The impact of *Agrobacterium tumefaciens* and other soil borne disease causing agents of economic importance in production of roses

Video conference on global competitiveness of the flower industry in the Eastern Africa Region

Kenya Development Learning Centre (KDLC) 07th June 2011
1. Agriculture is the mainstay of Kenya’s economy

2. Horticulture contributes 33% of agriculture’s GDP

3. Domestic value of horticultural produce US$. 2.0 Billion

4. The sub-sector employs over 6.5 Million Kenyans

5. The sub-sector foreign exchange earnings US$. 1.0 Billion (2010)

Flower industry in Kenya

1. Earnings from flower exports over the same were US$. 500 Million

2. There are about 150 registered flower growers and exporters in Kenya

3. The industry employs direct over 90,000 Kenyans and indirectly over 500,000

4. Flower exports (tonnes) to Europe
   a. 2005 - 81,215
   b. 2006 - 86,480
   c. 2007 - 91,193
   d. 2008 - 93,639
   e. 2009 - 117,713
   f. 2010 - 120,220

5. Kenyan flowers account for over 30% of flowers auctioned in Europe

6. Roses make up 74% of Kenya's flower exports
Agrobacterium tumefaciens - crown gall disease

1. In Kenya, the crown gall disease prevalence was noticed in 1998

2. Introduced in Kenya through imported infected root stock of roses

3. *A. tumefaciens* is widely spread in the Kenya

4. It is very versatile & adaptable - impossible to eradicate completely
Agrobacterium tumefaciens - impact

1. It is difficult to quantify the impact

2. An infected field can result into the entire farm infected in short period

3. Severely infected fields never attain prod. Targets usually lead to rouging

4. The disease significantly reduces production of roses
   a. stunted growth
   a. reduced stem length
   a. reduced production lifespan
   a. wilting and eventual death of the plant
Agrobacterium tumefaciens - Management

1. Cultural practices
   a. high field hygiene is vital in every activity in minimizing incidences
      i. avoid infected nursery stocks; inspect the roots
      ii. disinfect pruning, harvesting, and other farm tools
   b. avoid wounding plants during regular field operations
      i. weeding and pruning
      ii. Control chewing insects & piercing nematodes
   c. plants infected should be rouged as a matter of routine practice
   d. Incorporating high organic matter content in crop land
   e. regulating nutrients to promote uptake of Copper
2. Biological practices
   a. use non-pathogenic \textit{A. radiobacter} k84
      i. soaking seeds
      ii. dipping transplants

   b. no clear indications regarding use of resistant or tolerant varieties
      i. some older varieties conferred had these attributes
      ii. News varieties seemingly lack the attributes

   c. use of biopesticide based products
      i. Neem oil
      ii. AB spay for coating and drying of wound of galls
      iii. NO GALL (\textit{A. radiobacter} strain K1026) – prevents infection
3. chemical practices
   a. copper based compounds provide good results
      i. dipping transplants - KOCIDE 101
      ii. applying concentrated paste
   b. 2, 4 – Xylenol and metacresol mixture
      i. effective in managing established tumours
   c. dipping of seedlings in a bactericide at transplanting
      i. reduce disease incidence and severity
4. Integrated practices
   a. no out rightly recommended integrated approach in Kenya
      i. no empirical research has been done in this regard
   b. However, growers have reported that a combination use of
      i. “clean” planting materials;
      ii. high field hygiene and rouging of infected plants;
      iii. treatment of irrigation water (more so for the recycled) to kill microbes; and
      iv. Application of copper based compounds significantly reduces the disease severity.
Other Soil Borne Disease Causal Agents – Management

5. Other Soil Born Disease Causal Agents
   a. *Fusarium* sp.
   b. *Pythium* sp.
   c. *Rhizoctonia* sp.
   d. *Meloidogyne* sp.

6. Mainly managed through use of recommended
   a. fumigation practices and application of fungicides
   b. Use of fungi such as Arbscular mycorrhizae
   c. use of resistant / tolerant varieties
   d. use of clean planting material, and bio-pesticides
   e. use of UV/UF machines in water treatment
   f. biopesticide known as PHYTOPROTECT
Research conducted

1. *Agrobacterium tumefaciens*

   a. A research on a proper accurate testing mechanism, description of infection moments, and agents that control the actual bacterium with the Ti-plasmid

   i. was undertaken by “Kreative Roses”, the Kordes production company at Lake Naivasha in collaboration NAK Tuinbouw in Netherlands, and FERA (formerly CSL) in the UK

   ii. This research was funded by “Kreative Roses”, together with a group of breeders, and the United Kingdom Government
2. *Agrobacterium tumefaciens*

   b. Research on production of *Agrobacterium* free nursery stocks using biological control focusing on use of radiobacter strains that attack Ti *Agrobacterium* in combination with use of beneficial fungus

   i. was jointly undertaken by FERA and Real IPM

   ii. The research was funded by DFID and African Challenge fund.
3. Other than the Phytosanitary controls, we are not aware of regional or international protocols to mitigate against *Agrobacterium tumefaciens*. Different institutions have different protocols and these are not always economically viable.

4. **Other soil borne diseases:**

   a. Management of *Fusarium oxysporum f.sp. roae*, *Meloidogyne hapla*, and weeds using chemicals and Brassica biofumigants in greenhouse rose (*Rosa* sp.) production.

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THANKS YOU