions that brought a system to a tipping point versus the modest action that finally triggered it? Moreover, seeking to attribute outcomes of collective effort to the action of individual organizations can endanger trust and the positive feedback loops required to drive outcome trajectories in the first place.

[3] Axelrod & Cohen, 1999

# Findings

The findings come from answering the evaluation questions, as described in the Methodology Section (see Figure 1).

## EQ1: How can the chosen generic theory of change be made specific to the PMP control trajectory?

The generic Policy Window theory of change is made more specific by identifying what strategies identified in the timeline provided in Appendix 1, contributed to the model's three main outcomes. The three main outcomes are:

- *Shift in social norms*, understood as increasing shared agreement between responsible organizations on the severity of the PMP problem and the practicality and effectiveness of control measures;
- *Change in capacity*, understood as increased capability among 'champions' to individually and collectively advocate for an effective national response to PMP as well as for those involved in PMP control to know to do so;
- *Strengthened support base*, understood as more enabling political and financial environment for national coordinated response to PMP.

The three main outcomes together lead to improved policies, understood to be a national coordinated response to PMP developed and implemented.

### EQ1.1 How does the 'shift in social norms' manifest itself in the outcome trajectory?

**Finding 1:** The PMP timeline shows that there has been a 'shift in social norms,' whereby greater understanding exists in 2020 as to causes of PMP, how to control it and the economic and environmental threat that it poses. However, the causal agent(s), vector(s) and disease epidemiology are still under investigation. The understanding of the PMP threat has broadened from a disease caused by phytoplasmas and spread by the potato psyllid *B. cockerelli* to include a new disease in potatoes called Zebra Chip caused by *Candidatus Liberibacter solanacearum* (CaLSo), also believed to be spread by *B. cockerelli*, as well as the damage caused by the insect. This broadening is continuing with the addition of a leafhopper (*Aceratagallia* sp.) that may also spread phytoplasmas and cause damage to potato plants. The broadening has made it hard to establish a consensus on what PMP is and how best to control it.

The PMP timeline shows that a number of strategies have been used to bring about a 'shift in social norms' manifest in broadly shared agreement on the causes and impact of PMP and on how best to control it. The strategies are shown in the specified ToC, detailed in Table 1 and summarized below.

<u>Research to identify vectors(s) and causal agents(s)</u>

Table 1 shows that most effort has gone into identifying categorically the causal agent(s) and vector(s). The timeline shows that most of the research has been carried out by Agrocalidad and INIAP.

In 2012 – 2013 the first hypothesis was that PMP was caused by the fungal disease *R. Solani*, which was later rejected. In 2014, phytoplasmas were suspected due to the pattern of infection. Phytoplasmas are obligate bacterial parasites of plant phloem tissue and of the insect vectors that are involved in their plant-to-plant transmission. However, no insect vectors were found.

Next, the bacteria *Candidatus Liberibacter* was suspected. There are conflicting accounts as to whether the bacterium was found or not. Tests for phytoplasmas carried out at the same time were inconclusive. As a result, Agrocalidad recommended to use other methods to diagnose the disease. Agrocalidad is the agency in Ecuador responsible for phytosanitary and zoosanitary regulation and control.

As of 2018, two phytoplasmas – *C. phytoplasma aurentifolia* and C. *phytoplasma asteris* [4] – have been identified as causal agents and *Bactericera cockerelli* was identified as a vector.[5] *B. cockerelli* is an insect also known as the potato psyllid found from Central America north to the American Pacific Northwest and parts of Manitoba. It was first reported in Ecuador in 2017.[6]

A PMP risk assessment led by MAG in 2018 and published in February 2019 included Zebra Chip disease as a risk linked to PMP because it is also spread by *B. cockerelli*. Zebra Chip was first reported in 2007 in the USA, Mexico and Central America.[7] The disease was named for causing striped discoloration of potato chips and has resulted in several million dollars in losses among potato producers.[8] It has similar symptoms as PMP and is caused by *C. Liberibacter solanacearum* (CaLSo).

Research by the Central University of Ecuador has confirmed that *B. cockerelli* is spreading Zebra Chip disease in Ecuador and that a leaf hopper (*Aceratagallia sp.*) may also be spreading PMP.[9] The research also found that PMP is also transmitted by a leafhopper (*Aceratagallia sp.*). The work suggests that rather than a single threat from PMP, potatoes in Ecuador are at risk from physical damage by leafhoppers and the potato psyllids as well as two diseases they carry.

Bringing in outside experts to help diagnose the cause of PMP and identify control measures

A strategy recommended by Agrocalidad in 2015 was to bring in outside experts to help diagnose the cause of PMP and to identify effective control measures. As Table 1 indicates, experts were brought in from Mexico in 2015 by INIAP and from Honduras in 2018 by Syngenta and MAG. In 2019, the Regional Director of the International Regional Organization for Agricultural Health (OIRSA) attended the 8th Ecuadorian Conference on Potatoes held in Ambato, as an initiative led by INIAP and CIP.[10] In his presentation he said that PMP is caused by Candidatus liberibacter solanacearum and transmitted by *B. cockerelli*.[11]

In January 2020 CIP and RTB organized the International Workshop on Preventing the Spread of the Main Potato Pest and Diseases in the Andean Region that allowed researchers from Ecuador to contact experts from elsewhere (Caicedo et al., 2020).

**Finding 2:** There is some concern that current 'best practice' to control PMP is overly reliant on spraying to control insect vectors. Some want to see a more holistic approach to the control of PMP based on a broader understanding of agroecology. While the disease most likely originated from farmers bringing seed from other countries, some are suspicious of clean seed produced by INIAP believing that this may have been the cause of the disease in the first place.

[4] http://www.iniap.gob.ec/pruebav3/iniap-ejecuta-un-plan-emergente-frente-a-la-presencia-de-punta-morada-de-la-papa-en-ecuador/
[5] INIAP, Agrocalidad and MAG published a guide that specifies the cause of PMP https://issuu.com/cotopaxinoticias/docs/gu_a_de_manejo_de_la_punta_morada_d
[6] http://www.bulletinofinsectology.org/pdfarticles/vol72-2019-085-091castillo-carrillo.pdf
[7] https://cropwatch.unl.edu/potato/zebra_chip
[8] https://www.amazon.co.uk/s?k=9781780642802&i=stripbooks&linkCode=qs
[9] https://nkxms1019hx1xmtstxk3k9sko-wpengine.netdna-ssl.com/wp-content/uploads/2020/01/J.-Caicedo-Day-2.pdf
[10] Respondent 20
[11] https://www.oirsa.org/noticia-detalle.aspx?id=7838

Development of effective control measures

A strategy to reach agreement on control of PMP has been development of control measures that work. Building on research on PMP that began in 2016, INIAP and Agrocalidad together with MAG published a guide to the control of PMP in 2018. Recommended control measures are: 1) Use of clean seed; 2) monitoring and detection of eggs, nymphs and adults on leaves; 3) chemical control of *B. cockerelli* with 16 groups of chemicals that could be used at different growth stages of the potato crop. Half of the technical content is on chemical control; and, 4) cultural practices after harvest to reduce migration of the adult insects.

