

AWARENESS OF BANANA BACTERIAL WILT CONTROL IN UGANDA: 1. FARMERS' PERSPECTIVE

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ABSTRACT

The outbreak of banana bacterial wilt is increasingly threatening the production of bananas in Uganda. The most affected are the non-traditional banana types (Kayinja and Kivuvu) although the disease affects all types of bananas including Matooke. Due to the gravity of the problem, Uganda Government, through the Ministry of Agriculture Animal Industry and Fisheries and National Agricultural Organization-Banana Research Programme, has been implementing a programme of making farmers aware of the problem and what they can do to control it. A number of approaches have been used including media, training of local extension staff and local leaders, reaching out to civic leaders and policy makers and participatory development communication. This study was carried out specifically to assess farmers' awareness of BBW and the recommended control methods, to establish farmers' management of the BBW problem and to analyse constraints that are likely to limit farmers' adoption of recommended BBW management practices. Results show that a good proportion of farmers new about the outbreak of BBW but few knew its mode of spread and mainly in areas it has existed for some time (Kayunga, Kamuli and Luwero). In the same sites, a good proportion of farmers knew the importance of removal of male buds and other control methods such as uprooting infected plants but implementation was a problem. They cited lack of labour, tradition limitations (such as the practice of not removing male buds on kayinja), and inadequate information as some of the factors limiting adopting recommended practices for the control of Banana Bacterial Wilt. Sensitization either at district or subcounty level improved farmers' awareness of the BBW problem although they were concerned about receiving conflicting messages from different sources. Most of them reported that they were reluctant to implement messages received from media (e.g. radio). Participatory development communication seems to be a viable approach but will require commitment from all stakeholders in the banana production sector.

Key Words: Adoption constraints, cultural control practices, *Musa* sp.

RÉSUMÉ

La flambée de la maladie du flétrissement d'origine bactérienne de la banane (BBW) constitue une menace croissante à la production de bananes en Ouganda. Les types de bananes plus affectées sont ceux qui sont non-traditionnels (Kiyinja et Kivuvu) bien que la maladie s'attaque à toutes sortes de bananes y compris le Matooke. Etant donné la gravité de la question, le gouvernement ougandais à travers le Ministère de l'Agriculture, de l'Industrie Animale et de la Pêche et le Programme de Recherche sur la Banane-Organisation Nationale de l'Agriculture a été en train de mettre en œuvre un programme de vulgarisation des agriculteurs au sujet de ce problème et de ce qu'ils peuvent faire pour le combattre. Un certain nombre d'approches ont été utilisées y compris les médias, la formation de personnel local d'extension ainsi que celle de leaders locaux, atteignant les dirigeants civiques et les décideurs que la communication participative de développement. Cette étude a été menée spécifiquement en vue de pouvoir évaluer la prise de conscience chez l'agriculteur de l'ampleur du problème BBW et les méthodes de lutte recommandées, d'établir la gestion du problème BBW par les agriculteurs et d'analyser

les contraintes susceptibles de limiter l'adoption par les agriculteurs des pratiques de lutte anti-BBW recommandées. Les résultats démontrent que bon nombre d'agriculteurs étaient au courant de la flambée du BBW mais peu connaissaient son mode de propagation et cela principalement dans des zones où la maladie a existé depuis quelque temps (Kayunga, Kamuli et Luwero). Dans les mêmes sites, une bonne proportion d'agriculteurs connaissait l'importance de la pratique consistant à enlever les buds males et d'autres procédés de lutte tels que le déracinement des plantes infectées mais la mise en œuvre constituait un problème. Les agriculteurs citaient le manque de main d'œuvre, des limitations traditionnelles (Telle la pratique consistant à ne pas enlever les buds males sur Kayinja), et une information inadéquate comme certains des facteurs limitant l'adoption des pratiques recommandées dans la lutte contre la maladie du flétrissement d'origine bactérienne de la banane. La sensibilisation tant au niveau du district qu'à celui de la localité a amélioré la perception des agriculteurs face au problème BBW malgré le fait qu'ils étaient préoccupés par une information contradictoire qui leur parvenait de différentes sources. La plupart d'entre eux ont précisé qu'ils hésitaient à adopter des messages reçus à travers les médias (e. g. Radio). La communication participative de développement semble être une approche viable mais nécessitera un engagement de la part de tous les partenaires dans le secteur de la production de la banane.

