

AWARENESS OF BANANA BACTERIAL WILT CONTROL IN UGANDA: 2. COMMUNITY LEADERS PERSPECTIVES

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ABSTRACT

Banana is a major source of food and income for about 70% of Ugandan population. The crop is threatened by banana bacterial wilt (BBW) disease, which was first reported in Mukono District in 2001. There have been nationwide campaigns, sensitising and training of the farmers and other stakeholders to contain the disease. Self-administered questionnaires, to assess community leaders awareness, were sent to Chief Administrative Officers of affected districts and to Parish Community Leaders in four Parishes in two Sub Counties per district. In total 680 leaders from 50 sub-counties in 12 districts were interviewed. The study showed that BBW was first seen in seven Districts in 1999. By 2001, when official reporting was made about 17% of the respondents from ten districts had already seen the disease in their communities. The results also show that 90% parish community leaders were aware of BBW, 63% were aware of controlling it by roguing and 35% have tried to apply a known control measure on their farms.

Key Words: *Xanthomonas campestris p.v musacearum*, public awareness, Uganda

RÉSUMÉ

La banane est la source majeure de nourriture et de revenu pour à peu près 70% de la population Ougandaise. La plante est menacée par la maladie de flétrissement bactérien de la banane, qui était signalée pour la première fois en 2001 dans le district de Mukono. Il avait une campagne nationale, sensibilisant et formant les paysans et autres partenaires au contrôle de la maladie. Les questionnaires étaient administrés, déterminer le niveau de sensibilisation de leaders communautaires, étaient envoyés aux autorités administratives des districts affectés et aux chefs des villages. Quatre villages et deux sous localités par district étaient considérés. Au total 680 leaders de 50 sous localités de 12 districts étaient interviewés. Cette étude montre que le virus de flétrissement bactérien de la banane était signalé pour la première fois observée dans sept districts en 1999. En 2001 quand le report officiel était fait à peu près 16,5% des répondants de 10 districts avaient déjà vu la maladie dans leur communauté. Les résultats montrent aussi que 90% des leaders communautaires étaient sensibilisés sur le virus de flétrissement bactérien de la banane, 63% étaient sensibilisés dans son contrôle traditionnel/ non standard et 35% ont essayé une mesure connue de contrôle sur leur ferme.

Mots Clés: *Xanthomonas campestris p.v musacearum*, sensibilisation, Ouganda

INTRODUCTION

Banana is an important dual-purpose crop as a staple food and source of income for over 70% of the national population in the western, central and

eastern regions of Uganda. The region hosts a large collection of *Musa* diversity, with over 2320 indigenous East African highland cooking bananas (matooke) (*Musa* spp AAA) and East African highland brewing bananas mbidde (*Musa* AAA)

(Simmonds, 1966; Karamura, 1999) being grown by small scale farmers on average plot sizes of 1.6 ha/farm.

The other types of bananas grown by Ugandan farmers include the earlier exotic types like kayinja (ABB), kivuvu (ABB), ndizi (AAB), kisubi (AB). Others being grown are a variety of plantains, (gonja) and Gros Michiel (Bogoya) (Rubaihayo, 1991; Karamura 1999)

Series of national surveys namely rapid rural appraisal (Rubaihayo, 1991; Gold *et al.*, 1993), Masaka base line survey (Ssenyonga and Bagamba, 1999), Luwero baseline survey (Ssenyonga and Bagamba, 2000) have consistently identified and ranked the major banana production and utilisation constraints to farmers as (1) soil fertility decline, (2) pests (banana weevils and nematodes), (3) diseases (black Sigatoka, Fusarium wilt, matooke wilt, banana streak virus), (4) post harvest losses and (5) socio-economic (low/fluctuating market prices and lack of inputs) ones. However, most recently, the outbreak of banana bacterial wilt disease (BBW) is the most serious threat to production in Uganda. The BBW affects all types of bananas and spreads very fast causing a devastating effect on all types of bananas. The disease poses an imminent threat of wiping out total banana production in the country.