A second part of the strategy that began in 2018 was the establishment of provincial level technical committees (mesas de trabajo) to monitor the disease, better understand the problem and design mitigation strategies.

Up until 2018, the main advice to farmers was to use clean seed to prevent PMP, and this advice continued after 2018. Historically, INIAP has invested heavily in greenhouses as part of a formal system to provide farmers with clean seed. One respondent said that this investment had been controversial because the regulations that came with it on seed certification threatened the informal seed sector, although it should be noted that the informal seed sector operates under a different seed certification system as does the commercial seed sector.[12] While PMP most likely originated from farmers bringing infected seed into Ecuador,[13] the same respondent[14] said that the belief exists among some that INIAP may have inadvertently caused PMP through distribution of its 'clean' seed. This belief, and the controversial history, may help explain why providing farmers with clean seed comes across in the 2018 guide as less important than spraying against the vector. Two respondents also suggested that a strong agro-chemical lobby is pushing insecticides as the solution. A participant in the virtual workshop said that the integrated strategies developed by INIAP to control pests and diseases are overlooked by MAG in favor of kits provided by commercial companies that rely on the use of agrochemicals.[15] According to INIAP data, potato farmers are using six to eight times more pesticide than before PMP.[16] Another respondents said that recommended control strategies should build on what farmers are already doing and be tailored to altitude and locality.[17]

Formation of groups to tackle PMP

In 2018, INIAP established a permanent committee to bring together entomologists, plant pathologists, seed experts, experts in extension and technicians working on other crops in the potato family. INIAP also began forming provincial level technical committees to monitor the spread of the disease and better understand causes and vectors so as to design mitigation strategies.[18] Agrocalidad collaborated with PMP committees when requested.[19] In 2019, MAG and the Central University pushed for a national-level effort to develop a strategy to control PMP involving key stakeholders including farmers, public and private sector institutions, universities and international organizations such as CIP.[20]

[12] Respondent 15
[13] Respondent 12
[14] Respondent 15
[15] Respondent 5
[16] Presentacion papa 2019.ppt
[17] Respondent 19
[18] Respondent 20
[19] From Agrocalidad review of draft report
[20] Respondent 20 and https://www.lahora.com.ec/imbabura-carchi/noticia/1102213013/medidas-preventivas-contra-la-punta-morada-de-la-papa

**Finding 3:** Research to establish the impact of PMP has not persuaded all respondents as to the seriousness of the economic, environmental and social threat. This may be partly due to the lack so far of a systematic approach to gathering data on the farm-level impacts of PMP. The Minister of Agriculture has so far chosen not to declare a national emergency over PMP, based on the phytosanitary, economic and social advice received.[21] There is an urgent need to establish baselines and monitor the effects of PMP at farm level on a range of economic, environmental and indicators, including on human health. Findings need to be shared to help build a completer and more convincing picture of the impact of PMP. Findings also need to be better communicated.

Assessing the impact of PMP

The timeline indicates that some work has been done to establish the impact of PMP. Field work in Carchi by INIAP in 2012 – 2013 found that PMP caused losses of up to 50% of yield and increased cost of production by 70%.[22] In 2020, at the regional PMP workshop held at CIP in Peru, INIAP reported that:

- 80,000 potato farmers have been affected;
- 40% of land area lost in last 2 years, resulting in 2.1 million of days of work lost;
- 42% increase in price of potatoes, followed by a fall;
- Cost of production increased by 20 to 25%;
- 6 to 8 times more use of chemicals.

The figures come from two Central Bank of Ecuador documents (BCE 2019 & 2019a) and a MAG document (MAG-SIPA, 2019) and as one respondent stressed are not 'hard.'[23]. Respondents said that there has been no systematic measurement of the impact of PMP at farm level, including on the effects of additional spraying on human health and on the movement of potato cultivation into the Paramo.[24] Participants in the virtual workshop asked that impact data be shared to develop a more complete picture of the effects of PMP, that might be more convincing at the political level.

Communication and advocacy

An established strategy to create greater agreement on the importance of problems and the viability of solutions is communication and advocacy. One respondent reported that MAG and INIAP carried out several communication campaigns involving the print media and national and local TV and radio. One of the main mechanisms used for communicating among researchers and some decision-makers has been the annual Ecuadorian Potato Conference (Congreso Nacional de la Papa).

The evaluator found little evidence of an explicit advocacy strategy targeting key policy makers (also see Finding 4).

Funding new projects

Two CIP-led projects began in 2019 to carry out lifecycle monitoring of suspected insect vectors, and to better understand the epidemiology of PMP, respectively.

Also, in 2019, INIAP submitted a project proposal to MAG to control PMP as well as a proposal to Fontagro to develop tools for the early diagnosis of PMP. INIAP, with the support of the FAO-funded "Papa Clima" project

[21] Agrocalidad review of draft report
[22] Respondent 12
[23] Respondent
[24] Respondent 19, 17 & 16

PMP extension materials and organized four field days train farmers on identifying PMP vectors and management principals.[25]

**Table 1: Specifics of the activities, processes and outputs carried out within the PMP control trajectory that contribute to the three main policy window outcomes and provide impetus**

