

IMPACT OF AWARENESS CAMPAIGNS FOR BANANA BACTERIAL WILT CONTROL IN UGANDA

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ABSTRACT

A study was conducted in central Uganda to determine the impact of awareness campaigns raised through participatory development communication (PDC). Results showed that the majority of farmers were aware of key BBW symptoms, the modes of disease spread and the recommended control measures. The high level of awareness was attributed to the communication approach (PDC) employed. The control measures most commonly employed were removal of the male buds and cutting down affected plants. Most removed male buds using a forked stick though quite many were using knives as opposed to the recommended practice of using a forked stick. Farmers who practiced full packages of control measures reported lasting prevention or complete eradication of the disease from their farms.

Key Words: Control, participatory development communication, *Musa* sp.

RÉSUMÉ

Une étude a été conduite au centre de l'Ouganda pour déterminer l'impact de la campagne de sensibilisation conduite dans le cadre de la méthode participative pour le développement de la communication. Les résultats ont montré que la majorité des paysans était informée des symptômes majeurs du virus de flétrissement bactérien de la banane, les méthodes d'expansion de la maladie et les méthodes de contrôle de la maladie. Le niveau élevé de sensibilisation était attribué à l'approche de communication employée. Les mesures de contrôle communément employées étaient l'enlèvement du bourgeon mâle et la destruction de la plante infectée. La plupart des bourgeons mâles enlèvement en utilisant une fourchette attachée sur une tige même si un bon nombre des personnes utilisaient un couteau à l'opposé des pratiques recommandées. Les paysans qui ont utilisé les paquets des mesures de contrôle réputé de prévenir et éradiquer complètement la maladie des fermes.

Mots Clés: Sensibilisation, développement de la communication participative, *Musa* sp.

INTRODUCTION

Since the outbreak of banana bacterial wilt (BBW, also locally known as 'Kiwotoka') in 2001, this disease has been a serious threat to sustainable

production of bananas in Uganda (Tushemereirwe *et al.*, 2003). The gravity of the problem was brought to the fore mid 2003 when its presence was confirmed in 10 districts in Uganda, notably Mukono, Kayunga, Luwero, Sironko, Mbale,

Jinja, Kamuli, Apac, Lira and Kaberamaido. This led the National Banana Research Programme (NBRP), Kawanda, together with the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), working in partnership with other stakeholders, to intensify the activities of raising farmers' awareness of BBW and measures for its control. Although a number of approaches were used by different stakeholders to raise awareness, the NBRPs' employed Participatory Development Communication (PDC), an approach that involves identifying constraints and opportunities of a given problem with end users and then designing joint control measures. This approach was developed by the University of Philippines and now being promoted by the International Development Research Centre (Bassette, 2003). NBRP researchers, being at the forefront of its development and subsequent evaluation, hypothesised that PDC was the most effective means of reaching farmers and triggering disease control actions. The PDC approach was hence adopted (Odoi, 2005), involving farming communities and local leaders coming up with ways of implementing the recommended BBW control/mitigation measures best suited for their local conditions and needs. The communities were facilitated to develop action plans which they agreed to implement and monitor.

The PDC approach however had not yet been evaluated to assess the extent of its effectiveness in delivering messages. A survey was designed to carry out this assessment, exploring the impact of messages concerning BBW and determining whether it leads to actual adoption of recommended control measures.

The two main objectives were to: 1. determine farmers' level of awareness of BBW created using PDC approaches; 2. establish the effectiveness of the disseminated messages from various stakeholders for BBW control at farm level, in terms of the extent to which farmers are adopting the control practices.

The survey work carried out to address the above objectives was also intended to serve as the first round of monitoring and evaluation of activities undertaken to contain and control the spread of BBW. This paper reports the findings

from this work and discusses the implications of using PDC for future control of BBW in banana growing areas of Uganda.

SURVEY METHODOLOGY

Data was collected from 181 banana farm households in five districts using multi-stage sampling design. One district was randomly selected from the disease endemic zone and two selected from the "frontline" districts. These districts were selected on the basis of having sensitized farmers using the PDC approaches for different lengths of time and at different levels. Kiboga district was selected to represent one year of sensitisation through PDC at Bukomero sub-county level. Mubende district was selected as a frontline district where PDC had just been initiated (less than 6 months). In this district, two sub-counties of Myanzi and Sekanyonyi were picked. Luwero district was selected to represent areas where PDC had been used for more than 2 years. In this district the survey was done in Bamunanika sub-county. Jinja and Mayunge districts were selected for having been sensitised by trained trainers (NGOs) who had worked in the area for more than one year.

