MAIZE LETHAL NECROSIS:

Possible threat to local maize production

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Maize (*Zea mays* L.) is the most important cereal crop in sub-Saharan Africa, covering over 25 million hectares, largely in smallholder farming systems that produce over 38 million metric tons (MMT) of grain.

This represents 34% of cereal production and is 8% of the value of all crops in the region. Maize is critical for food security in sub-Saharan Africa – eastern and southern Africa use 85% of the maize produced as food, while Africa as a whole use 95% as food.

Maize production in South Africa is largely rain dependent as 60% of maize is cultivated on dry land while only 20% is irrigated. Maize is planted in seven of the nine provinces of South Africa and includes the Free State, Mpumalanga, North West Province, Gauteng, KwaZulu-Natal, Limpopo and the Northern Cape provinces on a total area of 2,78 million ha. A total of 11,72 million tons of maize in the 2012/2013 season were produced that increased to a total of 13,029 million tons of maize from 2,68 million ha in the 2013/2014 season.

History of maize lethal necrosis

A serious disease outbreak in Kenya, later diagnosed as maize lethal necrosis, was first reported in September 2011 in the Longisa division of the Bomet district. By 2012, symptoms consistent with maize lethal necrosis were observed in a number of districts in the Central, Nyanza, Western and Rift Valley provinces of Kenya.

Since then, the disease has been reported by Rwanda and Democratic Republic of Congo. Similar symptoms on maize have been reported by Uganda and Tanzania, and more recently by South Sudan and Ethiopia. Recent discussions with pathologists in Tanzania have raised suspicions that the disease may already be in Tanzania in the Mtwarao region which borders on northern Mozambique.

Maize lethal necrosis has previously been reported in Peru, United States of America, Argentina, Mexico, Thailand, Brazil and China. Crop losses of up to 100% have been reported. The potential avenues of reaching South Africa are from Tanzania into Mozambique and into the sub-tropical areas of South Africa where subsistence maize is often grown continuously throughout the year.

Viruses involved in maize lethal necrosis disease

Maize lethal necrosis disease symptoms (**Photo 1a** and **Photo 1b**) is caused by the synergistic co-infection of maize with maize chlorotic mottle virus symptoms (**Photo 2**) and any virus from the family *Potyviridae*, these include wheat streak mosaic virus, maize dwarf mosaic virus symptoms or sugarcane mosaic virus symptoms (formerly maize dwarf mosaic virus-B) (**Photo 3**).

Singular infections of each virus alone produces milder symptoms but when combined infections of maize chlorotic mottle virus and any of the potyviruses produce a synergistic reaction that results in plant death. In many cases maize chlorotic mottle virus infections alone under abiotic stress conditions, such as drought and low nitrogen have also been known to develop maize lethal necrosis symptoms.

Maize chlorotic mottle virus has not yet been reported in South Africa, however, maize dwarf mosaic virus infects maize plantings on a localised scale but can be very severe in certain areas. Sugarcane mosaic virus has been reported to occur on sugarcane in South Africa and is widespread throughout the sugarcane industry.

Sugarcane is often grown in close proximity to maize fields both commercially and by subsistence farmers. It is highly possible that maize grown in these areas may be infected with sugarcane mosaic virus. It is critical that a full survey on maize viruses be conducted throughout the South African maize industry to determine what viruses do occur in South Africa.

Maize dwarf mosaic virus and maize streak virus have been reported on maize in South Africa. The results of the survey will allow an objective assessment as to the potential risk we have of maize lethal necrosis becoming an epidemic in South Africa.

Maize streak virus is common throughout Africa and is restricted to sub-Saharan Africa where it has been known to result in major yield losses. The possible synergistic action of maize chlorotic mottle virus and maize streak virus has to date not been examined.

In a presentation in Naivasha in Kenya Dr Anne Wangai highlighted that the possible synergistic action of maize chlorotic mottle virus and other viruses outside the *Potyviridae* needs to be determined.

Host plants

The experimental host range where maize lethal necrosis disease is concerned, is restricted to the grass (*Poaceae*) family with maize being the primary and natural host. A number of natural and planted grass species have been infected with either or both viruses using mechanical inoculations and include: *Bromus* spp., *Digitaria sanguinalis, Eragrostis trichodes, Hordeum* spp., *Panicum* spp., *Setaria* spp., *Sorghum* spp. and *Triticum aestivum*.

Research on potential alternate host plants is ongoing in Kenya and the list of hosts is increasing. Locally we need to determine which of these alternate hosts grow naturally or are grown as crops in South Africa and where.

This will enable us to determine the extent of a potential inoculum reservoir for the different viruses involved in the possibility of a maize lethal necrosis outbreak in South Africa. This will require a survey of grasses in high risk areas and screening of the grasses for any of the previously reported maize viruses.

Transmission of maize lethal necrosis

Transmission is largely mechanical, by insect vectors and/or seed-borne. Mechanical transmission is illustrated by the ease at which plants can be inoculated using a blower to blow a fine mist virus suspension onto plants to screen them for maize lethal necrosis.

Mechanical transmission will also include movement of people, animals and implements through infected fields. Vector transmission of the primary viruses has been studied to a point but more research on the interactions between the vector, virus and host is required to determine latent periods for feeding to carry over the various viruses that are involved in this complex.

Seed transmission of maize chlorotic mottle virus was originally shown to be very low with maize chlorotic mottle virus transmis-