| Strategy | Details |
|---|---|
| 1. SHIFT IN SOCIAL NORMS | |
| Research to identify vector(s) and causal agent(s) | * 2012- 2013 - INIAP and Agrocalidad first collect samples in 2012 – 2013 to identify causal agents and hypothesize PMP is caused by *Rhizoctonia solani*. Hypothesis later rejected (Castillo et al., 2018)<br>* 2014 – Pattern of infection suggests caused by phytoplasma not *R. solani* but no vectors found (Navarrete, 2020)<br>* 2015 - INIAP send different DNA samples to labs in USA, Mexico, New Zealand and Peru to test for *C. Liberibacter* and phytoplasma. Findings differ between labs<br>* 2015 - Agrocalidad study yields different results from FISH and PCR tests. FISH test finds phytoplasmas in infected plants. PCR finds phytoplasmas in both symptomatic and asymptomatic plants and no *C. Liberibacter*<br>* 2016 - New samples taken in Carchi, Cumaltar and Mejia by Carmen Castillo<br>* 2017 – INIAP field work identifies *B. cockerelli* as possible vector (Castillo et al., 2019) |
| Bringing in outside experts | * 2015 - INIAP bring in a PMP expert from Mexico (Oswaldo Rubio) for a Symposium on Solanum plants<br>* 2018 - Expert from Honduras brought by Syngenta and MAG to help diagnose PMP causal agents<br>* 2019 - Carlos Urias, Director of OIRSA attended VIII Congreso Ecuatoriano de la Papa to talk about PMP and subsequently developed an action plan, funded by FAO<br>* 2020 – CIP and RTB organizes an International Workshop on Preventing the Spread of the Main Potato Pest and Diseases in the Andean Region that allows researchers from Ecuador to contact experts from elsewhere |
| Development of effective control measures | * 2016 - Agrocalidad work with INIAP to monitor and establish ways to control the disease<br>* 2018 - INIAP, MAG and Agrocalidad publish a guide to management of PMP in Ecuador[26] |
| Research to document impact of Purple Top | * 2012- 2013 - INIAP reports losses of up to 50% and up to 70% increase in production cost |
| Communication of the problem and/or solution; advocacy | * 2015 - Inconclusive attempt at identifying causal agents of purple top presented at the VI Congreso Ecuatoriano de la Papa |
| Formation of platforms, committees and groups to tackle PMP | * 2018 - Technical committees formed in Carchi and Santa Catalina by INIAP, MAG and the provincial government to monitor the disease better understand the problem and design mitigation strategies<br>* 2019 – National technical committee formed to develop a PMP control strategy[27] |
| Funding new research projects | * 2019 - Spanish Government-supported (AECID) Insect Life Cycle Monitoring (ILCYM) project begins<br>* 2019 - CIP and University of Wageningen begin research to understand the epidemiology of PMP |

[25] Respondent 20
[26] https://issuu.com/cotopaxinoticias/docs/gu_a_de_manejo_de_la_punta_morada_d
[27] https://www.lahora.com.ec/imbabura-carchi/noticia/1102213013/medidas-preventivas-contra-la-punta-morada-de-la-papa

| Strategy | Details |
|---|---|
| 2. CHANGE IN CAPACITY | |
| Training of technicians and farmers in the control of PMP | * 2018 to 2020 - INIAP start training technical extension workers and Agrocalidad technicians in control of PMP |
| 3. STRENGTHENED SUPPORT BASE | |
| Carrying out a risk assessment | * 2018 – CIP suggests and supports carrying out a risk assessment |
| Regional initiative to prevent the spread of PMP | * CIP organizes regional workshop to prevent the spread of potato diseases in the Andes, motivated by PMP outbreaks in Ecuador |
| PROVIDING IMPETUS OR RESTRAINT TO THE TRAJECTORY | |
| * 2019 - Regional Declaration on Fusarium TR4 banana disease | Ecuadorian Minister of Agriculture and Livestock issues Regional Declaration to support all measures to prevent the spread of TR4 and to foster collaboration between countries |

### EQ1.2 How does the 'change in capacity' main outcome manifest itself in the outcome trajectory?

**Finding 4:** The timeline shows that the main capacity development strategy has been to train farmers and technicians in how to control insect vectors using pesticides. Most of the training has been short – in the order of one day – reaching more than 10,000 out of the estimated 90,000 potato farmers in Ecuador.[28] Much smaller numbers of farmers have received more in-depth training through farmer field schools. Less emphasis has been given on training on use of clean seed. There has been no explicit identification and capacity development of PMP champions to lobby for greater attention to be paid to the risks posed by PMP outbreaks. Any advocacy has been informal, carried out by researchers who became concerned about the disease through their research. Windows of opportunity have included international conferences.

The main strategy to strengthen the capacity of technicians and farmers to control PMP has been to build farmer and technician capacity to prevent PMP. As already stated under Finding 1, INIAP, MAG and Agrocalidad published a guide to the control of PMP in 2018.[29] The guide informed training in 10,345 farmers and 775 technicians from pesticide suppliers from January to October 2019.[30] The training, which lasted one day, was largely focused on use of pesticides to control insect vectors. Training was carried out in the provinces of Carchi, Imbabura, Pichincha, Cotopaxi, Tungurahua, Chimborazo, Cañar, Bolívar Azuay and Loja.

A much smaller number of farmers have been trained since 2018, mainly in Carchi, to better identify and understand the *B. cockerelli* life cycle including adult insects, nymphs and eggs in farmer field schools.[31] The work in Carchi was carried out as part of an undergraduate thesis, so presumably on a relatively small scale.

There is no evidence that any of the main stakeholders have explicitly attempted to identify and work with champions or take other steps to help those involved identify and make use of policy windows. Interviews carried out for this study suggest that the champions that do exist are the researchers who have come to realize the threat posed by PMP through their work, and have formed an informal coalition to advocate for greater recognition of the problem with MAG. In the past, for example in the Papa Andina program, CIP has played a stronger convening role by helping to fund and facilitate stakeholder meetings that would help build a

[28] https://ipmil.cired.vt.edu/success-and-impact/success-stories/potatoes-undergrads-ecuador/#:~:text=Farmer%20on%20the%20slopes.,(or%20about%20148%2C000%20acres).
[29] https://issuu.com/cotopaxinoticias/docs/gu_a_de_manejo_de_la_punta_morada_d
[30] https://www.agricultura.gob.ec/mas-de-11-100-productores-capacitados-para-prevenir-la-punta-morada-de-la-papa/
[31] Farmer field schools have been used since the 1990s to facilitate farmers through a discovery learning process to be better aware of 'good' and 'bad' insects to be able to engage in integrated pest management that requires little or no use of inorganic pesticides. Farmer field schools are expensive if carried out for large numbers of farmers.

more coordinated policy response to issues.[32] Two interviewees called on CIP to play a similar more active leadership role,[33] given some institutional instability within national-level organizations. However, this requires additional funding. CIP is looking for such funding from RTB among other opportunities.

In January 2020, CIP and RTB held the "International Workshop on the Prevention of the Spread of the Principal Diseases of Potatoes in the Andes" in Lima, Peru.[34] Participants interviewed said that the event had helped build links between researchers and agencies concerned about the spread of PMP from Ecuador to Perú, Bolivia, Chile and Colombia. These links are expected to help countries and the region as a whole learn about and respond to PMP.

### EQ1.3 How does the 'strengthened support base' outcome manifest itself in the outcome trajectory?

**Finding 5:** The main strategy to build the support base for PMP control has been to persuade the Ecuadorian Government to take PMP more seriously through a declaration of emergency. Such a declaration will trigger the release of resources from the government and FAO. This strategy has not been successful, in part because of a lack of agreement as to the scale of the problem and in part because government attention was diverted to combat a serious disease of bananas. A second strategy to start to build a regional response to PMP has worked better, with Peru setting up high powered cross-cutting technical committee to monitor and prevent the spread of PMP after a regional workshop.