At the sub-county level in Luwero, four parishes and four villages per parish were randomly selected from each of these, 5 households were randomly picked for the study. The full details of sampling structure are shown in Table 1.

The primary purpose was to find out whether BBW related messages were received and understood by farmers in areas particularly targeted for this purpose and whether the messages were used to fight BBW. Relevant information to address study objectives were collected using a semi-structured questionnaire. Individual interviews were held on each respondent's farm and a cross sectional walk made through the banana fields to assess status of BBW in order to relate actual situations and information provided by the farmers. The data gathered included: history of the disease on the farm, farmers' awareness of BBW constraint and how it spreads, and methods known and practiced for the prevention/containment of BBW.

Data analysis. Descriptive statistics, in particular frequencies on farmers' response (frequencies weighted on the number of observation per district) were analysed using SAS (SAS Institute Inc., 1989) Statistical package. The weighted component took care of the unbalanced nature of the data cases. Based on different time and dissemination methods (PDC) employed over various districts, the districts were assigned the length of PDC application as; just started (less than 6 months), about one year, >2 years and areas where PDC based training was implemented by NGOs for, Mubende, Kiboga, Luwero; Jinja and Mayunge respectively.

RESULTS AND DISCUSSION

Importance of banana. The different types of bananas have been confirmed in previous studies to respond differently to different pests and diseases (Gold *et al.*, 1999; Bagamba *et al.*, 2000). Such studies have also shown that the importance of different banana types is revealed by the extent of their use, and the land size allocated to them.

Some of the farmers interviewed in the study who regard bananas as very important had larger

areas of land allocated to beer types (Table 2) implying that beer bananas were equally important than cooking bananas in the area. However, even farmers who considered bananas to be only slightly important, cultivated cooking bananas (a major staple food crop) on a similar scale to those who consider cooking types to be very important (Table 2).

Knowledge of BBW and modes of transmission.

It was found that most farmers interviewed were aware of BBW threat. However the number of farmers who knew BBW and how it is transmitted was highest in areas of longest PDC exposure. Similar trends were observed in the farmers' knowledge of the modes of transmission of BBW. Generally, most of the farmers interviewed were aware of how the disease is transmitted (Table 3). It was noted that in areas where PDC was carried out by the BBW team (led by NBRRP) and for a period of more than one year, the level of awareness was significantly higher than others ($X^2 = 11768$, d.f. = 105, $P < 0.0001$ (Table 4). This awareness could be attributed to the effectiveness of the campaigns carried out by the task force using PDC in these areas.

TABLE 1. Distribution of farming households surveyed across villages, parishes and districts

District/subcounty	Number of parishes	Number of villages	Number of farmers
Luwero/Bamunanika	4	16	80
Mubende/Myanzi	2	4	21
Mubende/Sekanyonyi	2	4	20
Kiboga/Bukomero	5	4	20
Jinja	2	2	20
Mayunge	3	9	20
Total	18	39	181

TABLE 2. Allocation of land (acres) to different type of bananas and farmers' rating of their importance (n=141)

Banana importance	Average number of acres under different banana types		
	Cooking bananas	Beer bananas (Kayinja)	Other bananas (Kivuvu)
Very Important	0.62	1.11	0.10
Important	0.83	0.61	0.13
Moderately important	0.36	0.52	0.03
Slightly important	0.74	0.05	0.03
Total	0.66	0.84	0.10

The suggestion that birds were a likely means of BBW transmission came mainly from farmers in Luwero and studies to investigate this issue have commenced within NARO. Bagamba *et al.*, 2005, reported that farmers recognize that insects are the major mode of transmission of BBW. Importantly, awareness of modes of transmission was not restricted to farmers who had the disease on their farm.

BBW symptoms. BBW is expressed on a plant through a number of symptoms. Sometimes all the symptoms can be seen on the same plant but in most cases only a few are expressed. Premature ripening, yellowing/ wilting of leaves and drying of the male bud were the symptoms of BBW best known to farmers (Table 5). Again, there was little evidence that knowledge of symptoms differed markedly according to whether or not a farmer was affected by the disease. It is observed that more than the ability of respondents to identify

the most distinguishing symptoms was high with increased PDC exposure. The results here further strengthen the hypothesis that awareness raising through PDC was effective. A good foundation therefore exists for disease control in the areas of the study.

