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SANITATION AND PHYTOSANITARY ISSUES TO ACHIEVING THE GLOBAL FOOD SECURITY STRATEGY: CASES ON FALL ARMYWORM AND AFLATOXIN

QUESTION AND ANSWER

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Elisa Loeser: Thank you so much, Ken. This is Elisa, and I'll jump in now.

So the next thing we just want to highlight about particularly aflatoxin control and specifically use of the biocontrol is the essential role of partnerships. This is not a singular effort. There's a lot of people and relationships involved that truly exist to take the biocontrol from the work in the lab to the field to the fork, to the consumer, and to ensure that the level of aflatoxin in that product is a safe amount for human consumption.

I just wanted to highlight where those key partnerships are in the overall process of developing the biocontrol. And you heard a little bit about it, on the left of the slide are the key steps that are taken in the process of developing the biocontrol. And the Foreign Agricultural Service has particularly been involved in helping to build relationships in developing the biocontrol in Africa, so some of these examples from that experience. Everything from developing baseline data for understanding what is the prevalence of aflatoxin, to identifying those native atoxigenic strains that are utilized in the biocontrol, to field efficacy trials to prove the product is effective, to gaining that regulatory approval to ensure that the product can be approved for market, and then finally moving to the commercialization and the distribution and the dissemination of that product.

There are key partners that are listed on the right hand side that are intricately involved in that process, everyone from academia, researchers such as ARS, to our key community and development partners, to the essential government bodies and key actors at the national, but also the regional and continental level, as well as international organizations, and the critical component of the private sector.

I just want to highlight one particular example is that, for example, before conducting field efficacy trials, it's very critical to ensure that the government is on board and very much aware of the biocontrol process. For example, we've found particularly in Africa that oftentimes there is a regulatory framework for pesticides, but not often for biopesticides.

In 2013, FAS partnered with an array of technical experts, including USAID, to develop a biopesticide guidance document to assist countries in developing a regulatory framework for biopesticides, and to ensure that that regulatory process could take place. To date, FAS has brought, in partner with the African Agricultural Technology Foundation and International Institute of Tropical Agricultural, has brought this really critical guidance document and tool to the governments of Malawi, Mozambique, and Zambia. That's one critical role and process that is needed to ensure that not just the science is there, but the whole regulatory process that you see, to make sure that when you're bringing that product to market, it can be utilized so that that kernel or that ground nut is safe

for human consumption.

I'm just going to move to our next slide here. In terms of relationships, our interagency collaboration has really been critical, particularly in Africa, both in bringing the biocontrol to the continent, but also in aflatoxin control overall. We have had a very strong relationship, the Foreign Agricultural Service, with ARS, the Agricultural Research Service, for nearly a decade, in terms of aflatoxin awareness on the continent.

In addition, it's not just interagency within USAID, but also within the US government. USAID DC offices and missions have played an essential role in providing key resources and raising awareness and partnering with local partners to progress the work. In particular, the biocontrol development in Africa has been led by the International Institute for Tropical Agriculture, IITA, and as Ken mentioned, that biocontrol is named Aflasafe, and because the biocontrol is using those local atoxigenic strains, you're finding that the products are actually different products, and they're adapted to the local environment. For example, the product in Senegal is called Aflasafe SN01. The product in Ghana is called Aflasafe GH02. Just for a little bit more information, the IITA website for Aflasafe is available on the slide, and I highly recommend that you check it out to see what IITA is up to. They are developing the biocontrol in 17 countries, 6 of which have full regulatory approval to sell the product. You can visit that website to understand how to purchase Aflasafe, and also to receive full updates on all countries where IITA is active.

This critical collaboration, which isn't just within USDA and the US government, but also involves critical development partners, such as the Bill and Melinda Gates Foundation, the Meridian Institute, as well as many others that have helped to support funding, including the governments of Kenya, Nigeria, Senegal, and others. All of this has led to an effort to not just promote biocontrol as a viable solution, but to promote aflatoxin awareness on the continent overall.