Stakeholders in the PMP trajectory employed two strategies to strengthen the support base for the control of the disease. The first was to conduct a risk assessment. This strategy was suggested by CIP and RTB who have experience carrying out such assessments for other diseases and pests. MAG, INIAP and Agrocalidad led the work with CIP and RTB playing a supporting and convening role. Part of the reason for carrying out the assessment was to encourage Agrocalidad to recommend to the Minister of Agriculture to declare PMP as an emergency. This would release more resources to develop and implement a national coordinated response, both from the government and from FAO that also has emergency funding available.

The declaration of an emergency has not yet happened and has subsequently become a somewhat politically sensitive issue. In June 2020, CIP wrote to the Executive Director of Agrocalidad to apologize for using the term "phytosanitary emergency" in a CIP blog-post published after the January 2020 regional workshop.[35] The title of the post was "Phytosanitary emergency in Ecuador could spread to the Andean Region." Agrocalidad formally complained to CIP because the title suggests that there is an emergency in Ecuador. An Agrocalidad respondent said that the problem of PMP has not reached levels that would justify declaring an emergency, and that recently the problem has diminished.[36]

Other respondents suggested that PMP was outcompeted for resources by a more compelling emergency – the threat of the banana disease Fusarium TR4.[37] TR4 is a fungal disease that can cause complete crop loss and once in the soil prevents future planting of bananas for decades.[38] As yet there is no known treatment of the fungus and it has already caused hundreds of millions of dollars loss worldwide. Ecuador is the world's largest exporters of bananas. In 2019, TR4 was found on four farms in neighboring Colombia. In August 2019, the

[32] Respondent 16
[33] Respondent 16 & 12
[34] https://cipotato.org/es/eventos/taller-prevencion-diseminacion-cultivo-papa/
[35] Letter reference: L-316-RD-2020
[36] Comment made by Agrocalidad participant in the study validation workshop
[37] Respondent 12 & 17
[38] http://www.fao.org/3/ca6911en/CA6911EN_TR4EN.pdf

Ecuadorian Minister of Agriculture and Livestock issued a regional declaration on TR4 to support all measures to prevent the spread of TR4 and to foster collaboration between countries.[39] In October, FAO launched regional project to combat TR4 but has not yet launched a project on PMP.[40] Respondents have suggested that banana growers are a more powerful lobby than potato growers and Ecuador can ill afford to fund responses to two emergencies, in particular during a time of economic recession due to a third disease – COVID-19.

Another reason given for PMP not to be declared an emergency is that, as the main subsistence crop of the large indigenous population, a declaration of an emergency might cause widespread concern with possibly unpredictable political consequences.

A second strategy was the holding of the "International Workshop on the Prevention of the Spread of the Principal Diseases of Potatoes in the Andes" organized by CIP and RTB mentioned above. Within days, as a result of the workshop, the Ministry of Agriculture and Irrigation (Minagri) – through the National Institute of Agrarian Innovation (INIA) and the National Service of Agrarian Health (Senasa) – the International Potato Center (CIP), the Inter-American Institute of Cooperation for Agriculture (IICA), as well as representatives of the Andean Community of Nations (CAN), formed a Technical Committee to monitor and prevent the spread of PMP, Zebra Chip and *B. cockerelli*. Peru's almost immediate response to set up an inclusive working group signals that the PMP is being taken seriously and there is broad support in Peru to tackle the threat in a coordinated way at national level. This may influence other Andean countries, including Ecuador, to continue to strengthen their response.

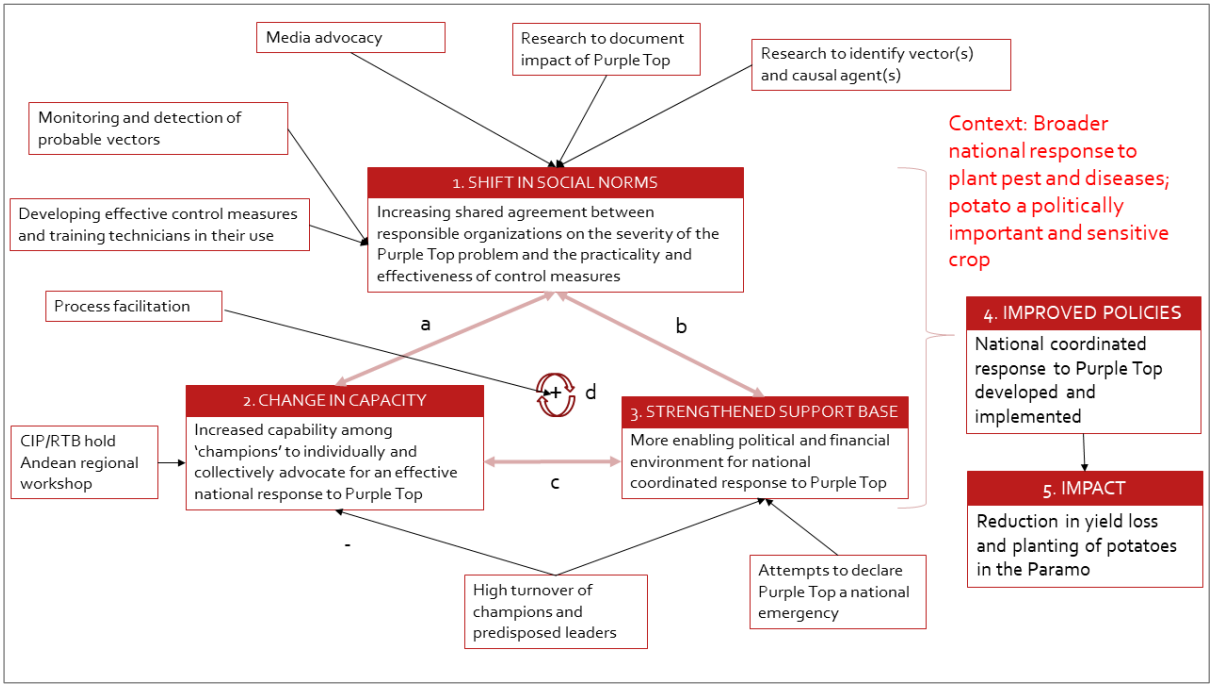
### EQ1.4 Based on the answers above, what adaptations to the generic theory of change make it more relevant to the PMP control trajectory?

**Finding 6:** The generic policy windows theory of change was made more specific and relevant by identifying and describing what strategies contributed in practice to the model's three main outcomes– shift in social norms, change in capacity and strengthened support base. The main structural change is to recognize that the three main outcomes are linked to each other and form a self-reinforcing loop that drives the outcome trajectory.