Banana bacterial wilt caused by *Xanthomonas campetris* pv. *Musacearum* is a new banana disease that was first reported in Ntunda subcounty, Mukono district, September 2001 (Tushemereirwe *et al.*, 2003). Before that it had only been reported from Ethiopia on onset (*Ensete ventricosum*) (Yirgou and Bradbury, 1968). Field observations suggest that kayinja, kivuvu and sukali ndizi are the most susceptible types of bananas to BBW disease.

Symptoms of the disease include premature uneven ripening, with reddish brown discolouration in banana fingers, which rot and stay on stalk. The banana fingers become hard and the diseased fruits cannot be eaten by both man and animals nor squeezed into juice. These can be confirmed by cutting the fingers with a knife. The male bud also withers off, rots, and eventually dries up but stays on the plant. When a banana plant is affected before flowering, the leaves droop at the leaf end; the lamina turns yellow and

then dries up. The core part of a diseased pseudostem turns dark brown and when cut yellow bacterial ooze comes out.

The means and agents of spread of disease include the use of contaminated farm tools (like knives, cutlass, hoes), movement of diseased plant materials (like suckers, leaves, fibre and fruits), insects (like flies, bees, wasps, ants) planting in infested soil and the acts of people and animals.

During 2002, steps were taken by the relevant authorities in Uganda, to control disease spread. By the end of 2003, the BBW had been reported in seven districts of Uganda and by August 2004, the disease had been confirmed in 21 districts of northern, eastern and central Uganda.

Following the outbreak of BBW epidemics, the Ministry of Agriculture, Animal industry and Fisheries (MAAIF) in conjunction with National Agricultural Research Organisation and other key stake holders constituted a national task force in December 2001, which in November 2003 formulated long-term strategy and action plan to eradicate the disease. This strategy includes national coordinated efforts of continuous monitoring of the epidemics; awareness raising and training campaigns, empowering all stakeholders at all (district, Sub County, parish and village) levels to control the disease. In November 2004, the stakeholders for the BBW control initiatives prepared to undertake a countrywide awareness raising campaigns using mass media such as radio, distribution of 39,000 posters and 67,000 brochures. These campaigns were to be followed by implementation of massive training of trainers and formation of BBW control task forces at district, sub county, parish and village levels.

In order to enable subsequent monitoring, evaluation and assessment of the impacts of BBW control activities, two types of baseline surveys to benchmark data were undertaken in January 2005. The BBW baseline surveys were (a) self-administered questionnaire targeting parish community leaders in some selected districts and (b) national BBW baseline survey. This paper describes the study to benchmark the status of BBW in 10 districts of Uganda as of February 2005.

The objectives of self-administered baseline survey were: a) to establish the level of awareness

of banana bacterial wilt by parish community leaders, and (b) to document benchmark data about awareness of BBW and its control measures that are being applied as of February 2005.

MATERIALS AND METHODS

A self-administered baseline survey targeting parish community leaders from 21 districts where by November 2003, BBW disease had been confirmed was administered. Questionnaires were mailed to the respective District chief administrative officers, who distributed them to parish community leaders from two or more sub counties (4 parishes per sub county). Earlier, a BBW surveillance and sensitisation team from MAAIF had visited and sensitised the Chief Administrative Officers (CAOs) of the 21 districts. In a number of districts, the BBW sensitisation team had also facilitated formation of BBW taskforce communities at district and sub county levels.

The questionnaire had the following sections: a) Personal and household characteristics, b) Awareness of recent banana problems and c) Actions being taken by the parish community leaders in their personal capacity and/or as community leaders. The personal and house hold characteristics (name, address, age, education, family size, major sources of food and major sources of agricultural information).

Questions on awareness of BBW, covered the major recent banana problem, their symptoms, year when the problem was first seen/heard, and the cultivars of bananas most affected on the respondents' farm. The questions on actions taken by the community leaders about the disease, what BBW control measures the respondents were

aware of, BBW control measures applied on affected individual farms of the respondents. Then what actions the respective communities were done/doing about the problem.

Twelve out of 21 districts returned completed questionnaires. A total of 680 self-administered questionnaires were received from respondents in twelve districts (Table 1).

The data was coded and analysed using descriptive statistics derived using SAS stastical package.

