POLICY BRIEF 01
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Bacterial wilt of potato in Ethiopia: What should be done?

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Highlights

- 80-90% Bacterial wilt (BW) prevalence was observed in major potato growing regions of Ethiopia
- *Ralstonia solanacearum* has been found at increasingly higher elevations (2500-3000 masl)
- Transmission of BW through latently infected asymptomatic tubers has played a role in the spread of *R. solanacearum* in Ethiopia
- Institutional support to control BW and measures to prevent further spread of *R. solanacearum* in seed potato should take a more comprehensive approach
- Quality Declared Seed (QDS), semi-formal seed certification scheme, that designates zero tolerance for BW, is a key determinant to prevent the further disease spread through seed potatoes

Introduction

Potato is an important crop grown for food and income in Ethiopia. The acreage and production of potato has increased over four folds since 1961. The current acreage under potato is 254,000 ha (including Meher and Belg seasons) with total production of 2.8 million Mt (CSA 2016). Nevertheless, the potato sub-sector is still underdeveloped in Ethiopia, and yields are very low, 8-11 t/ha, compared to a potential of up to 35-40 t/ha among smallholder yields. This substantial yield gap highlights a significant opportunity to increase productivity and total production of potato in Ethiopia.

Bacterial wilt (BW), caused by *Ralstonia solanacearum* (Smith 1896), has been a major production constraint to rapidly expanding potato cultivation in Ethiopia, and is one of the most significant limitations to clean planting material production. *Ralstonia solanacearum* is mainly seed borne, and it spreads rapidly through infected planting materials. A high prevalence of BW is largely attributable to inadequate provision of seed potato quality assurance and wide spread distribution of infected seeds in large quantities. Thus, the production and use of *R. solanacearum* free seed potatoes presents great opportunities to invigorate seed potato, meeting the required certification standards. There is an urgent need for policy makers and researchers to address the issue of *R. solanacearum* in seed potato; otherwise it would be a serious threat to the potato value chain, potentially affecting the food security, and livelihood of millions of potato farmers, consumers and the emerging potato industry in Ethiopia.

BW was first recorded in Ethiopia in 1956, and has spread to major potato growing areas in the country (Figure 1). A recent survey conducted by Ethiopian Institute of Agricultural Research (EIAR) in collaboration with International Potato Center (CIP) in Seed Potato Cooperatives from Amhara, Oromia and Southern Nations, Nationalities and People's regions of Ethiopia (the main seed potato producing area of the country) indicated that nearly all fields surveyed were infested with *R. solanacearum*.

Similarly, in Chencha, levels of BW prevalence was 97% in 2015 and there was complete crop loss in some potato fields (Abdurahman et al. 2017). Now the BW is also reported from Gamo Gofa Zone, thereby threatening food and nutritional security and the livelihood of seed potato producers in the area. BW has emerged as a serious threat to potato farmers, potentially impacting the food and nutritional security status of millions of potato farmers and consumers in Ethiopia.

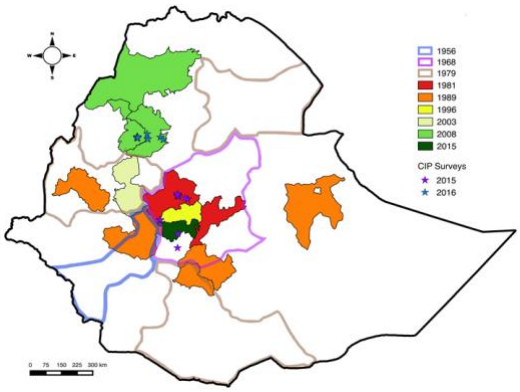

Figure 1. Occurrence and spatial dynamics of potato bacterial wilt disease spread in Ethiopia. Reports of bacterial wilt from 1956, 1968, and 1979 (unfilled areas) are demarcated using historical administrative boundaries accurate prior to 1991. More recent reports (filled areas) are demarcated using present administrative boundaries by national institutions, non-governmental organizations and private sectors.

Seed production in Ethiopia is concentrated in cooler and higher elevation areas to reduce the virus infection. However, *R. solanacearum* is capable of infecting and spreading within fields in cooler climates. The disease symptoms are not readily expressed and are often overlooked by visual inspection (i.e. certification); proper detection requires laboratory testing. In 2015 and 2016, very high BW incidences (latently infected fields) were recorded in seed potato production fields located at elevations exceeding 3000 m, the highest altitude ever recorded for BW in Ethiopia. Discovery of latent infection of seed potato tubers from 2500-3000 masl is the first evidence of the presence of BW disease in high altitude seed potato production areas of Ethiopia. Rising temperatures due to climate change might have enabled the establishment and spread of *R. solanacearum* in areas that were previously unsuitable for this pathogen. The presence of *R. solanacearum* in seed tubers produced at high elevations serve as main source of BW disease in the country (Figure 2).