The evaluator used the findings from the three questions above to adapt the generic policy window theory of change to be more specific about how the establishment of a national-level technical committee to, among other things, develop a coordinated national response for PMP control was supported. (Figure 4). The boxes contributing to the main outcomes indicate the strategies carried out by key stakeholders.

[39] http://www.fao.org/world-banana-forum/news/detail-events/en/c/1204990/
[40] https://www.freshfruitportal.com/news/2019/10/07/fao-launches-emergency-project-to-combat-banana-disease-tr4/

**Figure 4: Policy Window Theory of Change adapted to describe how the preparation of a coordinated national response for PMP control was supported**




The causal assumptions underpinning the theory of change are indicated by letters in the diagram and are as follows:

a. The framing of the problem and solution motivates the champions. Because they are convinced, champions play an important role in convincing key actors of the importance of the problem and solution, taking advantage of windows of opportunity.
b. The framing of the problem and solution motivates donors and responsible organizations create a more enabling political and financial environment for the emergence of a national response to Purple Top. Actors' perception of a more enabling political and financial environment reinforces the message that tackling PMP is possible and a high priority.
c. PMP champions lobby donors and political leaders. At the same time leaders support champions in their role.
d. A positive feedback loop provides momentum to develop and implement a national coordinated response to PMP.

The evaluator found evidence to support all six causal assumptions, at least by inference.

The specified theory of change shows the strategies that contributed to achieving the main outcomes. Table 1 provides more detail drawn from the descriptions of the cassava seed certification system trajectory.

## EQ2: What are the main outcomes resulting from the PMP control trajectory and how did CIP and RTB contribute to them?

**Finding 7:** The main outcome of the PMP control trajectory is the establishment of a national-level technical committee that includes Agrocalidad, INIAP and MAG. One of the committee's tasks is to develop a coordinated national strategy, and a draft has been written. CIP and RTB have supported research and a risk assessment to better understand the threat posed by PMP which helped motivate the formation of the committee in the first place. CIP and RTB have also been asked by INIAP to play a stronger convening and leadership role in the policy process but has been unable to do so because of limited funding. CIP and RTB have supported a call for PMP to be declared a national emergency as this would release funding, but this has not yet happened. Work to combat PMP nationally only began in earnest in 2018, so it may be premature to expect a national strategy to already be in place and implemented.

The main PMP control outputs and outcomes are shown in Table 2, together with the contribution made by CIP and RTB to achieving them. Overall, while much progress has been made, a fully agreed and implemented national-level PMP control strategy is not yet in place. What exists is a national-level technical committee to develop one. The committee has developed a draft.[41] The proper establishment and effective operation of this committee has been delayed by changes to key personnel.[42]

More generally, progress has been limited by a lack of funding for the work. CIP has been asked to play a more central convening and leadership role, similar to how it worked in the Papa Andina[43] program, but has been unable to do so because of limited funding. The total funding that has been available to CIP and RTB have been in the tens of thousands of dollars, compared to the hundreds of thousands of dollars available to carry out similar work in the African-based cases considered in this study.

CIP and RTB have been actively sourcing more funding for the outcome trajectory, with some success. Two CIP-led projects began in 2019 and 2020 to continue to carry out research on lifecycle monitoring of insect vectors and to better understand the epidemiology of PMP, respectively. CIP and RTB also supported the call by INIAP researchers among others for Ecuador to declare a phytosanitary emergency over PMP, which would release emergency funding. This was done in part by proposing and supporting the idea of carrying out a PMP risk assessment, published in February 2019. The assessment found that the economic risk is high given potatoes are the principal income for indigenous farmers and environmental risk is also high given lack of knowledge of how to control the disease shown to lead to over spraying.

Despite this, Agrocalidad, who advise the Minister of Agriculture on whether to declare a phytosanitary emergency, have chosen not to, citing that PMP outbreaks and losses have reduced.[44] The fact that Ecuador committed resources to combat a different crop disease - Fusarium TR4 in bananas – likely reduced the resources available to tackle another emergency. FAO, one of the main intended users of the risk assessment has so far not provided funding to combat PMP in Ecuador. A respondent[45] gave as reasons that the causes of PMP are still not well understood and effective control measures not yet clearly defined. FAO also follows the government's lead. FAO funded a regional project to combat TR4 in October 2019, just 2 months after a regional declaration made by the Minister of Agriculture and Livestock in Ecuador. Another respondent suggested that the large commercial enterprises growing bananas were more effective in putting together a

[41] Estrategia nacional borrador 001.doc
[42] Respondent 17
[43] https://ccafs.cgiar.org/publications/papa-andina#.Xw272ChKhPY
[44] Validation workshop respondent
[45] Respondent 14

coalition and lobbying for action at the highest levels.[46] TR4 is a disease that has generated global interest in a way that PMP has not.

Table 2 shows that all of the PMP control outputs and outcomes, except research, occurred in the last two and a half years, from the beginning of 2018. This is short compared to other outcome trajectories in this study, and the expectation that a coordinated national-level strategy to control PMP is in place is perhaps overly ambitious. One respondent lamented that it took four years from the first reports of PMP in 2014 until 2018 for CIP to become actively involved.[47]

**Finding 8:** A second important outcome is progress towards agreeing the scope of the threat to potato production in Ecuador. This is still work in progress. The Policy Window ToC suggests that agreement and clearer messaging is needed before a national PMP control strategy can be properly agreed and effectively implemented. Clarity is needed in particular as to whether the national strategy is to control only for PMP or PMP and Zebra Chip disease that is also spread by the same vector.

As discussed under Finding 1, the nature of the threat posed by PMP has broadened to include a new potato disease called Zebra Chip and the damage caused by the insect vectors of the two diseases. This has led to some mixed messaging as the understanding of the disease has evolved. Trained technicians have understood that PMP is "not an insect, nor a fungus, nor a virus, nor a bacterium, nor a nematode but is related *to B. cockerelli*."[48] The INIAP guide to the control of PMP that says PMP is caused by phytoplasmas, which are similar to bacteria, that are spread by *B. cockerelli.*[49] The guide does not mention Zebra Chip disease, which was diagnosed after the guide was written. Differences over what exactly is being labelled as PMP causes uncertainty over the best ways to monitor and control the threat and in reaching agreement on the level of risk posed.