RESULTS AND DISCUSSIONS

Demographic characteristics. Table 2 presents demographic characteristics of parish community leaders from twelve selected districts from the BBW affected zone of East and central Uganda. The data shows that parish community leaders from the twelve selected districts were on average 44.7 years old, with district means varying from 39.9 years in Tororo to 47.2 years in Mbale and 57.4 years in Mukono. The average family size in all districts was 9 persons, of whom 4 persons were children below 14 years old and 5 persons were above 14 years old. The district mean family sizes varied from 5 persons in Mukono to 10 persons in Mbale, Mayuge and Kaberamaido, to 13 persons in Kumi district.

About 93% of the whole sample of parish community leaders had received formal education of at least primary school level and could read and write. Thus only 7% community leaders were illiterate. The survey also showed that the overall district averages for different educational levels of parish community leaders were 8.1% illiterate and 37.8% having received primary level of education. About 37.3% had received secondary

TABLE 1. Number of respondents from 12 districts who returned the filled questions February 2005 (n=680)

District	Number	District	Number
Hoima	12	Luwero	56
Iganga	77	Mayuge	26
Jinja	70	Mbale	57
Kaberamaido	89	Mukono	7
Kumi	28	Sironko	200
Lira	47	Toro	11

TABLE 2. Demographic characteristics of parish community leaders by twelve selected Districts May 2005

Education	Hoima	Iganga	Jinja	Kaberamaido	Kumi	Lira	Luwero	Mayuge	Mbale	Mukono	Sironko	Tororo	District average
Illiterate (%)				7.8	3.6	2	16	19	14	28	7	-	8.1
Primary 1-7%	8.3	38	21	54	46	57	37	46	28	57	43.5	18	37.8
Secondary 1-4 %	58	50	62	28	28	29	43	19	49	14	41	27	37.3
Secondary 5-6 %		5	5.7	2	21	6.4	18	4	3.5	-	5	18	7.4
Tertiary level %	33.3	3.8	1.4	4		4.2	18	12	5		3	27	9.3

Data are compiled from respondents of each district

education, upto ordinary level, 7.4% had attended high school and 9.3% had received tertiary (including University) level of education.

Farming characteristics. The results of farming characteristics are presented in Table 3. Land size, their major sources of food and sources of agricultural information, whose results are presented in Table 3. Over all the average land size was 7.44 acres, with district means varying from 3.4 acres in Jinja to 8.8 acres in Tororo and Kaberamaido to 10 acres in Iganga and Hoima up to 13.9 acres.

Upto 3, 51.4% of parish community leaders in BBW affected areas of Central and Eastern Uganda have bananas as their staple food. Other sources of food for parish leaders in these areas include sweetpotatoes and cassava (23.03% and 21.27% respectively). In all study districts, banana was the most important staple food supporting 71.5% to 90.6% of the parish leaders in five districts. In three districts, sweet potatoes was the major staple food supporting 50% to 68% of the parish leaders in three districts and cassava was a major staple food supporting 33.3% to 46.9% in four districts (Table 3).

The major sources of agricultural information for parish community leaders in the study area were radio, agricultural extension service and friends/neighbours with overall average of 61.9%, 23.0% and 6% respectively.

Awareness of Banana Bacterial Wilt. Banana Bacterial Wilt was reported as highly devastating and the most prevailing disease affecting all types of bananas. By February 2005, about 86% out of 680 sampled parish community leaders from the twelve selected districts in Eastern and Central regions were aware of the disease. Over 90% of the sampled parish leaders from the districts of Hoima, Iganga and Luwero were also aware of the BBW disease.

Most of the parish community leaders identified, the type of bananas susceptible to the disease and when BBW was first seen in their communities. Many of the parish community leaders suggested that the most susceptible types of bananas were brewing types (Kayinja, Kivuvu and Ndizi). But they also indicated that all other types of bananas namely; cooking (matooke), brewing (mbidde)

TABLE 3. Percentage of respondents within a district showing major source of food and information of parish community leaders