Mots Clés: Contraintes à l'adoption, cultural control practices, *Musa* sp.

INTRODUCTION

Banana is one of the most important food crops grown in Uganda, mainly grown by resource poor farmers, who depend on it for food and cash income. Crop management and types of bananas produced are highly diversified, with southwest specialising mainly in the cooking type (Matooke) while the central and eastern regions mainly specialising in the production of nontraditional types (Kayinja, Sukali ndizi and of recent, Kivuvu) (Gold *et al.*, 1999; Bagamba *et al.*, 2000). The Matooke production system is quite intensified in terms of input use (specifically labour) and crop sanitation while labour bottlenecks limit adoption of certain management practices, specifically those that are labour intensive (e.g. crop sanitation) (Bagamba *et al.*, 2000). Imperfections in labour markets, seasonal labour bottlenecks, limited access to the inputs markets and credit, and lack of technical support have been reported as limiting factors for the adoption of crop production technologies in Africa (Johnston *et al.*, 2003; Benin, 2004) and in Uganda (Gold *et al.*, 1999; Deninger and Okidi, 2001). Lack of awareness, and varying perceptions and attitudes have also been at the forefront in influencing farmers' behavior in solving some of their production constraints (Nangoti *et al.*, 2004). Production of the non-traditional bananas in central and eastern Uganda had been influenced by their low management requirements in terms of inputs and

labour. For example Kayinja is rarely weeded, no crop sanitation is done and plantation longevity is higher than for Matooke (Bagamba *et al.*, 2000). Kivuvu has been slowly replacing matooke as a cooking banana because of its low production costs.

Despite the importance of the different types of bananas, they are quickly losing ground as a dependable crop due the outbreak of banana bacterial wilt (BBW) which was first reported in Kayunga in 2001 and was noted to be fast spreading because its incidence rose to 70% in one year (Tushemereirwe *et al.*, 2001). Currently it's in over 32 districts (central, Eastern, north-west and western) of the country with devastating effects on all types of bananas. Although the distribution is still localised to areas specialised in growing the nontraditional banana types, the disease is rapidly moving towards the dominantly Matooke growing areas (the south and western parts of the country) (Tushemereirwe *et al.*, 2004).

The disease is suspected to be spreading mainly through male flowers, contaminated garden tools used in banana plantations, browsing animals on infected banana plants, splashes of rain drops, winds and eroded contaminated soils to healthy plants (Tushemereirwe *et al.*, 2001). Farmers are currently encouraged to remove male buds, uproot, cut and bury affected plants and sterilize garden tools using fire or JIK (sodium hypochlorite). Since the crop is propagated vegetatively, planting material are suspected to be among the methods

of spreading the disease. Most farmers obtain the planting material from other farmers through farmer-to-farmer exchange.

Traditionally, information flow on agricultural related issues in Uganda has been through government extension system, which finally reaches the lowest farmer through farmer-to-farmer knowledge exchange and to a limited extent through non-governmental organizations. With the gravity of the BBW problem, government, through the ministry of agriculture animal industry and fisheries (MAAIF) and National Agricultural Research Organization (NARO), embarked on an intensive programme of sensitizing the farmers about the magnitude of the problem, its identification methods of spread and control options. Thus a number of approaches were used to reach out to the farmers including the traditional extension system, media, civic leaders, cultural leaders, local leaders and use of participatory development communication (PDC) approaches. The media included the use local area radio stations, television, newspapers and brochures. The PDC methodology involved organizing farmers, local leaders, extension, researcher and communication specialists at village level to participate in designing area specific for BBW. This paper attempts to analyse the constraints associated with the different communication approaches. Specifically we assessed farmers' awareness of the BBW problem and control methods and analysed the constraints likely to limit farmers' adoption of recommended BBW management practices.