**Table 2: Table of main PMP control-related results and CIP and RTB contribution to them**

| Date | PMP control-related results | CIP and RTB contribution |
|---|---|---|
| 2012 to present | INIAP, Agrocalidad, the Central University of Ecuador and CIP conduct research to better understand PMP and how it might be controlled | CIP and RTB provision of technical support to Agrocalidad<br>McKnight Foundation support to a PhD fellowship supervised by CIP |
| 2018 | Formation of technical committees at provincial level to monitor and control outbreaks | None |
| 2018 | MAG, INIAP and Agrocalidad meet with agrochemical companies to agree efficient forms of chemical control | None |
| 2018 | INIAP, MAG and Agrocalidad publish a guide to the management of PMP in Ecuador | Through CIP's contribution to research upon which the guide is based |
| 2019 | Establishment of a national-level technical committee to develop and implement a national PMP control strategy | Formation facilitated by CIP and RTB. Role limited compared to Papa Andina modus operandi due to limited budget to convene meetings |
| 2019 | Publication of a PMP risk assessment | The idea and the methodological, technical and financial support provided by CIP and RTB |
| 2019 | Agrocalidad assume leadership of the national effort to combat PMP | CIP and RTB support to the process |

[46] Respondent 18
[47] Respondent 22
[48] https://www.argenpapa.com.ar/noticia/7832-ecuador-tecnicos-del-mag-continuan-capacitando-a-productores-para-evitar-la-ldquo-punta-morada-de-la-papa-rdquo
[49] https://issuu.com/cotopaxinoticias/docs/gu_a_de_manejo_de_la_punta_morada_d

| Date | PMP control-related results | CIP and RTB contribution |
|---|---|---|
| 2019 | Regional declaration on Fusarium TR4 establishes the disease as a higher priority than PMP | None |
| 2019 | No phytosanitary emergency declared in Ecuador over PMP | CIP and RTB advise that an emergency be declared |
| 2020 | Regional workshop on major potato diseases in the Andes raises regional awareness of the threat posed by PMP, Zebra Chip and *B. cockerelli* | CIP and RTB organized the workshop |
| 2020 | Ministry of Agriculture and Irrigation in Peru forms a broad-based technical committee to monitor and prevent the spread of PMP, Zebra Chip and damage caused by *B. cockerelli* | As a result of the regional workshop organized by CIP and RTB |

## EQ 3: Has CIP and RTB contributed to integration/consideration of gender in the PMP control trajectory and how?

**Finding 9:** CIP and RTB have not yet contributed to the integration of gender in the PMP control trajectory, although research is being carried out that will.

The PMP outputs outcomes (Table 2) have documents associated with them. The evaluator reviewed these documents, in particular the draft national strategy to control PMP, to establish the extent to which gender and social inclusion has been considered. No mention of gender was found.

CIP and RTB is carrying out research to analyze gender differences in management of seed and seed replacement strategies. The objective is for CIP and RTB to make the findings available in the future to influence regulations on movement of seed and material from one region to the other. Other research is looking at gender differences at farmer and organizational level to help understand different levels of bias in access to information and support.

One respondent reflected that previously gender researchers in CIP and RTB have tended to want to carry out strategic research on issues such as how social context shapes agency. This took them to levels of high abstraction from which it has proved difficult to map back to answer practical questions that could help shape PMP control policies and regulations.

## EQ 4: Is the PMP control trajectory likely to be sustained and scale over the long term?

**Finding 10:** Sustaining a coordinated response to control PMP in Ecuador will require resources for a strong national technical committee, tasked with developing a control strategy, to continue its work and a much greater level of resources to implement the strategy. Provision of necessary resources will be helped by agreeing and communicating a common understanding of the PMP threat to potato production in the country, and how best to tackle its various manifestations. Clearer messaging will help PMP compete politically against other calls on limited government resources, for example with the powerful TR4 lobby that has so far been more successful in mobilizing funds.

# Conclusions

**Conclusion 1:** Good progress has been made to develop, agree and implement a coordinated national response to PMP, however, much remains to be done. This is perhaps not surprising given the first outbreaks occurred less than ten years ago and has proven difficult to diagnose and combat, given that it has been found to be probably spread by two insect vectors and caused by difficult-to-detect phytoplasmas.

**Conclusion 2:** The Opportunity Window theory of change suggests that further progress will depend on better agreement and clearer communication of the causes and impact of PMP, as well as the best ways to counter the disease in different localities, in particular at different altitudes. More research is needed to develop better ways of diagnosing PMP in the field. Decisions need to be made as to whether the national-level response should be simple or holistic, that is, based primarily on using pesticides to control the insect vectors or a more integrated approach based on agroecological principles.

**Conclusion 3:** The theory of change also suggests that clearer messaging will need to be accompanied by closer coordination between the organizations responsible for combating PMP. In this regard, CIP and RTB is being asked by one of these parties to play a stronger convening and coordinating role.

**Conclusion 4:** Overall, CIP and RTB have played a key part in the progress to date despite operating on low levels of funding. Some of this support has been 'behind the scenes' as motivated CIP and RTB staff have supported similarly-motivated colleagues to keep momentum going, despite lack of funding and institutional instability manifest in frequent staff turnover. CIP and RTB staff have carried out doctoral research, proposed and participated in successful projects and pushed for and supported a PMP risk assessment. CIP and RTB also convened a regional-level workshop to build a broader coalition of researchers and government representatives working to combat PMP while advocating that the outcome trajectory deserves being taken more seriously and given more resources. Building a regional response to PMP that learns from Ecuador's experience is clearly a priority for future work.

**Conclusion 5:** The strategy of urging the Ecuador government to declare a phytosanitary emergency so as to release funds to combat PMP, has not yet worked. Lack of clarity and agreement on the causes, symptoms, impact and control measures for PMP have worked against the strategy, as have competing claims for resources to combat another crop disease – Fusarium TR4 in bananas. The large companies concerned about Fusarium TR4 have been able to lobby more effectively such that progress towards agreeing and implementing a national response to Fusarium TR4 in Ecuador is moving faster than for PMP.