Variable	Hoima	Iganga	Jinja	Kaberamado	Kumi	Lira	Luwero	Mayuge	Mbale	Mukono	Sironko	Tororo	District average
a) Major source of food													
Banana %	16.7	46.0	77.1	36.4	71.5	27.6	85.7	8.0	87.6	42.9	90.6	27.3	51.45
Sweetpotatoes %	25	50	12.9	17.1	7.1	15	5.4	68	7.1	57.1	2.6	9.1	23.03
Cassava %	33.3	1.3	8.5	46.7	21.4	46.9	7.2	20	1.8	-	1.6	45.5	21.27
b) Major source of information													
Radio %	66	53	9	64	70	57	65	63	86	93	55	61.9	
Extension service %	32	46	10	21	28	11	8	25	14	22	36	23	
Friends/neighbours %	6	6	29	19	11	1	1	11	6	1	6	6	

and bogoya were also susceptible to the disease (Table 4).

The study revealed that BBW was first seen in 1999 by an average of 3.9% of the parish community leaders from seven districts out of twelve selected districts. Then in 2000, BBW was first seen in Kumi by 3.6% of the parish community leaders. Between 2001 and 2004, as the disease rapidly spread from more parish community leaders recognised the epidemics. Though many farmers and local leaders often confuse other banana diseases for BBW, technical personnel believe the disease was in Uganda earlier than 2001. The results appear to support the observation.

The average percentage of community leader who were aware of BBW by 1999 was 3.9%, in 2000, 4.3% and in 2001, 18.8%. But the overall percentage of the total sample who became aware of BBW in 1999 was 3.2%. In 2000, the proportion of total sample who were aware of BBW was 4.3%, in 2001, the percentage awareness of total was 8.9%. These results suggest that by 2001, when the BBW was first being reported in Mukono, about 16.5% of the parish community leaders in the twelve selected districts had already seen the disease in their communities. But by 2002, the proportion of parish community leaders who had seen the disease was 42.0%, increasing by 26% from the previous years. The results in the Table 4, suggest that Banana Bacterial Wilt disease was in Uganda, much earlier (1999) than the year 2001 when it was first officially reported.

Disease control measures. Table 5 shows BBW control measures known and table 6 shows BBW control measures applied by the parish community leaders in twelve selected districts. The BBW control measures known and applied by the parish community leaders were, use of clean tools, debudding male buds, cutting of diseased plants, uprooting of diseased mats, restrict movements of banana plant materials and the general crop sanitation.

The relatively most known method of BBW control was cutting of diseased plants. That was followed by rouging or uprooting of diseased mats and removing of male buds was in the third place, closely followed by use of clean tools disinfected by washing with sodium hypochloride or sterilisation by heat. In general, rouging is

expected to complement the use of cleaning tools with jik. The most aware district leaders of BBW were Tororo, Lira, Luwero and Sironko.

Table 6 shows the banana bacterial wilt control measures applied by community leaders on their farms. A comparison of the results of BBW control measures (Table 5), with the results of BBW control measures applied on farms. This study shows that not all the parish community leaders who were aware of the different BBW control

measures actually applied the control measures on their farms (Table 6). Parish community leaders in the selected districts most commonly used the BBW control measures of cutting diseased plants followed by removal of male buds and the diseased mats.

Considering the magnitude of numbers and percentages of community leaders who were aware of BBW control measures, and parish community leaders who applied the various BBW control

TABLE 4a. Percentage of farmers within each district that are aware of Banana Bacterial Wilt and when it was first seen by parish community leaders

Districts	BBW awareness within Districts	Years when BBW was first seen %					
		1999	2000	2001	2002	2003	2004
Hoima	90.9	-	-	-	-	27	63.6
Iganga	89.6	5.2	7.8	7.8	29.9	31.2	14.3
Jinja	100	10	5.7	14.3	21.4	44.2	2.8
Kaberamaido	97.7	1.1	5.6	7.8	44.9	29.2	8.9
Kumi	92.8	-	3.6	98.6	7.1	53.6	7.1
Lira	97.8	2.1	25.5	34.0	25.5	10.6	-
Luwero	94.8	-	-	1.9	13.5	53.8	34.6
Mayuge	96.3	7.7	3.8	-	7.7	61.5	19.2
Mbale	95.0	-	-	3.5	7.0	31.5	57.9
Mukono	100	-	-	100	-	-	-
Sironko	96.5	2.5	-	0.5	30	35	28.5
Tororo	100	18.2	-	27.3	27.3	9.1	18.2
Average %	95.9	3.9	4.3	18.8	17.8	32.2	21.2
Total%	-	3.2	4.3	9.9	25.6	34.8	21.3

