PESTICIDES: SAFETY, EFFICACY AND ACCESS

PRESENTATION TRANSCRIPT

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PRESENTERS

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Julie MacCartee: Hello. We're about ready to get started. Welcome, everyone. On behalf of the USAID Bureau for Food Security, the Agrilinks team, Feed the Future and the USAD Fall Armyworm task force, I would like to welcome you to the third and last webinar in our fall armyworm series, which will be focusing on pesticides and the challenges for safe and effective usage, especially for fall armyworm control in Africa.

My name is Julie MacCartee and I am a knowledge management and learning specialist with the USAID Bureau for Food Security, and I am probably a voice you've heard before if you've joined an Agrilinks webinar. I am your host and facilitator for the webinar today.

Before we get started with the content I just wanted to provide a few reminders. First is that the chat box is your main way to communicate today. So, please feel free to use it to introduce yourself, to share any resources, and to ask any questions that you have throughout the presentation. We love your questions. There's no question that is too simple or too complex. Please do feel free to ask and we'll be collecting those questions to ask after the main presentation today.

I would also like to point out that there are a few resources and links for you in the bottom link of your screen. You will see some file downloads, and especially exciting is we now have the fall armyworm IPM guide in French for you in the File Downloads box if that's needed for you, and some other key links, including links back to the first two webinars in this series, which we encourage you to take a look at. And we will make sure that we share those in the chat box as well.

Lastly, this webinar is being recorded and we will post the recording on Agrilinks. By virtue of attending today you will also get an e-mail with links to the recordings from all three of the webinars in this series if you would like to share them with your colleagues or re-watch any of them.

All right. So, to give an introduction to our main speaker today and also to the topic at hand I would like to introduce Brian Conklin, who is the Senior Ag Advisor for the Fall Armyworm Team at the USAID Bureau for Food Security. And I will pass the mic over to Brian.

Brian Conklin: Great. Thanks, Julie. We want to welcome you back to our third of three webinars. We have done one each week, and the first one of course covered our IPM technology basket. The second webinar covered a number of tools we've developed, including our IPM guide, our pest management decision guide, and the launching of a new animation for farmers on scouting the fall armyworm. All of these resources are available to you, including an opportunity to watch previous webinars on our Agrilinks website. So, we encourage you to come back to the Agrilinks website. If you Google "fall armyworm tools" you will find the tool page for the fall armyworm. There's also links within this guide here. So, we want to encourage you to come back and use those as a resource.

Today's webinar focuses on managing risk to human health and the environment. When the fall armyworm was discovered on the African continent the natural response from a number of governments was to flood farmers with pesticides. Today we're going to have a speaker who helps talk about the hazards and the challenges and the dangers of pesticides and dispel a number of myths that are out there shared not just by farmers but by the rest of us as well. We're also going to look for ways to move from higher risk to lower risk together.

And so, let me introduce our new – our final speaker of this three-part series. Paul Jepson is a professor at the university of – Oregon State University. He is probably the leading expert for IPM and pesticides risk management and it is a privilege to have Paul on the line with us today. And Paul, with that I'm going to turn it over to you.

Paul Jepson: Well, thank you very much, Brian and Julie. And good morning, good afternoon, good evening to everybody on the call. I hope you can hear me clearly. Really, the purpose today is to highlight some things we are going to be doing that will inform you about pesticides, hazards, and risks such that in your various roles you can support decisions that farmers make, or advise or inform others, or point individuals to information sources that they may not have been aware of.

I think there's four take home messages I want you to really consider in – while you're thinking about my presentation and as it's going along. First of all, we're not quite at the place yet where we can make what we might call recommendations about pesticides that are truly compatible with IPM goals. Those goals might be something – a pesticide that's efficacious, that actually works, that can be applied in a way that reaches the pest and is toxic to it, but also there's a minimal risk of any toxicity to humans, including children and

women that work in fields after treatment, as well as to the people that handle and apply the pesticides themselves. And then, also, with minimal to no risk also to the environment, and that would include domesticated animals – goats, chickens, other organisms that are fed, provided with forage, and also that wander around the fields. And don't forget pollinators. Please don't forget natural enemies. And so, we don't have sufficient information really yet but we're moving in that direction.