MATERIALS AND METHODS

The data for the study was drawn from 360 households selected using a multi-stage sampling methodology. The sample domain was purposively selected to represent major banana producing areas of Eastern, Central, Western and South-western Uganda. The sample was stratified according to disease incidences: (1) districts affected by disease for some time (>2 years), (2) districts recently affected by the disease (<2 years), (3) districts at the frontline or close to disease outbreak and thus at high risk or already infected by the time of data collection (<1 year), and (4) areas not yet affected by disease and remote from

disease front (low risk). Two districts were randomly selected from each group. Kayunga and Kamuli were selected to represent districts where the disease had been reported more than 2 years, while Mbale and Luwero were selected to represent the second group. Masindi and Mubende represented frontline districts and Bushenyi and Rukungiri represented districts that had not reported any BBW incidence and further away from the frontline. Data collection began with Bushenyi and Rukungiri, the districts that had not yet been affected lest they would get affected and change the criteria of sample selection. At the district level, two sub-counties were selected basing on previous history of sensitisation/awareness. At sub county level, three parishes were randomly selected from which 15 households were randomly selected in each of the parish.

Data was collected using a formal questionnaire pre-tested both in an area that was affected by BBW and one that was not affected. Data collected comprised of household and production characteristics, farmers' awareness of BBW problem and mode of spread, methods known and used for the control of BBW, the importance of removal of male buds and methods used and farmers' sources of information. The formal questionnaire interviews were supplemented with informal methods such as direct field observations and taking notes of the views of the farmers that had not been taken care of by the questionnaire. Direct field observations were made to relate information provided by the farmers during formal interviews.

Data collected was analysed using descriptive statistics (means and percentages) and presented in tabular or graphical forms.

RESULTS AND DISCUSSION

Table 1 summarises the demographic production characteristics of the study sites. The age of respondents ranged between 42-46 years while their education level was between classes 4-7. The study show that most farmers did not complete primary education and are in their mid forties.

Results further showed that 42-66% of the farmers derive their livelihoods solely from farming especially in central region (Luwero and Kayunga districts). With the exception of Mubende

TABLE 1. Demographic characteristics and importance of banana for the respondents by district

| Characteristics | Districts | | | | | | | |
|-----------------------------------|-----------|-----------|--------|---------|--------|-------|---------|---------|
| | Bushenyi | Rukungiri | Luwero | Kayunga | Kamuli | Mbale | Mubende | Masindi |
| Household characteristics | | | | | | | | |
| Age hh head (years) | 43.8 | 45.1 | 43.7 | 45.9 | 42.9 | 42.2 | 42.9 | 43.9 |
| Education hh head (years) | 3.9 | 5.6 | 3.8 | 4.7 | 6.6 | 6.8 | 5.4 | 7.2 |
| Production characteristics | | | | | | | | |
| Farm size (acres) | 3.6 | 3.7 | 6.9 | 4.7 | 3.7 | 4.4 | 7.7 | 3.4 |
| Acreage under bananas | 0.8 | 1.1 | 1.8 | 1.2 | 1.3 | 1.3 | 1.3 | 0.9 |
| Livelihoods | | | | | | | | |
| Farming only (%) | 56.9 | 51.7 | 66.0 | 65.0 | 44.1 | 42.4 | 46.4 | 45.0 |
| Banana primary crop (%) | 98.3 | 91.4 | 69.5 | 60.0 | 81.7 | 73.3 | 24.5 | 71.7 |
| Banana secondary crop (%) | 1.7 | 8.6 | 30.5 | 40 | 18.3 | 26.7 | 75.5 | 28.3 |
| Importance of bananas | | | | | | | | |
| Food only (%) | 45.5 | 21.7 | 35.0 | 28.3 | 36.7 | 50.0 | 24.5 | 20.0 |
| Cash only (%) | - | - | - | - | 1.7 | 10.0 | - | - |
| Food & cash (%) | 54.5 | 78.3 | 65.0 | 71.7 | 61.7 | 40.0 | 75.5 | 80.0 |

(24.5%), > 60% of the farmers grow bananas as a primary crop, the proportion being above 90% in the southwest. The primary objective of growing bananas is to meet household subsistence needs although a good proportion of farmers in addition grow it for a dual purpose of providing food and cash income (Table 1).