Presence/absence and extent of BBW. In this study, 69% of farmers indicated that they currently had BBW on their farms, while 3.6%, who had no BBW at the time of the survey reported having had some of their mats affected in the past. The extent of attack was serious for about 35% of the farmers since they had most or all of their mats affected. A few farmers (2.3%) whose plantations were infected by BBW in the past have eradicated the disease through practicing de-budding with a fork and uprooting of the pseudo stem, together with cleaning tools with JIK (Sodium hypochlorite).

TABLE 3. Farmers' responses (%) on transmission modes of BBW at different PDC exposure (August 2005)

	Exposure			
	BBW team		Trained trainers	
	< 6 months	About 1 year	> 2 years	NGOs for > 1 year
Recognition of BBW	4.0	16.4	63.2	13.6
Knowledge of BBW transmission	3.5	17.0	60.6	10.0

TABLE 4. Farmers' responses (%) on the modes of BBW transmission at different PDC exposure levels; August 2005

Mode of transmission	Level of PDC Exposure				Total
	BBW team		Trained trainers		
	< 6 months	About 1 year	> 2 years	NGOs for > 1 year	
Insects only	2.02	11.06	9.89	2.70	25.67
Insects and birds	0	0.92	6.29	0	7.21
Insect and farm tools	1.12	5.99	33.27	0.90	41.28
Insect, farm tools and birds	0	0	5.35	0	5.35
Insect & others	0.22	0	2.70	3.15	6.07
Farm tools only	0.44	0.46	1.80	0.45	3.15
others	0.02	0	6.32	4.93	11.27
Total	3.82	18.43	65.62	12.13	100.00

Knowledge and practices of BBW control measures. Of all the farmers who were aware of BBW symptoms (97%), only 1.4% were unaware of any measures of control. Methods of control mentioned by the remaining 95.6% farmers are presented in Table 6.

De-budding with a forked stick was the control measure mentioned most frequently by farmers (77% of farmers). However, it is of much concern that many farmers also mention de-budding with a knife as opposed to a forked stick as a means of BBW control. Unlike knives, forked sticks are effective because they avoid contact with sap thus minimizing transmission of the disease from plant to plant. The use of knives could be due to the message regarding initial removal of male bud not being communicated to farmers very clearly in terms of what tools to use and why. Hence farmers only consider male bud removal to be of

importance but not the specific method of removal.

The number and percentage of farmers actually practicing various measures of control are shown in Table 7. Comparing the first two rows of Tables 6 and 7 shows that of those farmers who were aware of forked stick de-budding and cutting of pseudo stem as recommended management practices, about two-thirds actually employ the practices. It was observed that farmers who had BBW were more likely to practice the recommended measures than those who did not have BBW on their farms. However, of those who mention uprooting of infected plants only 38% practice uprooting, while of those suggesting cleaning of tools with fire only 44% practice the method. Cleaning with JIK on the other hand is practiced by only 1% of the farmers.

It should be noted that about 35% farmers still de-bud with a knife as a control measure and,

TABLE 5. Farmers' response (%) on the various symptoms of BBW at different PDC exposure levels

BBW symptom	Level of PDC exposure			
	BBW team		Trained trainers	
	< 6 months	About 1 year	> 2 years	NGOs for > 1 year
Leaf yellowing	3.4	16.9	57.6	11.4
Leaf wilting	3.3	6.4	39.8	7.5
Early fruit ripening	4.0	14.6	61.3	12.2
Discoloration of fruit pulp	4.1	5.1	26.9	6.3
Drying of male bud	3.0	14.1	57.8	9.9
Puss like sap	3.2	2.4	26.8	3.2

TABLE 6. Farmer response (%) on awareness and methods used for managing BBW at different PDC exposure levels (August 2005)

Control method	Level of PDC exposure			
	BBW team		Trained trainers	
	< 6 months	About 1 year	> 2 years	NGOs for > 1 year
Knows control measures	3.7	17.4	67	8.7
De-budding with forked stick	3.1	16.2	57.3	0.95
De-budding with knife	2.0	4.6	41.4	6.7
Cutting pseudostem	3.4	10.7	48.6	10
Uprooting infected plants	2.1	10.1	15.9	2.8
Cleaning tools in fire	2.1	8.2	16.0	8.2
Cleaning tools with JIK	0.72	1.98	12.5	0.0

most of these farmers have also stated previously that they considered farm tools to be a means of BBW transmission. This perhaps suggests that they have difficulty relating knowledge of BBW management to knowledge of the disease itself.

Of the farmers interviewed, (21%) did not undertake any recommended control practices. Main reasons given for this included absence of BBW on their farm and lack of labour. Other single responses included old age, high cost, no information received, and in some cases, control measures being carried out only on a small portion of the farm.