This collaboration led to the development of the Partnership for Aflatoxin Control in Africa, which is a body within the African Union Commission. It was launched in October 2012 to support member states and regional economic communities to address multisectoral challenge caused by aflatoxin contamination. It is now firmly rooted within the AUC, within the Department of Rural Economy and Agriculture, and it has a long term mission to address aflatoxin as a cross-cutting issue through the continent.

Just for your awareness, the key countries where PACA focuses is Gambia, Senegal, Nigeria, Malawi, Uganda, and Tanzania. I highly recommend visiting the website listed there for information on how to connect with country directors in each of those countries. As I mentioned, I think this effort is not possible

without key communication and collaboration.

And in summary, I just want to mention that these examples do serve as models that have led to integrated efforts to truly address a very critical public health trade, nutrition, and food safety issue, and it is through this sort of collaboration and willingness to partner that lives can be saved and sustainable impact can be achieved. Thank you.

Julie MacCartee: Excellent. Thank you so much, Ken and Elisa. All right. We have some time, about – up to 30 minutes now to continue with some questions. We'll start with some questions that came in about aflatoxin, but you are welcome to continue to ask questions more generally about holistic SPS efforts, and about fall armyworm.

All right, I'm going to position my mic here between myself and Elisa. Hopefully that will work. All right. So I have some questions for Ken and Elisa. One that just came in that can be probably a quick answer, a bit earlier, John Lamb asked about how aflatoxins usually occur with other mycotoxins, some of which are also food safety or SPS hazards, fumonisins in maize, for example, how effective are these biocontrols like Aflasafe on any other worrisome mycotoxins? And if not, what to do about that.

Elisa Loeser: So Ken, I guess I can answer based on my – would you like to discuss the biocontrol use on other mycotoxins? I'm happy to facilitate as well.

Ken Shenge: Oh, yes, there's not much to say except that there's some biocontrol trials showing efficacy against these other mycotoxins, but in terms of scale of adoption and efficacy in the field, biocontrol against aflatoxins is by far the most successful. The other unique thing about the biocontrol technology for aflatoxins is we're actually using aspergillus flavus strains that don't produce toxins to competitively exclude toxin producers in crops. So it's a different model than, for example, many of the other biocontrol approaches for the other mycotoxins, where you're looking at like other organisms to control those toxin producers through maybe biocidal effects or the pesticidal action.

So those approaches are available, but in terms of scale and use and proven efficacy _____ conditions in a wide range of situations, biocontrol with aflatoxins is by far the most successful. But there are also other approaches for managing those other mycotoxins, such as maybe things like wet milling or using clay absorbents or through enzymatic degradation, which are approaches that

have been found to be useful, in combination with say resistant varieties against fusarium.

So those are all approaches that are especially used in combination can be very effective in controlling those other mycotoxins as well. But as explained in this talk, the focus and the major success story we've had so far is with aflatoxins. And these are by far the most widespread in terms of current harm. Aflatoxin B1 is the most, most toxic biological poison available in nature. It's very dangerous. Other aflatoxin like G1 and B2 are also very deadly, and that's mostly why we focus so much on them. Elisa, you can add a few things, also.

Elisa Loeser: Yeah, _____, Ken. I was just going to add just in terms of the partnerships we've discussed, we have not been involved in developing similar biocontrol for any other mycotoxins besides aflatoxin.

Julie MacCartee: All right. So a question about – from Harley Stokes that I think is interesting. For adoption of biocontrol, do you see this being adopted by smallholder farmers, and is this a financially feasible option for them? Interestingly, Lauren _____ did respond to that question, saying yes, in Nigeria, over 30,000 farmers use Aflasafe, and commercialized aflatoxin-safe maize at premium prices, besides saving for family consumption. There's at least one example of when smallholders have been using Aflasafe. Do you have other examples, or writ large, what do you think about smallholders being able to afford to use this?

Actually, I'm going to just bring up a side question. Valeria Sanchez mentioned can you talk about perceived consumer demand for low aflatoxin products. Is the final consumer willing to pay for these Aflasafe ground nuts, for example? How does that play into a smallholder farmer's decision to adopt biocontrol?

