The Agricultural Biotechnology Support Project (ABSPII) and Product-Driven Capacity Building for Emerging Markets

Presentation Transcript

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Importance of ABSPII to the Feed the Future Initiative

Opening Remarks by Ronnie Coffman (USAID), Larry Beach (USAID), and Julie Howard (USAID)

Larry Beach: ...the Agricultural Biotechnology Support Project, and today we're going to have a program that is called the Agricultural Biotechnology Support Project ABSPII and Product-Driven Capacity Building for Emerging Markets. ABSPII, as you might guess, is the follow-on of ABSPI, which was initially set up to try to have a way of doing capacity-building around product development of biotechnology-enhanced products. There are many cases where breeders are not able to have germ plasm with the traits that they need and one way to incorporate the traits they need is to do incorporation of new genes from outside of that germ plasm, so that's where this project has focused and along the way, work with individuals in developing country organizations to make these things happen.

What we are going to hear about today is just a representation of these, an overview as well as a little bit more details of some, but what we won't have time to spend a lot of time on are all of the different parts that go with this in terms of policy and biosafety. You'll hear a little bit about biosafety today. I don't want to spend a lot of time talking about what ABSPII is because you're going to hear that during the day.

What I would like to do is recognize and introduce Ronnie Coffman, who is the principle investigator for this project as well as several others, and I'm not going to go through the long list of what he's done. We don't have time. I think one of the things I'd like to mention – everybody in the room here has access to paper copies, but online are all the same resources including the speaker biographies. So I invite you to get the information about each speaker looking at that resource. So Ronnie, I'd like to introduce you, and he's going to be the MC for the day.

Ronnie Coffman: Thanks, Larry, and good morning to everybody. Thanks to everyone in the room here who's in attendance and everyone online. Larry's given you a pretty good overview of what ABSPII is. Just to say it a little

concisely, it's a USAID-funded consortium of public- and private-sector institutions that support scientists, regulators, extension workers, farmers, and the general public in developing countries to make informed decisions about agricultural biotechnology.

So I think it's pretty obvious to all of us that transgenic technologies are controversial, and when you think about anything controversial, I think it's important to consider how history is going to look at it, that is how will people look at it a hundred years from now, what we're dealing with today. Generally, those who oppose these technologies like to play on people's fears. They try to scare you into seeing things their way – and today we have some very well-funded people, and we'll talk about that during the communications section – very well-funded people who are trying to do just that, and I don't think history's going to see them in a very favorable light.

There are some people who are concerned about large companies taking control of the food system and they see biotechnology as a part of that phenomenon really because only large companies can afford to invest in these technologies so far, and in fact this is quite true. You really need a deep pocket if you're going to bring a product to market. So this is where ABSPII comes in. We're doing our best to make these technologies available through the public system to small-scale producers. This is a project that helps countries develop the capacity to apply these technologies, publicly-funded for the public good with small-holder farmers as the beneficiary.

People who are concerned about the influence of large companies should be supporting ABSPII so that the public sector – small-scale companies and smaller-scale producers – can have access to these beneficial technologies that you're going to hear about today. So today's webinar is a chance for participants to ask questions and clarify any issues, so whether you're present in person or present electronically, we hope you'll take advantage of this opportunity.

So our next speaker is Dr. Julie Howard, who's the chief scientist for USAID. She's going to lead off, and Julie, I guess you're supposed to use that microphone up there.

Julie Howard: Okay, all right, thank you. Well, good morning, everybody. It's great to see the turnout, and welcome to everybody on the webinar. Ronnie, thanks for the introduction. Again, my name is Julie Howard. I'm the Chief Scientist with the Bureau of Food Security and Senior Advisor to Administrator Shaw for Agricultural Research, Extension, and Education. So I just wanted to take a few minutes of your time to sort of tell you a little bit about why biotechnology and why ABSPII is important for Feed the Future.