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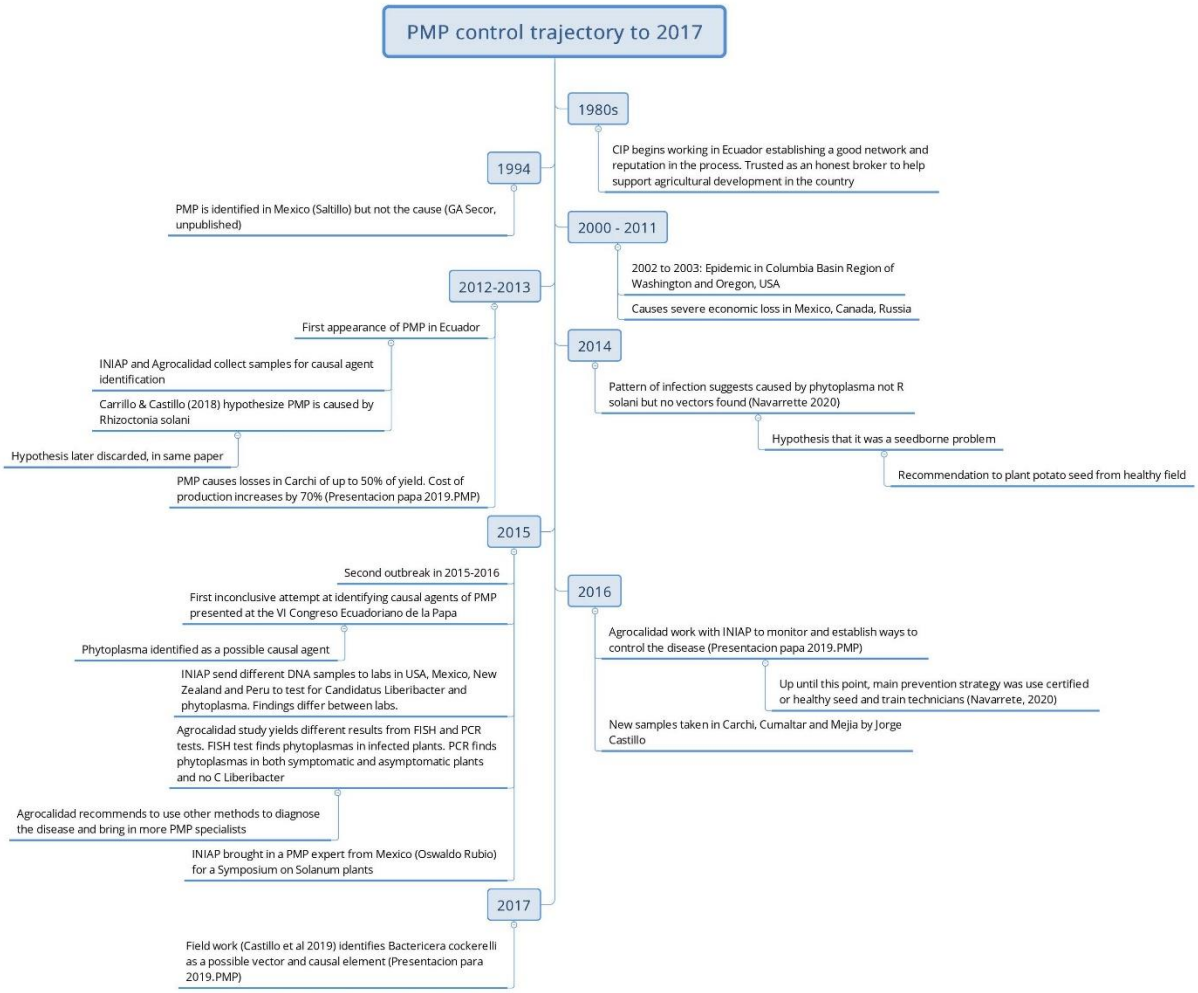
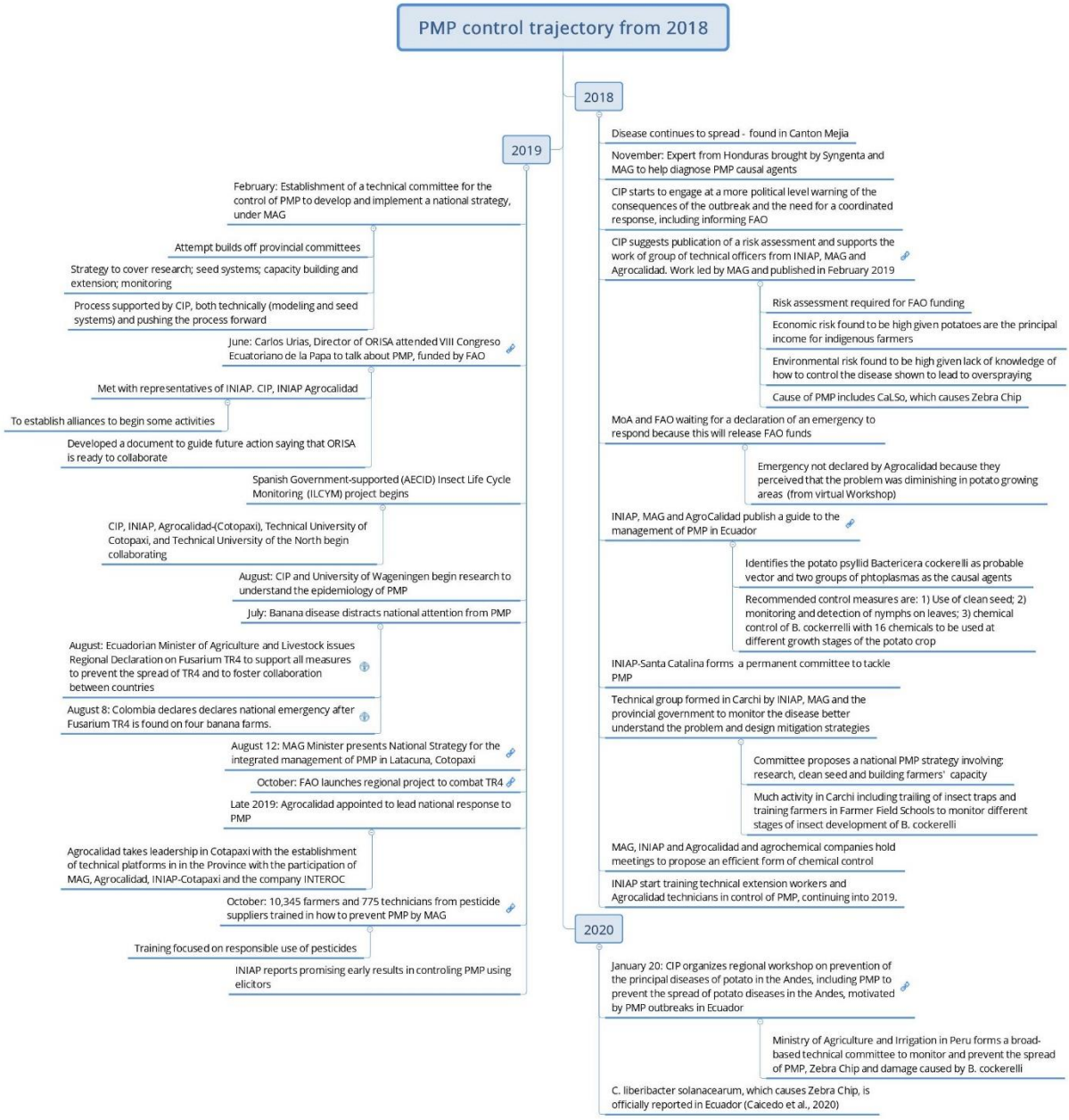
# Appendices

## Appendix 1: Timeline of the PMP control outcome trajectory

The timeline identifies the main events, happenings and processes that led to the outcome claimed by CIP and RTB – that they contributed to raising awareness of the severity of the disease and developing a coordinated national management response to control it. The timeline is split into two parts to better fit on the page – from 1980s until 2017, and from 2017 to 2020. The timeline is used to help specify the outcome trajectory and answer the evaluation questions in the main body of the report.