Elisa Loeser: I will say there are many examples, and to be frank, I really believe that the true partner to answer these questions is the International Institute of Tropical Agriculture that has really brought the biocontrol to Africa _____ the work on commercializing the product and making it available to smallholder farmers. The Foreign Agricultural Service has played a very critical role in helping to develop that product and ensure its efficiency through the regulatory process and the registration process. USAID has partnered with the Bill and Melinda Gates Foundation and IITA on a separate _____ to ensure that that commercialization process is in place.

I will say IITA is providing some really nice examples via the chat room that

demonstrate how the product is being made available to smallholder farmers. And I can't speak directly to premiums or incentives, primarily because that is a little bit outside of what we've been involved in, but I will say that there are many examples that point to how the product is being made available in a price efficient way, and how it is – the price for the product has decreased since its initial development.

Julie MacCartee: Great. Thank you very much. Let's see. A couple of questions came in about other elements that might affect maize crop besides just aflatoxin contamination. Actually, I think one that's interesting and can pull in Chris is are there explicit linkages between fall armyworm infestation and aflatoxin? That is, as fall armyworm damages the maize crop, the risk of aflatoxin might increase. Is that true, or known to be true? And so how might these two sectors coordinate? Chris, do you want to take that?

Chris Peterson: Yeah. It's pretty well assumed to be true. I don't know what scientific justification data have been collected on that. But pre-harvest, the main way for the aspergillus fungi to get into the corn is – it would have to get past the sheath, the – on the ears of the corn. And the fall armyworm, what it tends to do is it will start at the top of the ear through the silk and then eat its way down. That provides an opening within the protective cover on the corn cob, and any fungal spores that are on the insect will be moved into the ear.

There's certainly good logical justification for that, but as far as what data that I've seen, I haven't looked into it that much in depth, but I know people who have, and we can get those numbers at some point.

Julie MacCartee: I think that's very interesting. And perhaps, Ken, you can follow up on that question, but also address a side question that _____ asked, which is we're aware that drought increases pre-harvest aflatoxin contamination, so how best can biocontrol integrate drought considerations? Drought considerations, fall armyworm consideration, how does biocontrol integrate with other hazards that might be affecting maize?

Ken Shenge: Regarding the question on the fall armyworm, I totally agree with Chris. I did a search very recently on that subject, and also was unable to find any data directly linking fall armyworms to increase in aflatoxin contamination, but as Chris said, it's very logical to assume a connection indirectly because of the access that fall armyworm damage would provide for aspergillus to invade the crop, and

subsequently produce toxins under favorable conditions. So the data is still not there showing a direction connection.

With regard to stress management, that is also thought to be the case, that plants that are drought-stressed will be more susceptible to aflatoxin contamination. Generally, the aflatoxin is one component of plant health, and in general, healthy plants will most likely do better and be safer, especially if other good agricultural practices are in place. That's why in the recommendation slide I highlighted the need for gaps that will continue to emphasize those as far as preventing aflatoxins and ensuring a healthy crop and safe food that we can make available.

Yes, not just drought tolerance, but other agricultural practices that would enhance a healthy crop in general would also be helpful to minimizing aflatoxin contamination.

Chris Peterson: Just to jump back to the fall armyworm connection really quickly is that the way that Aflasafe works is that the non-toxin producing strains outcompete the toxin producing strains, and that's super important in a lot of this, because if fall armyworm were to get into ears of corn in fields that had been treated with Aflasafe, it would be the non-toxin producing strain that's getting into the corn, so therefore, there would be less aflatoxin produced by any fall armyworm infestation. As well, there's a founder effect that when this corn goes into storage, that any aflatoxin that's produced post-harvest would be reduced as well, because the fungi that are there are the non-toxin producing strains. By applying early during the growing, you're knocking out even the potential for aflatoxin production all the way till the product is milled and cooked up.

Ken Shenge: Thank you, Chris. That's a very important point.

Lee Gross: Just to add – this is Lee. I wanted to say that a lot of – with some of these SPS interventions, and looking at is this something additional that we need to be doing, and I think a lot of this is based around – even an application of Aflasafe is just in combination with best management practices. As part of your quality assurance programs, etcetera, in terms of the way that management practices, both in production and post-harvest, are applied, are going to mitigate a lot of these potential SPS issues.