I've got five points to make and the first point is I want to back up a little bit and say, "Well, why is agricultural research important to Feed the Future?" Well, I think if you're in the room today or listening in on the webinar, you are probably well aware of the enormity of the challenge we all face, and that challenge is roughly to increase production of basic food crops by 70% over the next 50 years, so that is just incredible. So I think many of us wake up in the morning, almost every day, sort of thinking about that. How are we going to get from here to there?

So, caveats – I'm an agricultural economist not a scientist so don't ask me any breeding questions. Save all those for Ronnie. When you look at our track record over the past decades, you see a pretty, pretty flat trend in terms of what's happened with yields of major staples and what's happened with productivity of animals over the last few decades, so I think as we face the enormity of the challenge, we also sort of realize that we're not getting as far and as fast as we need to using conventional techniques.

So we in Feed the Future have put research at the center of our portfolio, agricultural research in general, and in fact we have doubled our expenditures on research over the past five years. So we're roughly $120 million a year for agricultural research, and biotechnology is an important part of that portfolio. Right now we're at about 10%, possibly a bit more, of the portfolio, and that's because we feel like, to use an old expression, we really need to use all the arrows in our quiver to address this issue of the doubling, increasing by 70% agricultural production over the next 50 years.

So biotechnology has been important, and what's really incredible about our opportunity today is that we have the opportunity to think about what our investments have done not just over the past 5 years but really over the past 20 years because the U.S. and USAID in particular have been investing, were early investors, in biotechnology starting, Larry, about 20 years ago, and ABSPII has been an important partner for the past 10 years. So today we've got an incredible chance to sort of revisit what have those investments brought us and what's the outlook for the future. So that's the first point, basically the challenge in front of us, the need to see research as central to Feed the Future, and biotechnology and the key role there.

Why is biotechnology important particularly? – And I know Ronnie and many of you will speak about this today, and I will from an economist's perspective. We're not only facing this incredible challenge of increasing productivity; we're also facing a slew of different kinds of challenges that are coming at us fast and furious. We're seeing very rapid changes in environment so we need to develop crops; we need to develop livestock breeds that are tolerant to temperature, that are more efficient in utilizing water; and we also need crops that are more efficient in utilizing scarce resources like nitrogen.

So we're seeing biotechnology as a very important tool to sort of short-circuit, to bring forward more quickly the incorporation of some of these traits that we believe are going to be very, very important I meeting the

challenges of climate change. And another aspect of these stresses is with climate change, we're seeing increased outbreaks of bests and diseases, and so also biotechnology presents opportunities to more rapidly incorporate materials and bring about resistance to key pests and diseases. So that's two.

A third reason why biotechnology is so important for Feed the Future is we really have put a lot of focus not just on production but we've finally learned that you can have a lot of production but that may not result in improved nutrition for people. So we're almost at the point of equally rating productivity and the importance of improving nutrition, and again, biotechnology is proving a very, very important tool for us.

Through another partner, Harvest Plus, we've been investing in biofortification over the past years, and we're beginning to see now the emergence and the uptake of varieties with elevated levels of zinc and iron and vitamin A that we know to be really critical for human nutrition, and we're beginning to understand that if we don't hit these nutrition targets in the first thousand days of life, essentially we are sentencing generations to not only decreased stature but decreased cognitive ability. So that's three – nutrition.

Why ABSPII? Why is ABSPII an important player for Feed the Future? Well, let me back up again a little bit and say Feed the Future has also sort of put much more focus than ever before on investing in private sector, so we're putting a lot of RFAs on the street. We're reaching out to many private-sector companies as important partners for us especially in the biotechnology world; but we also know that that's not enough, that it's very, very important for us to continue to invest with public-sector partners, with U.S. universities, with universities in national agricultural research systems in developing countries. – Why? Because we need to hit under-researched crops, crops that may not be as interesting to the private sector, may not be as readily marketable, as easily commercializable. So we need that balance, that continued balance of

the continued public sector investment, so we rely on partners like ABSPII to do that.