Production objectives are linked to the types of bananas produced in the study sites although physical, biological and economic constraints play a major part (Gold *et al.*, 1999; Bagamba *et al.*, 2000). The different types of bananas are also hypothesized to respond differently to different pests and diseases. BBW is not an exception with respect to this hypothesis. Although BBW affects all types of bananas, the incidence is different for the different types. Farmers reported that Kayinja is the first to be attacked and then Kivuvu although in the case of Kivuvu, the disease quickly spreads to other plants.

Table 2 presents results on the different modes of transmission farmers were aware of. Spread by insects was the most known in Luwero, Kayunga and Masindi districts. Other modes of spread reported were tools or field implements (Mubende and Masindi), wind and people. Farmers reported that people spread the disease mainly through sucker transfer from other farmers' fields. A few reported some of these suckers to have originated from research institutions and a small section of these suspected the new cultivars that had been brought to their areas prior to the outbreak of the disease.

Results further show that awareness of the modes of spread varied greatly between the study sites. Farmers in Masindi, Mubende, Kayunga and Luwero districts were the most aware of the

mode of spread of the disease. This can be attributed to the intensive sensitisation of both local extension personnel and local leaders done in these districts at sub-county level. A few farmers in Bushenyi district (10%) were aware of the BBW spread mechanism while none knew in Rukungiri district. Sensitisation of district extension staff had been done at the district level in Bushenyi and not in Rukungiri. There was no significant difference in awareness for Kamuli and Mbale districts although farmers in Kamuli were slightly more aware than those of Mbale. The reason could be that farmers in Kamuli have stayed with the disease for a bit longer than those in Mbale. It should be noted that the proportions of farmers reporting awareness do not necessarily add up to 100%, as a farmer could be aware of more than one mode of transmission. From the results, we can conclude that sensitisation at local level (near the farmers) increases awareness and therefore eventual adoption of BBW control measures although farmers that were exposed to the disease for sometime could have been in a better position to seek for more information. In their study of farmers' organisations extension system, Mugisha *et al.* (2004) recommend regular visits to farmers as this increases farmers' awareness and for farmers to be taught the right skills and practices. In this study, farmers complained about different information they got from different sources and they would be more comfortable sharing their problem and solutions with the right people knowledgeable in that particular field (preferably NARO scientists).

BBW is expressed on a plant through a number of symptoms. Sometimes all the symptoms occur on the same plant but in most cases only one

TABLE 2. Farmers' awareness (% of farmers) of mode of spread of BBW in different districts

| Mode | Bushenyi | Rukungiri | Luwero | Kayunga | Kamuli | Mbale | Mubende | Masindi |
|-----------------|----------|-----------|--------|---------|--------|-------|---------|---------|
| Not known | 77 | 100 | 23 | 35 | 63 | 76 | 58 | 32 |
| Walking animals | - | - | 2 | 2 | - | - | 3 | - |
| Flying animals | - | - | - | 2 | - | - | 3 | 3 |
| People | 3 | - | 27 | 12 | 3 | 2 | 17 | 28 |
| Soil & water | 3 | - | 2 | 2 | 10 | 6 | - | 3 |
| Wind | 4 | - | 15 | 1 | 3 | 2 | - | 13 |
| Insects | 10 | - | 58 | 59 | 27 | 22 | 39 | 57 |
| Tools | 4 | - | 25 | 10 | 17 | 12 | 59 | 60 |

would be visible and in most cases this would be the drying male buds. Some farmers who do not remove male buds reported that they use them to identify affected bunches so that they are not harvested for consumption. Some farmers noted that it is in their tradition not to remove male buds from Kayinja because the practice reduces the quality of juice produced and therefore that of alcohol brewed from it. Others just found it tedious to remove the male buds. Some farmers maintain kayinja plots (especially in Luwero) for the sake of obtaining leaves for cooking. Others cited lack of labour as the most limiting factors preventing them from uprooting plants in infected plots. It was observed that such plots contained the largest proportion of infested mats and on which male buds were not removed. Nevertheless, farmers reported a number of advantages of de-budding in relation to the control of BBW (Table 3). Most farmers were not aware of the danger of not removing male buds especially in the southwest and Eastern regions. Ironically, the farmers in Luwero and Kayunga, who seemed to be more aware, were not removing male buds from their Kayinja plots. This calls for further sensitisation about the importance of removing male buds.