Other control measures known to farmers and practiced by them include burning, cutting and heaping infected plants, using different knives, covering the heaped materials and slashing diseased gardens. The survey results also showed that farmers who use a forked stick for de-budding

or knives, respectively, did it late (data not shown). Normally farmers de-bud when the fingers have turned upwards (about two to three weeks from the end of cluster formation). This may explain occasional claims by farmers that the disease becomes worse even when a forked stick is used for removal of male buds.

Further analysis was carried out to determine how many farmers were practicing a full package of practices are likely to either prevent the disease from reaching their farms or eradicate it if it was already there (Table 8). The package includes: 1) removing male buds using a forked stick which has the effect of preventing the disease from infecting unaffected plantations, 2) male bud removal using a forked stick together with roguing of affected plants and disinfecting (cleaning) used tools before using them again on unaffected plants, and 3) male bud removal with a forked stick,

TABLE 7. Farmers (%) practicing the various methods for BBW control at different PDC exposure levels (August 2005)

Control management practice method	Level of PDC exposure			
	BBW team		Trained trainers	
	< 6 months	About 1 year	> 2 years	NGOs for > 1 year
Debudding with forked stick	2.1	7.8	44.9	0.95
Cutting pseudostem*	2.8	5.2	38.8	4.2
Debudding with knife	1.2	4.9	27.6	1.4
Uprooting infected plants	0.7	1.0	12.4	1.0
Cleaning tools with fire	1.5	2.0	8.7	0.0
Cleaning tools with JIK	0.0	0.0	2.0	0.0

* cutting plants expressing only male bud wilting

TABLE 8. Farmers (%) practicing different disease control packages that are likely to prevent or eradicate the disease from farm at different PDC exposure levels (August 2005)

Mode of transmission	Level of PDC exposure			
	BBW team		Trained trainers	
	< 6 months	About 1 year	> 2 years	NGOs for > 1 year
De-budding with forked stick *	2.1	7.8	44.9	0.95
Forked stick, cutting sick stem and cleaning with fire/ jik**	1.6	7.7	33.8	5.9
Forked stick and uprooting sick plants	0.0	0.2	3.2	1.0

*The single component prevents the disease

**package complete if disease is by insect transmission and recent

cutting down the recently insect infected plants (males buds wilted but before finger ripening starts and disinfecting used tools).

Results (Table 8) show that more farmers in areas of highest PDC exposure practised full packages than those in areas of less exposure. More were practising male bud removal that protected plants from infection

The package involving uprooting affected plants was the least practised largely because of labour costs involved. Integrating a component such as a herbicide to kill off plants where whole mats require destruction was viewed as a promising innovation to introduce as efforts continue. It was observed that most farmers had situations which required them to deploy all the three different sets of packages on their farms. However, very few had deployed them together and as a result only a few had eradicated the disease from their farms. Empowering them to know when to deploy which package will improve adoption of the measures as a package. This study revealed that BBW eradication from farms is easily achievable and should be targeted. However, the farmers, extension service providers and local leaders will need to share the goal of eradicating the disease.

In Mubende, where PDC sensitization has been carried out for less than 6 months, 4.8% of farmers employ a full package of the recommended control measures while in Kiboga about 10% practice full control package. In contrast, at least 48% of Luwero farmers practice a full control package of the recommended control measures while approximately 45% practice partial packages of the recommended control methods (Table 8).

Another interesting finding is that even farmers who did not have BBW practiced some of the recommended measures. The mentioned measures practiced by unaffected farmers are de-budding and agronomic management of the banana plantations. Some of the farmers who practiced uprooting but have no BBW, commented that they had only got an outbreak of BBW on a few mats which they immediately uprooted, hence eliminating the disease from their farms. This further strengthens the argument that awareness rising was successful through PDC as demonstrated by the vigilance of farmers uprooting and removing male buds.

Results from this study show that farmers

interviewed regard beer bananas as being the most important banana type and allocated larger acreage of the farm land to these types. This finding highlights the importance of beer bananas (Kayinja types) in central Uganda that have for a long time not received adequate attention from research and development. Informal discussion with farmers revealed that Kayinja plantings, although less well attended, provide a continuous cash flow for various day by day household requirements in addition to payment of school fees. Beer bananas are therefore, economically the most important banana type in the area of study.

