The Importance of Resistance to Late Blight in Potato Breeding in Africa

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World potato production is 295 million metric tons produced on 18.4 million hectares of land, of which Africa produces 3.15% on 4.08% of the total hectarage. Production per unit area in Africa stands at 12.4 t/ha, while world average is 16.4 t/ha. Of the 34 countries in Africa producing potatoes, 22 produce less than 10 t/ha. Potato production in Africa has been hampered by many biotic and abiotic constraints, among which the most important ones include late blight (*Phytophthora infestans*), bacterial wilt (*Ralstonia soanacearum* Syn. *Pseudomonas solanacearum*), viruses, and lack of adapted cultivars and clean seed. Late blight is currently the most devastating potato disease. This is especially true in the African highlands where the fungus flourishes. At the same time, these are the areas most appropriate for potato production.

The potato was introduced to most African countries at the beginning of this century and very quickly became an important subsistence crop. Although potatoes had been imported and grown in Africa for many years, it was not until 1941 that potato late blight was first observed in East Africa. It is believed that the disease was introduced by a special consignment of seed tubers that had been certified to be virus-free. Most varieties presently known in tropical Africa deteriorate with late blight very rapidly.

The ultimate goal in adapting a new variety for continued potato cultivation is to satisfy consumer choice. Most national potato programs in Africa breed for adaptation, yield, resistance to late blight, bacterial wilt and viruses. In bacterial wilt-free areas, late blight resistance and yield are the major traits screened for. Yield losses range from 40 to 95% in unsprayed potato crops. In Kenya, for example, yield losses of between 56% and 76% have been recorded on different varieties during the 1991-1998 period. Losses depend on the timing of disease appearance and its subsequent build-up. In some years, however, when the disease appears early and continues to multiply throughout the season, the losses may get higher.

Resistance to late blight is important as a potato breeding strategy in Africa. Potato production in Africa has quadrupled over a dozen sub-Saharan African countries during the last thirty years. Factors contributing to this growth and possible continued expansion ranges from good marketing prospects to availability of adaptable varieties to expanded utilization channels. Processing of potatoes into food products such as French fries, chips, and dried products has become increasingly important in urban areas in Africa. Emphasis by a number of national programs on breeding for resistance to late blight and tapping the genotypes bred by CIP through international co-operation have made a number of suitable varieties available to the end-users. Initial introductions of potato cultivars to Africa were susceptible to late blight. They were mainly introduced from Europe, where use of fungicides to control blight was cheap and affordable and host resistance to late blight was not a big issue. Metalaxyl resistance was not yet a problem. Many countries in Africa have released varieties over the last thirty years with a combination of attributes, including late blight and virus resistance. South Africa, for instance, has released about 56 varieties since 1945 when the potato breeding program started. In some

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cases, seed was imported from the United Kingdom (UK) and was multiplied in the Northern Cape. In Uganda, at least 15 varieties have been released since 1968, when the potato improvement program was initiated with germplasm from Mexico and the United States Department of Agriculture (USDA). Prior to that time, seeds of various varieties were imported from UK and the Netherlands. In Cameroon, varieties like Desiree and Cardinal have been introduced from the Netherlands. Egypt still imports over 40,000 tons of seed from Europe annually.

Year round potato production is a common feature in many African countries. This has tended to promote the presence of late blight inoculum throughout the year. Continuous presence of spores, combined with year-round planting of potatoes, complicates the adoption of late blight control strategies and leads to production of virulent LB strains and mating types.

Changes in population structure of *Phytophthora infestans* have been reported in a few African countries. A2 mating type has been reported in Egypt and there are suspicions (yet to be confirmed) that these might also exist in Kenya and Uganda. The existence of A2 mating types seems to be coupled with resistance to Metalaxyl.

There is increased awareness of environment protection in Africa. Consequently, judicious use of fungicides is being given serious consideration.

Integrated disease management (IDM) strategy is becoming increasingly recognized as being environment friendly. Host resistance plays a pivotal role in controlling late blight when combined with reduced frequency of fungicide use. The IDM strategy can thus capitalize on the use of early maturing varieties, delay of the onset of disease epidemics, and slow down of disease development after the onset of the epidemics.

The ability of many plant pathogens to produce a seemingly endless number of new and highly virulent races tempts many scientists to conclude that stable control of diseases by resistance may not be feasible for some crops against some pathogens. Application of non-race-specific resistance to control potato late blight is being advocated as the most effective method. This, indeed, has to be combined with fungicide use and timely planting coupled with proper crop sanitation. Farmers will depend on the national potato programs to obtain varieties with horizontal resistance.

Cultivar development involves (a) formation of a population of genotypes, (b) evaluation of individuals within the population to select a new cultivar, and (c) multiplication of new cultivar seed. Most national programs in Africa are minimally involved in formation of populations. They depend on the genotypes generated by the breeding program at CIP. In order for national programs to successfully supply farmers with reliable varieties that have ample resistance to late blight, they need to consider the following issues and understand their applicability: Availability, source and nature of late blight resistance; existence of good, realistic screening methods for identification of resistance; relationship between disease susceptibility and crop loss under different environmental and cultural regimes; environments in which the new cultivars will be produced; available LB management options; population structure of *Phytophthora infestans*; and the type of farmers likely to use the varieties being developed.

Increased potato production in Africa, which is in the hands of resource-poor farmers, will be realized if successful implementation of late blight and bacterial wilt control are accomplished through integrated disease management. Host resistance to late blight will play a big role in IDM since the population structure of *P. infestans* is changing, fungicide resistance is increasing, and farmers are still unable to afford the high cost of fungicides.