I also found the conversation – I think Ranajit mentioned about the application of premiums and the market demand for these things. It'd be good to look at the data in terms of the awareness around consumer and local markets, but also in terms

of – back to my presentation on the – for the export-oriented market, whether eventually crops proving essentially that they don't have these mycotoxins within them is essential in terms of export.

Whether some premiums will play a role at least in the early stages, until – in terms of adoption among smallholders and in certain value chains, key value chains, but eventually, over time, it will become the benchmark or the norm. Certainly in the application of both HACCP and even FSMA regulations that are down the pike for export-oriented crops, this will be a necessary thing.

Investing in those control points, like we mentioned earlier, whether it's at production or in the laboratory, in testing for countries to be able to actually prove that these certain mycotoxins exist, will be critical.

Julie MacCartee: Great. Excellent. Thank you very much. Let's see. We'll ask some sort of shorter questions that came in around aflatoxins. Ernest Tey asks about rapid detection for aflatoxins. So rapid detection exist, and is it key in the fight against aflatoxin? Ken, is that something for you?

Ken Shenge: Yes, there are many _____ for rapid detection. There are many potent _____ which are strip tests, where you can immediately, even in the field, be able to quantify reasonably – at least detect, and to some extent, at least within a reasonable range of what the contamination levels are for crops. So yes, those tests are available. We don't develop them, but they are commercially available in the market. So yes, they are very useful, especially where you may need to make a rapid decision that may be tied to either SPS or market _____ situation, knowing if the product you're buying is free from toxins can be a very key part of your decision making tool, so that would certainly be very useful.

That's probably why they're very popular also, because of the speed of detection that those afford. Other than that, you can also use genomic approaches. There are also approaches you can use in the lab as well. Maybe those will take longer, but yes, there are kits available for rapid detection.

Elisa Loeser: And Ken, I can just add that PACA recently published just a general report on those rapid methods available. That report is available on their website, and we'll make sure that we provide that report to the audience as well so the text is available to the audience. Thanks.

Julie MacCartee: Thank you. A couple of questions have come in about push/pull technology. That's something I am not highly familiar with, and so I would – and maybe some others on the webinar are not, either. Perhaps if one of our panelists could explain what is meant by push/pull technology, and then there was a question, have you tried biocontrol using push/pull technology, and also – let's see. Also, push/pull technology for IPM, such as utilizing border grasses and inter-crop grasses to protect the cereal crops from fall armyworm. So _____ if you can quickly explain what that is and how it's been used in these cases.

Chris Peterson: Sure. So push/pull technology is based on the principle, if you attract a pest to something that you don't care about, such as a pheromone trap, where the pest is killed, or sometimes people will use what's called a trap crop, which is – they plant it solely to attract the pest away from their higher value crop that they want to protect. Depending on the pest, push/pull can be all sorts of different combinations, based on what the pest responds to.

For fall armyworm in Africa, the technology and the level of knowledge of what exactly is going to work in Africa isn't there yet. There's a lot of research going into that. There's resistant varieties. Are there varieties that could be used as a trap crop? How realistic is it to use pheromone traps, rather than just monitor for the presence of the pest, but how realistic is it to roll out, like we did for boll weevil in the Southwestern US, how realistic is it to put just traps everywhere and capture and kill so many of these pests that you reduce the populations?

People are asking those questions, and there's research going on, but we've only had two or three growing seasons in Africa where we've known that this pest was there. So there's work going on, but I don't think we have any clear conclusions yet, because the climate is so different in Africa. The natural predators are different in Africa. It's one of those questions that remain to be answered.

Julie MacCartee: Very interesting. Anything further from the other presenters on that? No?

Ken Shenge: No, I don't have anything.

Julie MacCartee: We have up to ten minutes left for questions. I just wanted to highlight that we have put a few polls up on our screen. These are helpful for us shaping future presentations, for you to share with us what you learned today, what you thought was the most interesting, whether you can apply this to your work, a little bit about how you plan to integrate what you've learned today, and some of your

opinions about whether this webinar was useful for you in providing clear and actionable information. These things will help us plan future webinars. Lee, were you about to –

Lee Gross: No, I was just going to say, I think – of course, we're talking about integrated pest management, but I seem to think of push/pull in terms of market systems and trade. A lot of what we're doing with USDA and with USAID is a regulatory capacity building within governments, so thinking about that policy and enabling environment. I'm also aware that many of you are kind of working on the incentive structure, and there's been a lot of discussion around that, and the actual uptake, especially among smallholders Ranajit asked the question about. How do we raise awareness among policy makers about this issue?