The study further demonstrates that the PDC approaches did contribute to the high levels of awareness among farmers. Most of farmers were aware of at least two of the three most distinctive symptoms of BBW (drying of male bud, premature ripening and fruit pulp discoloration), irrespective of whether or not they had the disease on their farms. A number of them (22%) could identify all three key symptoms of the disease. Informal discussion with farmers also revealed that they could provide clear explanations on possible methods of BBW spread and pathogen transmission based on their observations of affected plants. For example they concluded that, in a young crop where plants were nearing flowering but showing signs of wilting, the most likely mode of spread was through suckers used for planting. Where young suckers were found to have symptoms, they were able to tell that it is likely they became affected through the mother plant, or contaminated tools used. Where a mature plant was found to have premature ripening of the fingers and a dried male bud, this was correctly perceived to be due to bees and other insects visiting the bud. There was little to suggest that their knowledge of key symptoms differed markedly between farmers with BBW and without, suggesting that knowledge was not necessarily acquired due to the presence of the disease but perhaps due to broad-based exposure of farmers to PDC sensitisations. The fact that awareness raising among farmers was effective suggests that a good foundation exists for ultimate effective disease control in the areas of study.

The high prevalence of BBW on farms in the study area (69% of farms studied) indicates that

farmers may not, as yet, have done enough to try and eradicate the disease, despite the fact that most of them are aware of how to tackle the disease. This is further confirmed by results of this study which showed that only a limited number of farmers were deploying a package that was likely to result in disease eradication. It may also be partially attributed to the high number of farmers who still use a knife to remove the male bud or perhaps a lack of vigilance.

Bagamba *et al.* (2006) reported that BBW management using a forked stick and cleaning tools had not taken off at the time of their study. This study however reveals that about two-thirds of those who are aware of fork de-budding and cutting of diseased pseudostems as management approaches also practice these methods and clearly indicates that farmers are adopting the recommended control measures as a result of PDC exposure. As the NBRP team moved through villages they noted farms where cooking banana and Kayinja plants with very young bunches and unfilled, downward pointing fingers had had the male buds removed. This is in contrast to the strong tradition in central Uganda in which the male bud is only removed once the banana fingers have filled and are pointing upwards. Unfortunately cleaning tools with JIK disinfectant was practiced by very few farmers, but this is likely due to the cost and inconvenience associated with its use.

It must be emphasised that the use of a single component of the recommended control package is unlikely to achieve the desired level of BBW control. Indeed this study showed that, farmers who deployed a full control package were able to eradicate the disease from their gardens. The continued use of uncleaned knives to de-bud remains a concern as it has a negative implication on the likely success of the overall control strategy for BBW. Bagamba *et al.* (2006) emphasized the need for greater sensitization of farmers and other stakeholders in practices that are recommended for BBW control. Such sensitization should clearly convey the dangers presented by use of a knife for de-budding. Improving farmers' understanding of the nature of BBW in the communication process, by placing greater emphasis on the epidemiology of the disease, may lead to increased uptake of those management practices of which

they are already aware but for which they perhaps do not fully appreciate the implications.

Non-adoption of recommended practices amongst the farming community will lower the motivation of those farmers who are already attempting to manage the disease. Several of the farmers consulted observed that neighbouring farmers who were affected by BBW often do not take the necessary action on their fields, probably because they have lost interest in their crop or have too few banana mats for BBW to impact on their own livelihoods. They correctly perceived this as a danger that leads to a source of inoculum being maintained within the community and as a disincentive to farmers who wish to eradicate the disease from their gardens.

Overall, the PDC seems to have been effective in creating awareness amongst farmers in the fight against BBW. The key impact of the PDC activities observed is that as a result of continued direct interaction with farming communities by the BBW control team and encouraging learning and implementation of the recommended BBW control measures, the management of the banana fields has improved. Inclusion of other stakeholders and strengthening and clarifying the messages being disseminated to farmers will lead to even greater success. For the disease to be eliminated, other stakeholders need to be integrated into the process to quicken the process and provide the broader coverage it requires. The success created needs to be scaled out to new areas through sensitization of other development agents to deploy the PDC approach in their areas of operation.

CONCLUSIONS

The knowledge of BBW acquired by farmers through PDC in the area of study and implementation of recommended practices confirms the beneficial effect of the PDC approach. The study has shown that BBW can be controlled and affected banana fields revived if farmers implement recommended practices, including de-budding with a forked stick and rouging affected plants and cleaning used tools. Beer bananas (Kayinja types), on which the disease has been shown to develop more rapidly in comparison with matooke types when the two are intercropped, were considered to be an important commodity

for farmers in this study yet have for a long time been neglected or poorly managed by farmers and underrated by research and development agencies. This should, in the light of BBW spread, be addressed.

The sites where this success has been created should be used as demonstration places from which experiences can be shared with the wider areas where BBW is still a big problem. Efforts should be made to share this success story with the wider community.

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