African farms are highly vulnerable to adverse impacts. Vulnerability goes beyond our concepts of normal risk, the "Oh, don't run across the road because there's a high risk you're going to be run over by a car." Well, if you're not aware that cars are potentially harmful in the first place, then the concept of not running across the road is a challenge. And in many cases and – the awareness of pesticide toxicity is not as widely distributed as it should be. And I have to say that applies to American farmers that I work with, Central American farmers also, not just African farmers. But there's a vulnerability in Africa in terms of awareness of the risk in addition to the level of training and access to equipment and support that's required to use pesticides in a way that maximizes their benefits and minimizes their costs.

So, there's actually a high risk of adverse pesticide impact in Africa, and one of the scientific articles I'm going to make you aware of today highlights these, and I will talk about that a little bit later on. But the kind of good news at the end in a sense is that critical information needs can be met, because I represent a group of scientists who basically said, "Enough is enough." All of the information I'm going to share with you today is widely distributed in the pesticide industry, in regulatory agencies, and in research and support agencies and nonprofit organizations. It just doesn't happen to be placed in the domain of farmers who need this information to make decisions. So, I'm part of a movement of, we hope, high integrity scientists who are trying to correct this ill in the system such that better decisions can be made and that you are not intimidated by the idea that pesticide toxicity is an overriding factor that cannot be managed in any way.

When we looked at the profiles of pesticides for fall armyworm – and this information is in the USAID and CIMMYT's published fall armyworm manual in chapter three that I was the lead author for. Eight of those pesticides which are widely used are highly hazardous. These are pesticides that are acutely toxic. They can result in a lethal outcome if you have a spill or you're exposed to a small amount of them. They also have chronic risks associated with them in many cases. They can cause cancer if you're a pregnant woman. Birth defects or

other chronic degenerative conditions can result from being exposed to them. So, there's eight of them that are highly hazardous and many others have high risk that would need some management or mitigation if they were to be compatible with the goals of IPM. So, that's achieving some efficacy, compatibility with natural enemies, and also not killing pollinators or bystanders also. And finally, natural enemy risk and restricted entry intervals that I'm going to be talking about have not really been factored into consideration for use of many compounds, and this is a barrier to progress.

You will not be able to see the writing on this slide, but if you download the presentation you can see there's the titles of four scientific papers today. All of the papers I'm mentioning today are open source. You can just click on the links to them and find them in the literature, or do a Google search on the article name and find it. Organic phosphate pesticides, certainly some of them caused long term harm to children that were fetuses in their pregnant mothers at the time that they were exposed. This is work from the USA of a relatively small number of exposures per year by Hispanic farm workers working in fields in the Eastern United States and fields in the Western United States. The exposure levels were thousands of times less than women are exposed to in fields in West Africa where I have done a great deal of work, thousands of times less. And yet at the levels of exposure in the United States there was a 15 point reduction in IQ in children five years after they were born, following the exposure of their mothers when they were pregnant.

These are not trivial impacts but they're difficult to discern. If someone is not doing very well at school or doesn't have very good motor control, isn't able to hold a pencil, you don't necessarily attribute that to an experience that you may have had years before. So, chronic risks are a major factor that we have to consider.

And why is this important? These are data from wristbands that 35 farmers and farm family members wore in Senegal a few years ago – and we published this in *Royal Society Open Science* – there were 75 wristbands in total because 35 people wore them on two occasions of one week. These risk profiles, these curves show the concentration in each wristband. We found in Senegal the highest levels of pesticide exposure of any measurements that had been made around the world. We also found a larger number of pesticides in these wristbands than had been found elsewhere, and also pesticides that are highly toxic, including the compound that caused the neurodegenerative outcomes that I talked about in the previous slide.

If you look at the middle of the slide, about the 35 percent point, you'll see Chlorpyrifos there, dot, dot, dot, dot, dot, is present in nearly half – in half of the wristbands and at significant concentrations. I would note to you that the Senegalese farmers and farm families were not even aware that Chlorpyrifos was marketed, and it wasn't labelled for use in the fields in which we carried out these exposure measurements. And so, managing and limiting and reducing exposure through high risk pesticides and highly hazardous pesticides is a priority and something we can all contribute to.