Also another key reason – and I will say I'm relatively new in U.S. government so I've been here over a year – but I've been of course involved in food security and agriculture for the past 30 years – I now hesitate to say that number. But as I've looked at how U.S. government and USAID have invested in biotechnology, I've always been very, very proud because it's been about letting countries make a choice. It's not been about, "Here's the technology. We need you to take it." It's not been about sort of jamming technology at people.

It's been about first training. It's been about creating scientific capacity in our partners abroad, and I know you'll hear from a number of those folks that have benefited from training. It's been about building scientific capacity and it's been about building a regulatory environment in which biotechnology can be safely used if countries use. So I always think about that as a really important model.

I think we at USAID don't talk about it that much but I try and talk about it whenever I have the opportunity because I think it resonates so much with Feed the Future because Feed the Future has put so much focus on responding to country priorities and building country capacity; and building the capacity for countries to make the best informed choices with their own developed human capacity I think really speaks to the heart of what Feed the Future is all about. And coming back to why ABSPII is important, you know our public sector partners, our U.S. university partners and our partners in developing countries, are just absolutely central to building that capacity, to building scientific capacity, to building capacity to commercialize these innovations, and to helping to build the regulatory capacity.

I'm sorry that I can't stay with you all of today. I wish I could because I think this is going to be just a fascinating discussion. Research takes such a long time, it seems, to come up with results and so it's rare that we have the opportunity to sit back at this juncture of 10 years and reflect on, "Well, what is it that we have accomplished?" – And it's a lot. So anyway, I wish you good discussions. I'm really pleased that we're having this event, and thank you all for participating.

Lessons learned from ABSPII: A decade of taking a product-driven approach to capacity building in agricultural biotechnology research and product development in emerging markets.

Presentation by Frank Shotkoski (Director, ABSPII)

Ronnie Coffman: Our next speaker is Frank Shotkoski. He's the Director of ABSPII and he came to us from Syngenta about – how long ago, Frank, eight years? Almost eight years ago. He has a long and distinguished record in these technologies. He's a graduate of one of those western places, Nebraska I believe it is. So Frank, please, go ahead.

F. Shotkoski: Well thank you very much, Ronnie, for the introduction. I'm Frank Shotkoski and I have the privilege to be the director of this wonderful project, the Agricultural Biotechnology, the ABSPII project. This project is very interesting. I've got to say it's probably one of the most interesting projects the USAID has. It has all the elements of a good drama. It has cutting-edge technology, international intrigue, controversy, law suits with Supreme Courts, just about everything that's challenging there is to do, this project just about has it all, and it's been challenging but also very fun to be involved in it.

But as you've heard from Ronnie and speakers already, agricultural biotechnology is in fact going to have to be one of the tools in the tool boxes of the techniques we're going to have to use to meet the needs of food security of the future and try to feed this population that's growing very quickly on the globe there. We by no means see agricultural biotechnology as being the panacea or silver bullet, but we see it as being a very important component of this whole attempt to produce better agriculture. As it was already mentioned, the big multi-national companies have actually been the driver for agricultural biotechnology and that's led to some controversies, but it's also led to the development

of some of the most unbelievable advances in agriculture in the developed world.

What we're seeing now is that the fastest growth and acceptance and adoption of agricultural biotechnology is in fact in developing countries and we see that as being something that's going to continue. The important thing is there are countries out there that are going to need to have the capacity, the willingness, and the understanding of how to do that, and that's what ABSPII is all about. As Ronnie already mentioned, ABSPII is a USAID-funded but Cornell-led research project that complements the national and regional efforts to develop agricultural biotechnology in those countries.

The countries that we are particularly working in right now in south Asia is India and Bangladesh; in southeast Asia Philippines and Indonesia; and in Africa we currently have projects in Uganda but we originally had some projects in Mali that I'll touch on a little bit later that are no longer in there. The whole idea is to produce safe and effective agriculture biotechnology products, to go through a product development pathway that will lead eventually to the commercialization of ag-biotech products in those countries – not just doing research, not just bringing in technology, not just training people – but the main objective is to actually, when this project is finished, to have products commercialized and available to the resource-poor farmers, and that's really what we're all about.