Bacterial wilt management strategy

BW management strategy must focus on two broader aspects, *managing BW in the seed* and *managing BW infected fields.*

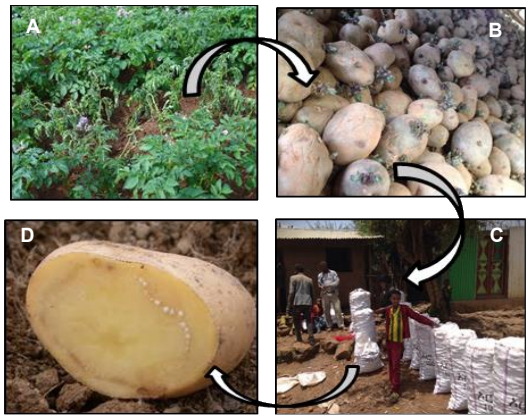

Figure 2. Bacterial wilt pathogen (R. solanacearum) at different stages of potato value chain. A) Potato field with some bacterial wilt infected plants. B) Storage of healthy looking seed tubers C) Sale and distribution of healthy looking seed potato, and D) Symptoms of R. solanacearum on healthy looking seed tuber.

Managing BW in the seed

BW in seed can be managed through rigorous seed certification and testing programs. This has been proven in Europe, South Africa, and Egypt which afford a well-structured and well-regulated formal seed system supplying majority of seed requirement in the countries. However, the formal seed potato certification scheme is not well-developed in Ethiopia, and high-quality seed accounts for only about 1.3% of all seed potato planted (Gildemacher et al., 2009). Most potato growers save their own seed from year to year or purchase unregulated seed potato from informal markets which are often difficult to discriminate between seed and ware potato. Such practices provide no assurances over quality and carry a high risk of introduction and/or increase in *R. solanacearum* in the potato field.

Quality assurance processes, such as accreditation, authorization, licensing of field, truth in-labelling do not exist and are not consistently enforced due to inadequate resources. A critical factor in the seed potato certification for *R. solanacearum* is the diagnostic test, as visual field inspection often is insufficient, i.e. visually healthy-looking plants can have latent infection of *R. solanacearum* and produce healthy looking tubers. This presents a specific challenge to countries like Ethiopia that are not well equipped or trained in such diagnostic tools. Because of the lack of a reliable quality assurance mechanism, quality of the early generation seed is always in question. The loss of quality at this stage causes rapid deterioration of seed quality in subsequent generations. Such a poor-quality assurance system often results in farmers having a 'bad experience' of buying seed which erodes trust

and discourages them from buying seed potato again. At present, farmers are not aware of the benefits of high quality seed and there is no system in place that can reward growers for delivering quality seed.

In an effort to mitigate some of the short-comings in certified seed production, CIP and the National Potato Program have introduced the Quality Declared Seed (QDS) certification system as a partial solution (Schulz et al., 2013). This certification system has been stipulated in national seed legislation and proposes an alternative to costly and logistically burdensome formal certification programs. QDS is largely implemented by seed producers and regulatory authority at the community level, forming a distributed labeling regime less costly than the formal certification that provides access to relatively good quality seed. Despite early success of QDS, it is not sufficiently rigorous to cope with the increasing BW problem as it does not include a sensitive test for *R. solanacearum* and relies on visual inspection. It is therefore, very important to advise policy makers about these limitations, to prioritize quality assurance processes, to develop evidence-based policies for a meaningful guidance and strategic advice to farmers and other actors of the potato value chain.

Managing BW infected fields

BW, once established in farmer's field, is one of the most difficult diseases to manage, largely due to the soil and seed borne nature of the bacteria. *Ralstonia solanacearum is* often disseminated from one field to another by contaminated soil, water, shared use of farm tools, transplanting infected plants, tubers, or cuttings and by animals and other farm activities. There is no cure once a potato plant or tuber is infected with BW hence preventive measures are currently the most effective way to manage BW. When infection has already occurred, or the pathogen has been established, then measures are needed to contain the disease. Because of a wider geographical distribution and broad host range, rapid spread and heavy economic loss, *R. solanacearum* is considered as a quarantine pathogen in Europe (Directive 2000/29/EC, EPPO A2 list) and is listed as "Bioterrorism Select Agent" in the United States. Hence, there is a strong need to increase awareness about BW and undertake research and practical actions to overcome BW.

No single management strategy effectively prevents losses caused by BW. Thus, management of BW should follow a system approach that incorporates specific operational practices to reduce likelihood of incursion, establishment and spread of *R. solanacearum* in potato crops (Sharma et al. 2017). This includes training farmers on improved potato production practices, use of healthy seed tubers, crop rotations with non Solanaceous crops, rouging of self-grown potatoes, field sanitation and weed control, planting potato in clean soils and use of disease resistant varieties. BW control needs a wider institutional approach from individual farmers, community institutions, research institutions and policy enforcement and regulatory authorities. This could improve epidemic management and control, as well as containment efforts to cease the spread of the pathogen during and in-between disease outbreaks.

Critical points of interventions

- Commend institutional support to control BW and measures to prevent further spread in seed potatoes
- The integration of actors of seed production, ware potato producers and markets, each operating on a commercially viable basis
- The detection of latent infection in tubers via standardized molecular methods, equally suited for use with other crop pests
- The strengthening of institutional capacity, extending to the capacity of certification personnel and innovation in the use of smart ICT tools
- Creation and transfer of innovative crop management technologies to farmers and farming communities
- Awareness on BW disease. Farm hygiene practices for management and containment of BW

Conclusion

By adopting the above measures, the potato value chain will be safeguarded against the specific risks associated with poor seed health and the threat of BW. The result will be increased potato productivity thereby enhancing food and nutritional security and alleviating poverty for millions of smallholder farming households. This will open up investment opportunities leading to scaling-up of potato-based enterprises.

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