TABLE 4b. Percentage of different types of bananas affected by BBW in selected districts

Districts	Types of bananas affected(%)				
	All banana types (a)	Matooke(m)	Kayinja (k)	Bogoya (b)	Ndizi (n)
Hoima	-	-	-	-	-
Iganga	90	2.6	-	-	-
Jinja	70	2.0	-	-	-
Kaberamaido	12	11.0	-	-	-
Kumi	96	4.0	-	4.0	-
Lira	100	-	-	-	21.0
Luwero	23	41.0	34.0	-	-
Mayuge	23	3.0	-	-	-
Mbale	63	5.0	28.0	2.0	-
Mukono	98	-	-	-	-
Sironko	80	0.5	0.5	0.5	-
Tororo	73	9.0	-	-	-

measures on their farms, reveal that those numbers were significant in the eight of the districts and they are insignificant in four districts

Table 7, presents community actions implemented by parish community leaders to control BBW. Among the community actions that were implemented against BBW were cutting down severely infected banana plantations and reporting to district authorities, fresh out breaks of BBW in their parish communities. The

magnitude of the heavily infected farms cut down by the communities were in Kumi (98%), Lira (19%), Sironko(31%) and Mukono(45%) district. In addition, in 10 districts, 11% to 50% of the community leaders reported the fresh out breaks of BBW to higher, (sub county and district) authorities.

The major comments made by the community leaders were that in five districts, although some farmers had started adopting BBW cultural control

TABLE 5. The banana bacterial wilt control measures known by parish community leaders in percentage by District.* (n=680 the district sample sizes are shown in Table 1)

District	Control measure aware of (count)					
	Clean tools	De-bud	Cut	Residue removal	Sanitation	Rogue
Hoima	2 (17)	4 (33)	6 (50)	3 (25)		2 (17)
Iganga	6 (8)	12 (16)	49 (64)	3 (4)	8 (10)	39(51)
Jinja	3 (4)	5 (7)	24 (34)		39(56)	70 (100)
Kaberamaido	2 (2)	7 (8)	32 (36)	3 (3)	2 (2)	4 (4)
Kumi	3 (11)	2 (7)	23 (82)	2 (7)		1 (4)
Lira	3 (6)		40 (85)		1 (2)	11 (23)
Luwero	3 (5)	40 (71)	36 (64)	6 (11)	1 (2)	3 (5)
Mayuge	2 (8)	5 (19)	12 (46)			3 (12)
Mbale	8 (14)	10 (18)	38 (67)	5 (9)	1 (2)	12 (21)
Mukono	7 (100)	5 (71)	6 (86)			
Sironko	134 (67)	122(61)	159(80)	17 (9)	30 (15)	7 (4)
Tororo	2 (18)		8 (73)		7 (64)	5 (45)

*Values in parenthesis are percentage per district (N=680 and district sample sizes are given in Table 1)

TABLE 6. The banana bacterial wilt control measures applied by parish community leaders' percentage by District

District	Control measures applied on the farm (count)					
	Clean tools	De-bud	Cut	Residue removal	Sanitation	Rogue
Hoima	1 (9)	4 (36)	3 (27)	2 (18)		
Iganga	4 (5.2)	12 (16)	35 (45.5)	2 (2.6)	3 (3.8)	24 (31.2)
Jinja	3 (4.3)	5 (7.1)	25 (35.7)		41 (58.6)	33 (47.1)
Kaberamaido		4 (4.5)	19 (21.3)	1 (1.1)	1 (1.1)	1 (1.1)
Kumi	2 (7.1)		18 (64.3)			
Lira	1 (2.1)		32 (68.1)	2 (4.2)		1 (2.1)
Luwero		37 (64.9)	11 (19.3)	5 (8.8)	1 (1.7)	
Mayuge		2 (7.6)	8 (30.8)			2 (7.7)
Mbale		7 (12.3)	10 (17.5)	1 (1.7)	1 (1.7)	4 (7)
Mukono		4 (57.1)	2 (28.6)			
Sironko	18 (9)	110 (55)	74 (37)	2 (1)	16 (8)	10 (5)
Tororo	4 (36)		6 (54)		6 (54)	6 (54)