Table 4 further shows that most farmers still used or would use either a knife or a pruning knife to de-bud as a means of controlling BBW. This further implies that farmers were not aware of the danger posed by tools in the spread of BBW as already shown in Table 2. If it is true that tools facilitate the spread of BBW, then de-budding has mainly contributed to its spread rather than its control. The recommended use of a forked stick and use of Jik was found not to be common among the farmers. However, more than 15% of the farmers in sites where PDC was being implemented (Masindi and Mubende) were aware and using the stick for removal of the male buds. This calls for more sensitisation of farmers and other stakeholders in practices that are recommended for the control of BBW. For PDC to be successful, more participants should be brought on board to enhance institutional capacity and mobilize enough resources needed to reach the farmers. Sensitisation is needed for the local government officials (at the district) to integrate BBW activities in their annual budget proposals. Many instances, the district staff have complained for having not done their part because of lack of facilitation. They expected facilitation either from

TABLE 3. Importance of de-budding in relation to BBW (% of farmers reporting)

| Importance | Bushenyi | Rukungiri | Luwero | Kayunga | Kamuli | Mbale | Mubende | Masindi |
|-----------------------------|----------|-----------|--------|---------|--------|-------|---------|---------|
| Protects affected plants | - | - | 8 | - | 5 | - | 2 | - |
| Male buds cause BBW | 3 | - | 23 | 25 | 10 | 7 | 15 | 38 |
| Stop spread to other plants | 17 | 3 | 7 | 25 | 23 | 12 | 10 | 35 |
| Stop spread by insect | 15 | 5 | 25 | 49 | 27 | 22 | 41 | 70 |
| Not important | 4 | - | 10 | 18 | 17 | - | 3 | 3 |
| Not aware | 73 | 95 | 37 | 16 | 37 | 63 | 29 | 17 |

TABLE 4. Methods used in de-budding as a control measure for BBW (% of farmers reporting)

| Importance | Bushenyi | Rukungiri | Luwero | Kayunga | Kamuli | Mbale | Mubende | Masindi |
|------------------|----------|-----------|--------|---------|--------|-------|---------|---------|
| Stick/hand | 7 | - | 10 | 10 | 2 | 8 | 15 | 23 |
| Ordinary knife | 18 | 5 | 40 | 53 | 22 | 42 | 15 | 10 |
| Pruning knife | 42 | 24 | 48 | 67 | 68 | 58 | 63 | 63 |
| Jik | 1 | 2 | 5 | - | 3 | 5 | - | 2 |
| Heat treat knife | 1 | - | - | - | - | - | - | 10 |
| Do not know | 48 | 81 | 13 | - | 5 | 5 | - | 2 |

TABLE 5. Farmer sources of information regarding BBW problem and its management (% of farmers reporting)

| Source | Bushenyi | Rukungiri | Luwero | Kayunga | Kamuli | Mbale | Mubende | Masindi |
|--------------------|----------|-----------|--------|---------|--------|-------|---------|---------|
| Friends/neighbours | 8 | 5 | 54 | 42 | 63 | 55 | 61 | 45 |
| School/institution | - | - | - | 3 | 2 | 2 | - | 2 |
| Church | 2 | - | 4 | 5 | 2 | - | 2 | - |
| Extension | - | 2 | 9 | 27 | 3 | 7 | 15 | 3 |
| Traders | 2 | - | - | - | - | - | - | - |
| Newspapers | - | - | - | - | 2 | - | - | - |
| Training | 2 | - | 5 | 5 | - | - | 12 | 15 |
| Radio | 48 | 20 | 41 | 40 | 37 | 42 | 59 | 55 |
| TV/Video | 5 | 2 | 4 | 2 | 3 | 2 | - | 2 |
| Nothing | 39 | 72 | 17 | 8 | 15 | 27 | 3 | 2 |

NARO or MAAIF. For PDC to be successful, the district and sub-county leaders must commit themselves to give appropriate support, financial and otherwise.