We consider what we're doing to be a product-driven strategy, that we're using a product-driven strategy. That means we want to go into these places using something that's going to be in demand by the farmers, by the researchers, by the politicians, by everybody that's involved in the entire chain of agriculture. For example in most of the developed world, the multi-national companies are working on four major crops – we've got maize, we've got soybeans, we've got cotton, and we've got canola. Those are the four crops that pretty much drive the ag-biotech in the developed world, and the reason for that is there's a huge return on the investment. Companies aren't doing this for charity. They've got to make money.

But a lot of those crops are not very important in the countries that we work in. The other countries have different staple crops, but they are crops that the multi-nationals aren't necessarily that keen to work on because there won't be a big return on investment, and in many cases the countries that we're working on don't have the regulatory capacity or they don't have everything in place that allows the companies to come in

and work freely, okay. So the idea is to go into the countries that we worked on, to produce the right genetically-engineered crop for the right place, and we did that early on by doing a priority-setting exercise. This is before I came into the project but it needs to be discussed because it's a very important component of ABSPII.

We had to decide what projects to work and where, okay? – So that became the function of identifying crops that were very important to particular countries that we were interested in working in. We had to know what those constraints were for growing those crops and if there was a genetic or a biotech-type technology that was available to circumvent that constraint. This was very important, and once those were identified – there were many different ones that were identified – we had socio-economic impact assessments done on these to try to assess what would be the best way to approach this. If we produced this product, would it in fact have an impact on the agricultural production in those countries, or the socio-economic impact to the farmers or the consumers in those countries?

So because this is a controversial area – I'm sure you're all familiar with some of the _____ ag-biotech is perceived by many – so communication and outreach had to become a major component of our project. We had to be able to go in and discuss this with the farmers. Would they actually be interested in using this technology? Would scientists be actually interested in developing the technology in these countries? And would there be the political will for the politicians to develop policies that would allow to actually do what we wanted to do?

That had to be all dealt with, and we felt the best way to do that was to come into these places with concrete examples of what we wanted to work with, and those dealt with access to technology. Did we have freedom to operate? Did we have the right licenses in order, in place? Did we have public/private partnerships? Did we have access to technologies that we wanted to use? The policy issues, intellectual property rights, were all those assessed? Biosafety – most of the countries we work in don't have biosafety laws and they have, in many cases, very rudimentary regulatory systems which actually can make it easier to work in to start with.

And in any of the countries, product development from a biotech perspective just didn't exist so the capacity-building there had to be great. That was the whole key to the project is to do product development and commercialization. The regulatory approval process had to be addressed. We wanted to come in with a product that would give the policy-makers

the impetus to act. If we came in with something that had absolutely no benefit to them, why would they have the incentive to pass regulatory laws? So it was very important that we picked the right products for the right place, and the communication and outreach, which I already mentioned.

This is a slide that we like to show because it shows kind of the holistic integrated approach that we use to actually produce a bio-engineered project, or genetically-engineered product. Every country we work in had a different level. The technology development, in some cases we were coming in with technology that was already very well established in commercial crops. In some countries, we were coming in with technology that had not been proven but we were very interested in testing it.

Policy – some countries already had a fairly solid regulatory system – India, Philippines – they're well developed; we could work with. Other countries I was working in had absolutely none – Uganda, Bangladesh, places like this, there really is nothing in place, and Indonesia even. Outreach and communication – that's a real enigma for us because we really are finding that to be difficult because every country is different particularly when it comes to the anti-GM movements. We have a very difficult time understanding what their doing and it's very unfortunate, actually.

