A new napier grass stunting disease in Kenya associated with phytoplasma

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Introduction Napier grass (*Pennisetum purpureum* Schum) is a cultivated elephant grass native to Eastern and Central Africa forming the major livestock feed on East African smallholder dairy farms (Valk, 1990) as it is suitable for cut and carry for zero-grazing management systems. Although several plant pathogens have been described historically they were seldom severe. However, in 1970s there was an outbreak of snow mould fungal disease caused by *Beniowskia spheroidea* that attacked most varieties of napier grass. A napier grass variety clone 13 was bred which is resistant to the disease. In the 1990s two major outbreaks of napier grass diseases occurred in Kenya. In Central Kenya a napier grass head smut caused by *Ustilago kamerunensis* H Sydow and Sydow in 1992 and in Western Kenya a napier grass stunting disease was first reported in Bungoma in 1997. A similar stunting disease had been reported in Uganda (Tilley, 1969), which was suspected to be a virus transmitted by insects. This new outbreak of napier grass stunting disease is of major concern as it attacks all varieties of napier grass. The main objective of this study was to survey the extent of the disease and to identify the organism causing this disease.

Materials and methods A survey was carried in 2001 of 100 farmers' fields in five districts of Western Kenya by a multidisciplinary team of scientists to assess the occurrence of napier grass stunting disease, describe its symptoms, assess its spread and collect samples for laboratory analysis. Samples collected for laboratory analysis included leaves, roots, stems and insects found feeding on the whorls of diseased plants. Individual sections of the leaves, roots and stems from healthy and diseased samples were tested for possible fungal pathogens using a method developed by Lloyd and Pillay (1980). Further samples were used to test the presence of viruses. A third set of samples was taken to Rthamsted, U.K. to test for both virus and mycoplasma pathogens. At Rthamsted, yellowed and apparently healthy napier grass were grown under quarantine. A total DNA extraction was done from each sample for use as a template in a nested Polymerase Chain Reaction using phytoplasma 16S ribosomal DNA primers P1/P7 and R16F2n/R16R2. A band of 1250-bp rDNA product was amplified from all yellow leaves and in two of three apparently healthy leaves.

Results and discussion The survey and subsequent farm visits indicated that the disease had spread from the original district to five adjacent districts by 2001. The disease had spread to four more districts by 2003. Disease incidence ranged from 10-100%. The highest mean incidence recorded was in Bungoma and the least was in districts further away. No resistant napier grass variety was found. Cutting frequency, low soil fertility and water intensity stress intensify incidence and severity of the disease. The characteristic symptoms of the disease are yellowing of napier grass foliage, reduced leaf size, proliferation of tillers and shortening of internodes resulting in stunted growth. Laboratory analysis of external and internal morphology showed that the disease was not caused by either nematodes or fungus or virus. The DNA analysis showed that the sample grown had yellowed leaves and stunted growth and were phytoplasma positive. Refracted fragment length polymorphism (RFLP) analysis of amplimers showed similar patterns for all samples. While BLAST analysis showed the phytoplasmas to be the member of 16SrX1 (Rice yellow dwarf group). The higher homology 96% was with the 16SrX1 Bermuda grass white leaf group phytoplasma. Thrips, aphids and leaf hoppers were the main insects found feeding in the whorls of diseased plants.

Conclusion A phytoplasma similar to the rice yellow dwarf group is the casual organism of napier grass stunting disease in Western Kenya. Sugarcane and upland rice are possible hosts of this group of mycoplasma. A leaf hopper is the most probable vector. Movements of vegetatively propagated napier grass planting material provides a means for the rapid spread of the pytoplasma. There is a need to develop a napier grass variety resistant to this disease.

References

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