# Effect of Phytotoxic Factors and Potassium Nutrition on Banana Xanthomonas Wilt

*M. Atim[1], F. Beed[2], L.Tripathi[2], G.Tusiime[1], M. Mwangi[2,4] and J. Kubiriba[3]*

*[1]Crop Science Department, Faculty of Agriculture, Makerere University, Kampala, Uganda; [2] International Institute of Tropical Agriculture, Kampala, Uganda; [3] National Agricultural Biotechnology Centre, Kawanda Agriculture Research Institute, Kampala, Uganda; FaCT BioSciences Ltd, Nairobi, Kenya.*

## Introduction

Banana Bacterial Wilt (BXW) caused by *Xanthomonas vasicola* pv. *musacearum* (*Xvm)* is a major threat to banana production in the Great Lakes Region. Within this region bananas are grown to ensure food security and to generate income. In order to sustain and further develop the banana sector it is imperative that this newly introduced disease is efficiently controlled. Based on the premise that control interventions can only be developed when the epidemiology of a disease is understood, the aim of this study was to better understand key factors that contribute to the development of BXW. One set of experiments investigated whether *Xvm* produces chemicals in culture medium that induce phytotoxic symptoms in a bioassay using detached banana leaves. Such chemicals are known to aid pathogenicity or virulence for other bacterial plant pathogens. A second set of experiments investigated whether the availability of a range of different nutrients, at varied concentrations, influenced the development of BXW on banana plantlets. Results from varied potassium applications are reported here. The quality and quantity of nutrients in soil are known to either increase or decrease disease, depending on the pathosystem, and hence soil amendments can be modified accordingly.

## Phytotoxic factors

*Xvm* was cultured on Yeast Peptone Glucose Broth (YPGB) for 12 days. Crude cell free culture filtrates were obtained and tested using a bioassay with detached leaves of the BXW susceptible cultivar; Yangambi Km5. Leaves treated with cell free filtrate demonstrated symptoms of water soaking followed by chlorosis and necrosis (similar to those that developed following inoculation of a leaf petiole with *Xvm)* (Figure 1). The sensitivity of different banana cultivars and plant species to the culture filtrate is being elucidated through further study.

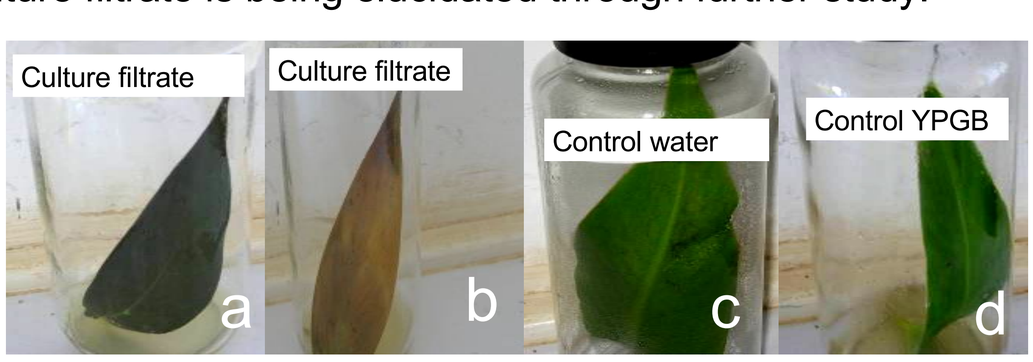


Figure 1. Demonstration of phytotoxic compounds in cell free culture filtrate of *Xvm* using a detached leaf bioassay. Initial symptoms of water soaking (a) followed by chlorosis (b). Controls; water (c) and YPGB medium alone (d).

## Potassium nutrition

Plantlets of the BXW susceptible cultivars FHIA 17 and *Pisang awak* were regenerated for 8 weeks on Murashige and Skoog (MS) medium containing varied potassium concentrations (0.1X, 0.5X, 1.0X and 2X the routine concentration of 783 mg/l). Plantlets were then inoculated with *Xvm* and evaluated for disease incidence, according to the *in vitro* screening method for BXW developed by Tripathi *et al* (2008). Diseased plantlets showed chlorotic and necrotic symptoms (Figure 2).