And the marketing and distribution – this is very important to us because in many of these countries we work in, there is not a formal C distribution system; and if we're going to come in with a genetically-engineered crop, we want to be able to understand what's happening to that crop. What's the adoption rate? Are people, for example, abiding by refugal recommendations. What's happening to that seed? So it's very important that we come up with some systems in these countries that would allow us to do that, and using a genetically-engineered crop gives these people or countries the incentive to actually develop an organized marketing and distribution system. So we like to use this slide as sort of the whole picture that we do.

I couldn't do this justice. I only have 45 minutes to talk but I really have to talk about the projects some because it's hard for you guys to understand exactly what's going on without knowing what the projects actually are. I'm going to go into these a little, not too much technical detail, but I want to talk about each one of them a little bit. Our star project is a fruit-and-shoot borer resistant eggplant for India, Bangladesh, and the Philippines. This is a very important crop for many places in the

world; and then late blight-resistant potato. Late blight disease is the disease that caused the Irish famine in the 1860s. It hasn't gone away. It's still there and it's still causing trouble in many parts of the world.

We also work on the disease, the nematode-resistant East African Highland banana, because as we all know, the banana is facing extinction in our lifetime if we don't do something to help with the diseases; papaya ringspot virus resistant papaya for the Philippines, also a very important product; drought and salt tolerant rice for Bangladesh. I think we're all familiar with what's happening with climate change. There's areas of the world where salt water is encroaching on some of the major growing areas and it's having a major impact on the ability to grow rice and other crops that are normally grown in those areas. And then a multi-virus resistant tomato in Mali – I'm just that to touch on that one just a very little bit later on.

But I'm going to start with eggplant – eggplant is a very large crop in many parts of the world, and we've decided to work on this crop in India, Bangladesh, and the Philippines. In India alone, there's over half a million hectares that are growing eggplant. That's a lot of land. It's the number one vegetable in the Philippines. Of all the different vegetables grown in the Philippines, it's number one, and once it's again, it's a copy that's grown primarily by small-holder farmers. – And in many of these countries, it's their only cash crop because it's one crop the consumers want to buy.

But there's one major problem with this thing: in all these countries there's an insect, a small little moth, it's called the eggplant fruit and shoot borer, and it is extremely destructive for the eggplants. Losses range from 50% to 70% every year whether or not they're using insecticides, and then when the farmers do spray, they spray sometimes between 85 to over 80 times a year. They spray every day during the production cycle just because of the biology of the math. If it laid its egg and the larvae hatches, it goes right into the fruit or the shoot and you can't get it so they have to spray constantly, and they're using very difficult pesticides, things that are banned in lots of countries. These insecticide majors rarely work and there's extreme health concerns about pesticide exposure not only to the applicators, the people applying it, which are usually children, but also the consumers because of the residues that are left on these crops.

Our objective was to take a simple VT gene, the same VT gene that Monsanto has in cotton. This project represents one of the best examples that we have of a public/private partnership, and I'm not going

to go into that because Vijay later on will spend time talking about that. The whole idea was to put this simple gene – it's very well-characterized, very well-studied, very well-known – into the eggplant so that the farmers could increase their marketable yield and considerably reduce their pesticides. That was our goal.

We've gone through multi-location field trials in India, Bangladesh, and in the Philippines. In India, this project has been approved for commercial release by the Genetic Engineering Approval Committee. It's gone through all the studies. It's proven to be safe. We have it in about 15 or 16 different varieties of eggplant; and the Eco Company, which was our private partner, is also ready to go commercial with the thing. But because of the anti-GM movement and a lot of misinformation that Ronnie was talking about earlier, the Ministry of Environment and Forestry at the time elected to put a moratorium on the project until more could be understood about it – and that was about two-and-a-half years ago now. So we're still hoping that that's going to go through.

So India's on hold. We're continuing to move forward in the Philippines and in Bangladesh, and we are very near commercial release in *[brief interruption because of technical situation]* – anyway, this particular project is going very, very well for us. It's been kind of our hallmark project and we're still very optimistic that this thing is going to come through for commercial release probably in Bangladesh first or in the Philippines, and eventually it will come through in India. It's just a matter of time. We're very proud of this project and it's one of our best ones.