Why are exposures in Africa so high? It's because people work diligently in the fields for much of the week to produce the harvestable yield that they support their livestock and their families with. So, in vegetable production in Senegal, men work up to eight hours a day six days a week. So do women. And children of around ten and upwards work in the field for about five hours a day. Babies are also carried in the field by women. So, we have extreme concerns about high levels of exposure that exceed the one to three hours a day one or two days a week that might occur in the United States. And in a situation where protective clothing is not available and fundamental education about pesticide risk is not widely distributed these exposures are definitely occurring, sadly. And the paper I refer to below, which is also referred to in the IPM guide published by USAID and CYMMIT, is open source and it shows data for 15 villages in Africa where you can see for yourself what the pesticide uses and exposures were.

One thing we have done, which I'll – at the end of the talk will be going to show you is we've calculated the period after spraying that you would have to wait before it's safe to reenter the field. We used the Environmental Protection Agency's criteria here, but these are not over-precautionary criteria. If you enter the field before this number of days has elapsed, you are exposed to a dose of pesticide that has the potential to cause harm to you. If your bodyweight is lower than it is for someone in the United States – and in Africa that is commonly the case – or if you are very young compared to the assumptions we make in the United States about who is walking the fields or who is working the fields all the day, then those concentrations of pesticides in your body are more harmful.

And so, here we can see a concentration of pesticides that decays over time. And at some point you reach the time at which if you wore protective clothing, which is not available in most of Africa, it would be okay to enter the field. Then, a further number of days elapse as you move towards the right until you reach the

point where reentry might be okay without TPE. What I want you to do is get real about this. If an African family is in the field every day, it is not a reasonable assumption to make that they could use a pesticide that requires them to delay entering the field for several days. It's impossible. If your ten-year-old son is running through the field with a stick chasing rats or birds again to stop them eating your fruits or your grain every day, then he is exposing himself to large amounts of pesticide deposits on leaves as he's running through the fields unless this interval has been observed.

So, here's the paper measuring pesticide ecological and health risk in West Africa. There's another paper that we're just preparing to submit to a major journal. You can download this and read that, but our question is – you know, we're not going to be distributing a *Royal Society Journal* article to 30 million farmers. Of course not. We publish in high integrity journals to protect ourselves from the types of responses that we commonly get to this work when we publish it because the messages we convey are not necessarily welcome to everybody.

However, what we've done is we've asked ourselves the question "How do we translate this information into a form that an African farmer may be able to make use of this?" And here we see a set of pictograms. On the left you see the alphabetical list of pesticide names – and this was a 45, I believe, compound list for Senegal that were the commonly used pesticides. Many of them have the same active ingredients, but each one of these relates to a specific name. And when we share this with farmers in Senegal we have a photograph of the label. Then, the first indicator is an unacceptable high risk to a pesticide applicator. We've found up to 100,000 times more than the acceptable daily dose if certain pesticides were used in a backpack sprayer. Why is this? It's because firstly farmers are brushing themselves against the foliage of quite tall plants as they walk through them, so the exposures are higher than you would have for most backpack applications in the west where people do not use backpack sprayers for tall and foliose crops. And secondly, very, very highly toxic pesticides are still available in Africa and labelled for use in many countries that are no longer available in the west. And so, that's that first indicator.

The second indicator is for inhalation toxicity. And this is inhalation for a child who stood at the edge of the field 24 hours or later after spraying: Would they receive a toxic insult to their bodies by simply breathing next to the field?

Then, the next column shows a histogram which shows the number of days that you would need to delay reentry in order to not receive a dose that can be potentially harmful to you. And you can see in some cases here we've got up to three weeks, which is impossible if you are wanting to be in the field every day.

The next column shows toxicity to aquatic organisms, perhaps fish that you're harvesting in your rice paddy, or irrigation system, or a pond. Next, it's toxicity for domesticated animals, which would also include wildlife, of course. Next, toxicity to bees, pollinators, which are vital not only as a source of honey but actually to pollinate the crops that we rely upon to produce the nutrients that our children require when they're growing up, as well as adults' needs. And finally, toxicity for natural enemies, which I have some renown in. If you look up my name on Google Scholar, you'll see I've published nearly a hundred papers about pesticide toxicity to natural enemies. This is a barrier to IPM, no question about it. There's nobody that can challenge that assertion. If you use a pesticide and it kills the natural enemies in the field, your pest outbreak following this is worse than it would have been if you had not used the pesticide. In some cases the pesticide use is needed and there are ways to avoid excessive impacts on natural enemies. But if you're using a pesticide and it's toxic to parasitic wasps, navy beetles, spiders, other organisms, then you provide opportunities for pests that can attack the crop, and other pests that you were not expecting can appear in the field.