PMP control trajectory from 2018
2018
Disease continues to spread - found in Canton Mejia
November: Expert from Honduras brought by Syngenta and MAG to help diagnose PMP causal agents
CIP starts to engage at a more political level warning of the consequences of the outbreak and the need for a coordinated response, including informing FAO
CIP suggests publication of a risk assessment and supports the work of group of technical officers from INIAP, MAG and Agrocalidad. Work led by MAG and published in February 2019
Risk assessment required for FAO funding
Economic risk found to be high given potatoes are the principal income for indigenous farmers
Environmental risk found to be high given lack of knowledge of how to control the disease shown to lead to overspraying
Cause of PMP includes CaLSo, which causes Zebra Chip
MoA and FAO waiting for a declaration of an emergency to respond because this will release FAO funds
Emergency not declared by Agrocalidad because they perceived that the problem was diminishing in potato growing areas (from virtual Workshop)
INIAP, MAG and AgroCalidad publish a guide to the management of PMP in Ecuador
Identifies the potato psyllid Bactericera cockerelli as probable vector and two groups of phtoplasmas as the causal agents
Recommended control measures are: 1) Use of clean seed; 2) monitoring and detection of nymphs on leaves; 3) chemical control of B. cockerrelli with 16 chemicals to be used at different growth stages of the potato crop
INIAP-Santa Catalina forms a permanent committee to tackle PMP
Technical group formed in Carchi by INIAP, MAG and the provincial government to monitor the disease better understand the problem and design mitigation strategies
Committee proposes a national PMP strategy involving: research, clean seed and building farmers' capacity
Much activity in Carchi including trailing of insect traps and training farmers in Farmer Field Schools to monitor different stages of insect development of B. cockerelli
MAG, INIAP and Agrocalidad and agrochemical companies hold meetings to propose an efficient form of chemical control
INIAP start training technical extension workers and Agrocalidad technicians in control of PMP, continuing into 2019.
2019
February: Establishment of a technical committee for the control of PMP to develop and implement a national strategy, under MAG
Attempt builds off provincial committees
Strategy to cover research; seed systems; capacity building and extension; monitoring
Process supported by CIP, both technically (modeling and seed systems) and pushing the process forward
June: Carlos Urias, Director of ORISA attended VIII Congreso Ecuatoriano de la Papa to talk about PMP, funded by FAO
Met with representatives of INIAP. CIP, INIAP Agrocalidad
To establish alliances to begin some activities
Developed a document to guide future action saying that ORISA is ready to collaborate
Spanish Government-supported (AECID) Insect Life Cycle Monitoring (ILCYM) project begins
CIP, INIAP, Agrocalidad-(Cotopaxi), Technical University of Cotopaxi, and Technical University of the North begin collaborating
August: CIP and University of Wageningen begin research to understand the epidemiology of PMP
July: Banana disease distracts national attention from PMP
August: Ecuadorian Minister of Agriculture and Livestock issues Regional Declaration on Fusarium TR4 to support all measures to prevent the spread of TR4 and to foster collaboration between countries
August 8: Colombia declares declares national emergency after Fusarium TR4 is found on four banana farms.
August 12: MAG Minister presents National Strategy for the integrated management of PMP in Latacuna, Cotopaxi
October: FAO launches regional project to combat TR4
Late 2019: Agrocalidad appointed to lead national response to PMP
Agrocalidad takes leadership in Cotapaxi with the establishment of technical platforms in in the Province with the participation of MAG, Agrocalidad, INIAP-Cotapaxi and the company INTEROC
October: 10,345 farmers and 775 technicians from pesticide suppliers trained in how to prevent PMP by MAG
Training focused on responsible use of pesticides
INIAP reports promising early results in controling PMP using elicitors
2020
January 20: CIP organizes regional workshop on prevention of the principal diseases of potato in the Andes, including PMP to prevent the spread of potato diseases in the Andes, motivated by PMP outbreaks in Ecuador
Ministry of Agriculture and Irrigation in Peru forms a broad-based technical committee to monitor and prevent the spread of PMP, Zebra Chip and damage caused by B. cockerelli
C. liberibacter solanacearum, which causes Zebra Chip, is officially reported in Ecuador (Caicedo et al., 2020)

## Appendix 2: List of interviewees and participants in validation workshop

| Name | Gender | Affiliation | Interview | Workshop |
|---|---|---|---|---|
| Carmen Castillo | F | INIAP | Yes | Yes |
| Jorge Caicedo | M | Central University of Ecuador | Yes | |
| Karina Marcillo | F | FAO | Yes | |
| Clare Nicklin | F | McKnight Foundation | Yes | |
| Jorge Andrade | M | CIP and RTB | Yes | Yes |
| Israel Navarrete | M | CIP and RTB | Yes | Yes |
| Graham Thiele | M | CIP and RTB | Yes | |
| José Ochoa | M | INIAP | | Yes |
| Xavier Cuesta | M | INIAP | | Yes |
| Diego Peñaherrera | M | INIAP | | Yes |
| Verónica Tipan | F | Agrocalidad | | Yes |
| Santiago Reyes | M | Agrocalidad | | Yes |
| Paul Comina | M | MAG - Subsecretaria de Producción | | Yes |
| Jovanny Suquillo | M | INIAP UVTT-Carchi | | Yes |
| Victoria Lopez | F | INIAP UVTT-Carchi | | Yes |
| Luis Montesdeoca | M | CONPAPA | | Yes |
| Nancy Panchi | F | CIP-Quito | | Yes |
| Pedro Oyarzún | M | Representative of Ekorural | | Yes |
| Betty Paucar | F | INIAP | | Yes |
| Vivian Polar | F | RTB – workshop facilitator | | Yes |
| Claudio Proietti | M | RTB – workshop facilitator | | Yes |

The CGIAR Research Program on Roots, Tubers and Bananas (RTB) is a partnership collaboration led by the International Potato Center implemented jointly with the Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT), the International Institute of Tropical Agriculture (IITA), and the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), that includes a growing number of research and development partners. RTB brings together research on its mandate crops: bananas and plantains, cassava, potato, sweetpotato, yams, and minor roots and tubers, to improve nutrition and food security and foster greater gender equity especially among some of the world's poorest and most vulnerable populations. **www.rtb.cgiar.org/**

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