Overall, most farmers obtained information about BBW problem and management from the radio (Table 5). A significant proportion of farmers obtained information from friends, relatives and neighbours, especially in already affected areas and in districts where PDC is being implemented. A few farmers obtained information from extension agents and training exercises, the proportion being higher in Mubende and Masindi, for training, and Kayunga, Luwero and Mubende for extension staff.

CONCLUSION

The importance of bananas as a food security crop is increasingly becoming threatened by the outbreak and spread of BBW. Most affected cultivars are the non-traditional types (Kayinja and Kivuvu) although Matooke is increasingly becoming threatened. Farmers' knowledge of the BBW problem and its spread was varied and patchy. Government's sensitisation activities through MAAIF and NARO-Banana Research Programme have contributed a lot to farmers' awareness of the problem. However, districts and sub-county leaders must increasingly be sensitised to integrate BBW related activities in their budgets. Integrating non governmental organisations (NGOs) and cultural institutions in BBW activities will increase the resource base required to reach out to farmers but this should be accompanied with appropriate training to avoid

giving farmers contradictory messages. PDC is a viable option for the control of BBW as it involves locals and farmers in coming up with solutions suited to their area. Thus to solve the BBW problem, it will require all stakeholders in the banana sub sector (researchers, policy makers, extension practitioners, NGOs, local and cultural leaders and farmers) to combine and commit resources to promote PDC in the control of BBW.

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REFERENCES

- Bagamba, F., Ssenyonga, J., Tushemereirwe, W., Katungi, E., Gold, C.S. and Katwijukye, A. 2000. Banana production systems: Luwero Baseline report. NBRP. Kawanda. Uganda.
- Bagamba, F., Ruben, R. and Rufino, M. 2005. Determinants of banana production efficiency in Uganda, Forthcoming, IFPRI, Washington, D.C. (In press).
- Benin, S. 2004. Enabling policies and linking producers to markets. *Uganda Journal of Agricultural Sciences* 9:871-886.
- Deninger, K. and Okidi, J. 2001. Rural households: incomes, productivity, and nonfarm enterprises. In Reinikka, R. and P. Collier (Eds.). *Uganda's Recovery: the role of farms and governments*, Washington, D.C.: The World Bank.

- Gold, C.S., Karamura, E.B., Kiggundu, A., Bagamba, F. and Abera, A.M.K. 1999. Geographical shifts in highland banana production in Uganda. *The International Journal of Sustainable Development and World Ecology* 6:45-59.
- Johnston, M., Hazell, P. and Gulati, A. 2003. The role of intermediate factor markets in Asia's green revolution: lessons for Africa. *American Journal of Agricultural Economics* 85:1211-1216.
- Mugisha, J., Madsen, O., Tumusiime, E. and Byekwaso, J. 2004. Performance of farmers led extension system in agricultural technology transfer and adoption. *Uganda Journal of Agricultural Sciences* 9:730-735.
- Nangoti, N., Kayoby, G. and Rees, D.J. 2004. Seed demand and supply in eastern and north Uganda: implications for government and non-government interventions. *Uganda Journal of Agricultural sciences* 9:778-784.
- Tushemereirwe, W., Kangire, A., Smith, J., Nakyanzi, M., Kataama, D., Musiitwa, C. and Karyeija, R. 2001. An outbreak of banana bacterial wilt in Mukono and Kayunga districts: A new and devastating disease. NARO/KARI.
- Tushemereirwe, W., Kangire, A., Ssekiwoko, F., Offord, L. C., Crozier, J., Boa, E., Rutherford, M. and Smith, J. J. 2004. First report of *Xanthomonas campestris* pv. *musacearum* on banana in Uganda. *Plant Pathology* 53:802-802.