Unfortunately, it's always reactive more than it is proactive, and until we get large devastating outcomes in terms of economic on a primary export crop, we don't kind of get the movement that we need and investment that we need among governments and regional stakeholders.

I think we need to be thinking both at – working with governments on both the regulatory side, and then also continuing to build into our market systems and our value chain approaches the appropriate incentive structure to deal with these issues.

I think, as I mentioned previously, that we'll also see these things very highly linked with quality and productivity in terms of best management practice. It'll be a win/win in terms of those objectives, along with just ensuring that food is safe and nutritious.

Julie MacCartee: Great. Let's see. We're plowing through our questions here. We have time for a few more. I just think this is an interesting question, probably for Ken, and I would like to know the answer myself, from Matargay. Are there specific biological or other reasons for the relatively higher vulnerability of maize and ground nut to aflatoxin compared to other crops? We know that aflatoxin does affect many different crops, but what is it about maize and ground nut that is making them the key focus here, or that are making them the most vulnerable?

Ken Shenge: That's a very good question, and I am not sure that I know the answer in detail myself. Some of the work we've done in our labs shows that there are definitely some crop characteristics that can influence the colonization by aflatoxin-producing fungi. One of them is definitely nutrients. We've found in some of the

studies conducted in our lab that nutrient rich substrates in general also had richer amounts of organisms growing there, including those organisms that produce aflatoxins.

Other than that, I am not sure that I can speak competently on why those two crops are such a major target, but I will look into that and provide an answer. Maybe I can pass it on and we can make it available to the presenters – to the participants, rather.

Julie MacCartee: Great. Thank you so much, Ken. I think we have time for one more question. This came in a bit earlier from Esther Ngumbi. How has technology been helpful in spreading information about available fall armyworm management and solutions? And this can apply to other food safety issues as well, but starting with fall armyworm.

Chris Peterson: Yeah. I noticed in the chat box earlier somebody had mentioned FAO's mobile app for monitoring fall armyworm populations, and I mentioned the large data sets that are being compiled. That's probably the principal one that people are using mostly. This is an app that just is on smartphones, which everybody in Africa has now, and in the field, they're able to upload, and with the latest version of the app, it doesn't even need to be online when you're collecting data, just when you're transmitting it.

That's been hugely helpful in finding out the extent of the problem. As far as dissemination of information, I know in Zambia there's a WhatsApp group that a lot of people have formed around fall armyworm. Not everybody participates in that, but it's been a good venue for discussion, as well as Twitter, Facebook, that everybody can do on their phones now. And Twitter blasts, and even SMS blasts in some cases, where they can get authoritative information out to a lot of people very quickly.

Like I said, everybody in Africa has a cell phone. It amazed me the first time I went, that they seemed to be ahead of the US in mobile applications. And the US has caught up a bit lately. But I don't really see how we could have had as effective a fall armyworm response as we've had without mobile technologies.

Julie MacCartee: Very interesting point. Thank you. All right. Well, we are coming up on the end of our webinar. I've been really excited to see all of the comments and experiences and resources that have been shared in the chat box, so thank you very much to you, our participants, for being so active and engaging and sharing

what you know. I think that really adds an extra layer for the other participants on the webinar, and also for the speakers. We will surely be reading back through all your comments and seeing what we can glean and sharing additional resources through Agrilinks.

Please do keep your eye open for an email with the recording of this webinar, with the transcript, and with some additional suggested resources. We do have a lot of on Agrilinks that April has been sharing in the chat box, a featured collection, and of course, we want you to visit the Food Safety Network's hub on Agrilinks as well.

I'd like to extent a sincere thank you to our presenters and to the supportive Agrilinks team who makes these webinars happen, and we will see you at future Agrilinks webinars. Thank you all very much.

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