So, this is information we provided to Senegalese farmers in this form, and we developed this in collaboration with them and they really enjoyed the work. So, although when we presented this in our erudite scientific articles, we talk about on the left here a period of research and discovery, looking at the local context through a variety of anthropological enquiries, we then develop a decision support tool – and you'll see a little drawing there of these pictograms – then present it to farmers, the farmers then guide us through how they manage their crop. At what point are they making decisions about whether or not they would need a pesticide? And what we do is we get them to tell us how they would use this guide in order to assist that decision, and then we refine the guide.

So, we develop capable decision makers and then – the outcomes then are that risks are reduced. And one key thing to point out to you is that many people – and this is including some regulatory agencies – and many labels in West Africa carry the assumption that a dry deposit of pesticide, crystals of pesticide on a leaf, are not toxic to people as they walk through the field. And that is a complete fallacy. It's perfectly possible for that pesticide to be absorbed into your skin and

absorbed into your body, or if you're eating your lunch in the field for those crystals to enter your mouth, or if you rub your eye or wipe sweat away from your brow with a contaminated hand or body part, then you are exposing yourself to that compound. So, restricting entry, particularly for women and children, is a thing that we've seen with African farmers hundreds of them have responded to most. But many also realize there are lower-risk pesticides that they can select, and that's what the purpose of this particular educational mechanism is.

So, a couple of years ago we worked with a group of – within a village, farmer field school facilitators in Senegal and taught them how to explain these pictograms and work them into decision making by farmers. It's a four-day course that we run, and by the end of it these farmers then went and worked out with several hundred other farmers to see what would happen. And once a week for 12 weeks they met for an hour with farmers in their fields and worked them through the idea of when they go to the kiosk selecting a lower-risk pesticide.

And in doing that – here's some data that we've recently analyzed – we found that most of the farmers that were trained to actions to reduce risk. Many of them realized they could select low-risk pesticides. And finally, the top motivation, really, is protecting human health and preventing reentry, particularly for women and children. I won't go through the whole detail of that and it will be published soon. However, you'll note that what I'm not talking about in this presentation is whether or not people are making the decision to use pesticides in the first place. That's really critical because in many cases pesticides are not necessarily at all. But also, we're in the real world here. We're not in an imaginary world where we're simply saying to a farmer whose field is being ravaged, "Oh, you should be relying on natural enemies, not going out to find a spray." And there are many fallacies out there; there's much misinformation. We're not advocating pesticide use at all, but if pesticides are going to be selected, what we want to do is minimize those risks that are measurable and known and can be lethal, shorten someone's life, and have an adverse outcome that leads to more pests in the field. So, by generating this information we want to provide a starting point for being more assertive about things that are well known that we have certainty about and that we can manage if only we can get this information out there.

I'm finishing my talk in a minute or so. Here's a recommendation I saw from a Southern African country. It's for a widely used pesticide against fall armyworm: emamectin benzoate. And the recommendation was that it should be mixed with a wetting agent, nonylphenol. And so, I could ask myself, or you might ask yourself, "What is it that Paul and his group of collaborators might provide me

with that might insist a decision about whether or not emamectin benzoate is compatible with IPM goals and family health goals and environmental goals for a smallholder farmer in Africa?"

Well, through the pictograms and other data that we could provide there's a very high level of concern about emamectin benzoate and use conditions in the United States. Levels of exposure should not exceed 0.0025 milligrams per kilogram of bodyweight per day. That would probably be a lower expectation in Africa because people are not always as fully healthy as they would be in the United States, as people working on farms necessarily. There are neurological and brain function effects, however, that are a deep concern, and levels of exposure need to be kept low if it's going to be used at all. There's a limit of the tiny amount you can see on the slide for food tolerance of corn cobs, of people eating the corn. And this pesticide is also highly toxic to aquatic invertebrates, mammals, and bees. And finally, it may accumulate in the environment as well.