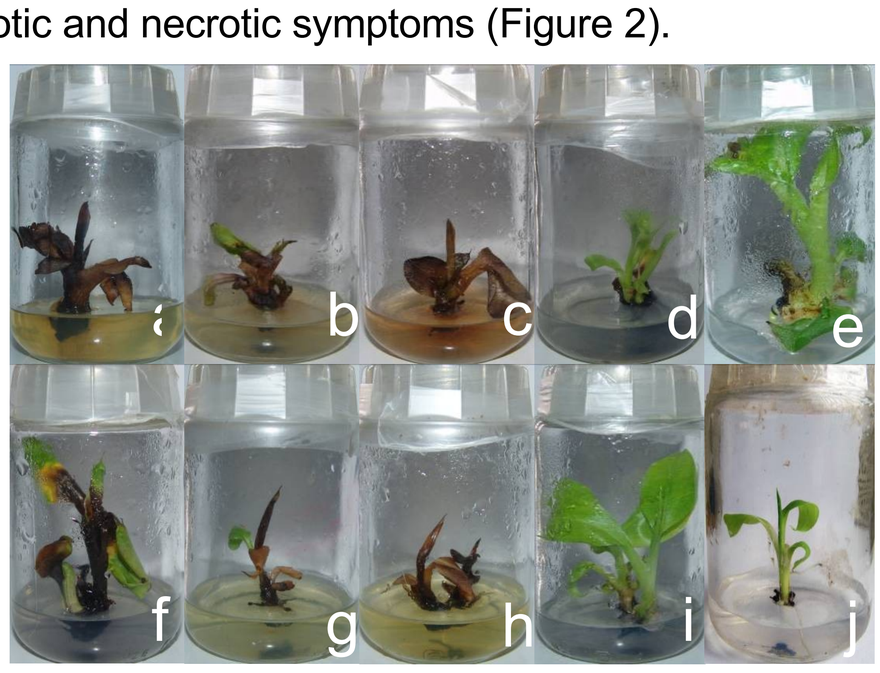


Figure 2. BXW symptoms (33 days after inoculation) on *Pisang awak* grown on 0.1K (a), 0.5K (b), 1K (c) and 2K (d) and on FHIA 17 grown on 0.1K (f), 0.5K (g), 1K (h) and 2K (i). Controls (e) and (j) were inoculated with sterile distilled water.

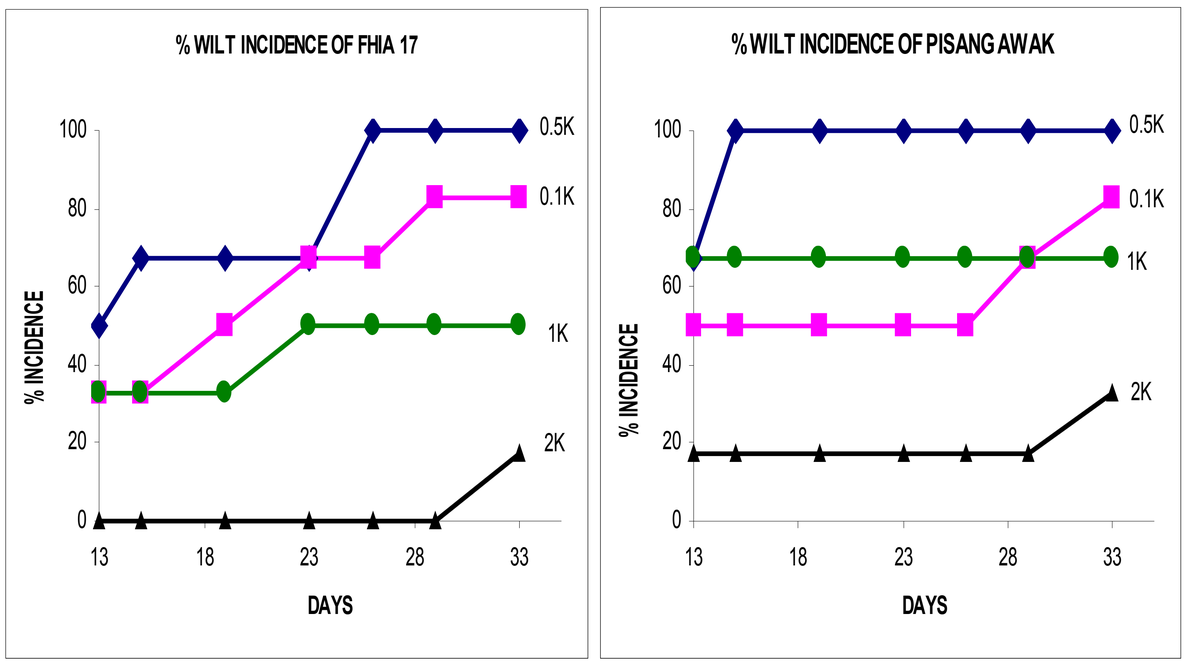


Figure 3. Wilt incidence (%) of FHIA 17 and *Pisang awak* plantlets grown on MS media with varied concentrations of potassium.

For both cultivars tested; wilt incidence was significantly reduced with increased potassium concentration (Figure 3). In addition, for FHIA 17 it took longer for the first symptoms to appear when plantlets were grown under the 2X potassium concentration.

## Conclusion

• Phytotoxic factors for banana were shown to be produced by *Xvm*. Further isolation and characterisation of these factors and proof of their fundamental role in pathogenicity or virulence could lead to their use in breeding programs to screen for BXW resistance. Furthermore, identification of substrates that encourage their production could lead to agronomic practices that reduce their availability in the field and hence limit disease development.

• Increased potassium availability for banana reduced disease incidence. Field trials are recommended to test the impact of agronomic practices, that increase the supply of potassium to bananas, on BXW. Further study is also required to elucidate the mechanism induced by increased potassium that results in reduced disease incidence.

### Reference

Tripathi, L., Odipio, J., Tripathi, J.N. and Tusiime, G. (2008). A rapid technique for screening banana cultivars for resistance to Xanthomonas wilt. European Journal of Plant Pathology. 121(1):9-19.

### Acknowledgements

•To Piet Van Asten of IITA for his expert advice in nutrient studies.
•IITA for funding the study.
•BTC for the MSc. Scholarship awarded to M. Atim.

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