

Potato Bacterial Disease Surveillance in Kenya - Explanatory note #2

In 2019/20 CABI and KEPHIS conducted an extensive survey on potato diseases most notably on blackleg, a "wilting disease" caused by a complex of bacteria, including *Pectobacterium* and *Dickeya* spp. This group of bacteria is sometimes referred to as the "Erwinia complex", and can be transferred by tubers but also by water, insects, wind and rain. The full report of 157 pages is available as PDF. In addition a series of what we call the "Explanatory notes" is published and disseminated to stakeholders in the Kenya potato sector, to make the often very technical details in the report more accessible.

This paper explains the implications of the survey results for food security in Kenya. The "Explanatory notes" and the full CABI/KEPHIS potato disease surveillance report can be found on the following web page: https://www.wur.nl/en/Research-Results/Research-Institutes/centre-for-development-innovation/show-cdi/seed_potato_phase3.htm

Implications for potato as a major food crop in Kenya

The results of the survey on bacterial diseases caused by the "Erwinia complex" have implications for the future of potato as a major food crop. We will focus on decreasing potato yields, current efforts to increase output of certified seed, and implications for seed quality standards on bacterial diseases.

1. Trend of decreasing potato yields

In Kenya potato is the second food crop after maize. The role as a major food crop is under threat since potato yields are declining. Whereas in many countries worldwide potato yields are increasing or stabilising, in Kenya average yields have consistently declined from 21.2 tons/ha in 2008 to 8.6 tons/ha in 2018 (FAO data). The reasons for this decline have been well documented: use of poor quality (informal) seed, poor crop management, low use of agro-chemicals to control pest and diseases, and lack of crop rotation. The extensive use of informal seed (over 95 % of the area is planted with informal seed) for many years has enhanced the spread of diseases and pests to almost every potato production area, as there are no limitations to distribution and sales of infected seed. As a result bacterial diseases, virus diseases and nematodes are widely spread since they are carried over by seed. The findings of the survey showing high incidence of blackleg caused by bacteria of the Erwinia complex is therefore not surprising. To stop the trend of declining yields, the quality of planting material must improve through increased use of certified seed to replace informal seed. If nothing is done, potato will cease to be a major food crop as bacterial diseases will cause further reduction in yields and increase in losses during transport, storage and marketing making potato production un-economical.

2. Current efforts to increase the output of certified seed

Planting certified seed to replace informal seed is the basis for improving yields. In an effort to increase the output of certified seed a wide range of initiatives are being implemented. These initiatives include increased production of mini-tubers from tissue culture, production of apical cuttings and professional multiplication of basic seed from different sources. All these initiatives have in common that a relatively small amount of clean (basic) seed is multiplied several times before it is marketed as certified seed. During multiplication, seed borne diseases infect seed stocks causing gradual degeneration of the seed. Some infection of seed during multiplication is natural and unavoidable, particularly for common diseases like viruses and Blackleg. To ensure that high seed quality is achieved, the number of multiplications in a seed certification scheme is limited and disease tolerances are kept low.

Options to increase the output of certified seed include:

- Producing more mini-tubers;
- Planting more basic seed;
- Ensuring that seed quality standards are realistic and in line with the disease situation in the country. This also means alignment with international standards in which a distinction is made between quality and quarantine diseases.

Producing more mini-tubers or planting more basic seed is not effective to increase the output of certified seed when seed quality standards are not realistic. When the standards are too low, large quantities of seed may be produced but the seed will give poor yields. On the other hand, when the standards are too strict, e.g. for quality diseases, hardly any certified seed will be produced since it will be difficult to meet

the quality standards after field multiplication of basic seed. The latter is the case in Kenya, particularly related to blackleg, which has a zero tolerance for all seed classes while it is abundantly present.

3. Implications for seed quality standards

The survey shows that blackleg caused by bacteria of the Erwinia complex is common and widely spread in the main potato production areas in Kenya. Since these bacteria are easily transmitted by seed, soil, water, and rain they will always be present and cannot be eradicated. Worldwide, blackleg is a very common disease and considered as a quality disease with a certain tolerance level in the lower seed classes of a certification scheme. A zero tolerance is normally only applied to quarantine diseases such as *Ralstonia solanacearum*, also referred to as Bacterial Wilt.

The case of Tanzania may serve as an example. Seed production in Tanzania takes place under environmental conditions very similar to those in Kenya. The main difference is that in Tanzania there is less pressure on agricultural land and crop rotation for potato is easier to implement. In fact, Tanzania has the conditions to become a major producer of seed potatoes in East Africa. The tolerance for the quarantine disease *Ralstonia solanacearum* is zero for all seed classes. The tolerances for bacterial diseases of the Erwinia complex are indicated in table 1. The tolerances are zero for pre-basic seed while for basic seed and certified seed there is a small tolerance for blackleg. If the tolerance for blackleg would have been set at zero for all classes, virtually no official seed could have been produced. With the tolerances as indicated it is expected that Tanzania will be self-sufficient in certified seed in the near future.

Table 1. Tolerances (%) for Blackleg caused by bacterial diseases of the Erwinia complex in Tanzania (TOSCI, 2020)

| Pre-basic tissue culture | Pre-basic | Basic seed class 1 | Basic seed class 2 | Certified seed class 1 | Certified seed class 2 |
|--------------------------|-----------|--------------------|--------------------|------------------------|------------------------|
| 0 | 0 | 0.5 | 1 | 1.5 | 2 |

4. Conclusion

The future of potato as a major food crop is at stake due to decreasing yields and stagnating production of certified seed. Increasing output of certified seed to replace informal seed is crucial to stop the trend of decreasing yields. Current efforts to increase seed production through tissue culture and mini-tuber production systems have little effect as long as quality standards of certified seed have a zero tolerance to a common disease like blackleg. Alignment with international standards in which bacterial diseases of the Erwinia complex are considered quality diseases, with a certain tolerance in the lower seed classes, is needed to boost production of certified seed.

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