So, in that particular case, the conditions under which emamectin benzoate could be used would certainly require access to protective clothing which, as I say, is not widely available. Nonylphenol is a hormone analog. It's a female estrogen mimic. It feminizes males that use them. It reduces sperm counts. I'm – some of my own research with the students of Meyer-Scott Techs was the publication of the year in *Environmental Toxicology and Chemistry*, a major toxicology journal, and we showed that fish were feminized and unable to complete their reproductive life cycles when exposed to tiny amounts of nonylphenol. And this material has been banned in the United States and European Union for a very long time. So, to see this recommended by a government agency for use by farmers in fields who are unaware of its potential chronic health hazards is distressing to me, and this is information, I feel, we should be getting out to you.

So, in summary, we started on the left in October with knowledge of chemicals that are out in the system and are being talked about in terms of toxicity to fall armyworm. Eight of these are highly hazardous and should not be used, but others have high risk to other – to organisms and bystanders and workers in the field that need to be managed. We've discerned that there are 10 to 15 compounds at a lower risk, of which we believe 6 to 10 may be efficacious against fall armyworm. We're hoping to get to the green box as quickly as we can, and that will be a good place to be. But what we want you to understand is until we get there we've got uncertainties about what to actually support in terms of a usage that may not impose hazards on a farmer and their family that are

unreasonable for them to expect them – a burden that's unreasonable to expect them to bear.

One other thing we have done in collaboration with Commonwealth Agricultural Bureau International is to support them in their development of pest management decision guides. So, in Senegal there's around 50 pesticides that are commonly available in farm kiosks around the country. What CABI has done is to isolate those groups of compounds – in this case, BT, chlorantraniliprole, and a combination of acetomiprid and lambda-cyhalothrin that have short restricted entry intervals if protective clothing is not properly available to farm workers. You will notice that the pre-harvest interval for two of these compounds is rather long. And also, I would note to you that the combination of acetomiprid and lambda-cyhalothrin is probably useless, or of very low efficacy. It may be that BT and chlorantraniliprole are the only two compounds that are useful. However, we are trying to get this information out to you as quickly as we can.

I'm just about to finish now, in case the organizers are getting nervous about how long I'm taking. So, there's three things we're going to do in the next few months, three key elements that you can expect to hear from, and I'm responsible for delivering these, so you can phone me at 3:00 in the morning if I'm not delivering them. Firstly, we're going to provide an applicator training guide that addresses the risks that applicators and pesticide handlers are actually exposed to, as well as how to use the sprayer. There's no existing guide out there that currently talks about those critical aspects of handling a pesticide sprayer that can result in high levels of exposure, and this is a great concern to us. And we're working with an artist in Senegal to provide cartoons and drawings that are going to help in this regard.

Secondly, I showed you the pictograms and told explained that we have perfected this methodology of training trainers. We're going to convert that into a manual. And then, in Ethiopia probably, and certainly Malawi, and possibly Ghana and other countries that you might invite us to, we're going to be training trainers in how to recognize which compounds on a kiosk shelf are less toxic than others in the way that I explained to you.

And finally, we use a methodology at Oregon State where we actually go out into the field and talk directly to farmers. I know this is shocking to many of you. But we talk directly to farmers and find out "How do you make decisions? What are your concerns?" So, we use this diagnostic approach. It's called an IPM ST, an

IPM strategic plan. And what it delivers is our instructions to scientists, the technical experts, on what the farmers require in order to improve their decisions and improve management of the crop. These are very wide ranging. They apply to all aspects of IPM. But with respect to pesticides, it's going to tell us a huge amount about how to address vulnerabilities in the system.

So, thanks very much to you for listening today. Dawn has just appeared on the West Coast here in the United States and I know some of you are finishing work and about to go home, so thank you so much for listening. But here's three things that we're going to provide that address critical knowledge gaps in the system at the moment. And so, if you have access to these, you – any individual in this call will be able to contribute positively towards improving the efficacy of pesticides if they are deemed to be appropriate in a particular use case, and also to minimize the likelihood of adverse, acute and chronic risk to chronic health in the environment, all of which we're concerned about, but all of which we tend to talk about rather a lot and not do much about. So, what we've worked on for a very long time – and I've been working since 1977 on these factors, so I do have a certain amount of experience – we're trying to channel this information into guides that can be helpful to you.

And at that point I'm going to hand over to my esteemed colleagues, who are going to talk a little bit more about how we can follow up with this information if you found it useful. Thank you.

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