Values in parenthesis represent the percentage per district. (N=680 and district sample sizes are given in Table 1)

TABLE 7. Community actions, comments and demands made by parish community leaders about the control of BBW percentages by district. March 2005

District	Comments		Community actions		Demands resistant Cultivars	More information	Treatment	Government assistance
	Farmers adopting	No improvements	Cutting	Reporting				
Hoima			9	42		41.7	25.0	
Iganga	1.3	11.7	7	14	29.9	31.2	15.6	11.7
Jinja		1.4	11	56	17.1	80.0	5.7	4.3
Kaberamaido	5.6		2	40	29.2	55.0	4.5	8.9
Kumi	7.1	3.6	28	11	42.8	28.6	25.0	17.8
Lira			19	11	69.9	14.9	4.2	12.8
Luwero	7		5	14	26.3	45.6	12.3	15.8
Mayuge		3.7	11		18.5	44.4	7.4	14.8
Mbale	11.6	1.6		48	16.7	51.7	5.0	28.3
Mukono	42.8	1.4	45			57.1	14.3	14.3
Sironko	15.4	8.4	31	14	23.4	33.3	33.8	25.4
Tororo				27	36.4	45.4	9.1	

measures their communities had not yet seen improvements in containing of the BBW disease. This raises four key issues:

- (i) Replacement of planting materials: Are there any plans to give farmers improved banana cultivars that are resistant to BBW?
- (ii) Destructive control methods: Is there any form of chemical, biological treatment, which can be applied to reduce the effect of BBW disease?
- (iii) Funding to access new material: Can the government give assistance to the communities badly hit by the BBW disease?
- (iv) Knowledge management: Shall the communities be provided with more information about how to deal with the BBW disease? (Table 7)

In this study, three major conclusions can be drawn. First, the study has shown that banana bacterial wilt had been seen by parish community leaders in 1999 which is much earlier than 2001 when the disease was officially reported in Ntunda, Mukono District. Secondly, the study shows that two of the cultural control methods, namely

cutting/rouging diseased plants and removing the male buds were already being adopted by the parish community leaders. The messages about the BBW threat and how it had reached the majority of community leaders through other studies showed that only a limited number of community members were implementing the control measures.

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REFERENCES

- Gold, C. S., Ogenga-Latigo, M.W., Tushemerierwe, W., Kashaija, I. and Nankinga, C. 1993. Farmer perceptions of banana pest constraints in Uganda: results from a rapid rural appraisal. In: Gold, C. S. and Gemmill, B. (Eds.), pp. 3-24. Biological and intergrated control of highland banana and plantain disease. Contonou, Benin, IITA.
- Karamura, D. A. 1999. Numerical taxonomic studies of the East African highland banans (*Musa* spp, AAA-EA) in Uganda. Ph.D. thesis, the University of Reading, INIBAP/IPGRI, France 192 p.

- Rubaihayo, P. R. 1991. A report of a rapid appraisal on banana production. Research Bulletin No. 2, Makerere University. Uganda.
- Simmonds, N. W. 1966. Bananas long man Green, London 466pp.
- Ssenyonga, J. and Bagamba, F. 1999. Baseline survey of banana production in Kisekka Subcounty, Masaka District (unpublished report).
- Ssenyonga, J. and Bagamba, F. 2000. Baseline survey of Bamunanika benchmark site, Luwero District (unpublished report).
- Tushemereirwe, W. K., Kangire, A., Smith, Z., Ssekiwoko, F., Nakyanzi, M., Kataama, D., Musiitwa, C., and Karyebara, R. 2003. An outbreak of bacterial wilt on banana in Uganda. *Infomusa* 12:6-8.
- Yirgou, D. and Bradbury, J. F. 1968. Bacterial wilt of Enset (*Ensete ventricosum*) incited by *Xanthomonas musacearum*. *Phytopathology* 58:111-112.