The next one, I'm going to talk a little bit about the late blight resistant potato. Like I said, late blight is a fungal disease from Phytophthora infestans. It is the same pathogen that caused the Irish potato famine in the 1860s. It's still there and it's still causing problems in many parts of the world. The major objective of this project was to develop a late blight-resistant potato for over 2 million resource-poor farmers in India, Bangladesh, and in Indonesia, and our main objective was to reduce the use fungicides. Just like the BTA plant, these guys spray up to 40 times a year with fungicide during the growing seasons but particularly in Indonesia and Bangladesh. They use an enormous amount of fungicide.

And then the idea here was there's a lot of capacity building about this. We were using a technology that had not been developed already. It wasn't commercialized by anyone. We were taking a technology that was developed by the University of Wisconsin, the WARF, the Wisconsin Alumni Research Foundation, and this was going to allow us to do a lot of capacity-building at the scientific level and at the product development

level and at the commercial level because we had to do the transformations ourselves. In many cases we had to do the – you don't back-cross in potatoes. You actually do forward-breeding, so this project from a technology perspective was very interesting.

One of the things that makes this project also very interesting is that the gene itself comes from a wild-type potato, and it's a potato that people in the Andes actually enjoy eating. It's kind of a bitter little thing but it actually produces tubers. The thing is this particular potato was distant enough from the commercial potatoes that it could not be crossed, so you couldn't do it just by normal breeding, by conventional breeding. Researchers at Wisconsin actually cloned the gene that represented about 90% of the resistance, and when that gene is transformed, or the ____ was transformed into conventional potatoes, it does in fact confer very high levels of resistance.

It isn't immunity and we aren't expecting immunity. We're expecting to reduce the use of fungicides. In our product profile on this originally was a 45% reduction in fungicide and from a scientific perspective, what we're seeing when we go the field trials – field trials like this – is that we're actually seeing probably about an 80% reduction in fungicide need. We're down to the point where if we're going to use fungicide at all, maybe one or two applications at the very end of the year, just to sort of protect your major. In many cases where we don't do that spray, we don't see a decrease in yields.

What you're going to see here in this slide is that the one on the upper left here is the conventional potatoes in Indonesia, _____. It's just devastated by late blight; and down below is its counterpart, this transgenic, we call it the RB gene, just totally unaffected at this stage. And down below on the right, this was a picture taken in Bangladesh, in Rangpur, where you can see that down in the very bottom there's a plot that the potatoes are just dead, and the other plots that are transgenic for the RB gene are still growing fine, absolutely perfect. It's amazing this technology, how it's working.

This particular technology in both Bangladesh and in Indonesia are very near commercial, and India as well; but we're very near commercial release of this. If there is any sort of a controversy about this one it's the fact that we're using a single gene for the protection. We are also looking at stacking that with an RNAI technology, a new type of technology, Interfering RNA that will help make the technology more durable because durability is very important to us. If we're going to develop these products in these countries, we want them to last. We don't want them

to be short-lived because of mismanagement or improper use of the technology.

The funnest project I have personally is the East African Highland Banana Project in Uganda. I'm not going to go really deeply into this because we have the PI, the person who actually runs this project from Uganda here, and he will later on give a talk about this. But the East African Highland banana, a cooking banana, is in fact the staple crop for that part of Africa. It is the number one crop by far, nothing comes close, and it's almost exclusively grown by resource-poor farmers; but the banana is suffering from severe pest and disease problems.

People talk about bananas going extinct in the next 20, 30 years – it is a real possibly because there are new strains of fusarium and there are new strains of other bacterial diseases that are devastating to banana. Well, all bananas – rooting-type bananas are sterile so breeding is not a good option. Conventional types of technologies are not going to work for banana. The only solution we have is the genetic engineering approach. The objective in this particular project was to use genetic engineering to help control one disease called black sigatoka and nematodes. The nematodes are microscopic worms that feed on the roots that cause an enormous amount of damage to plantations.

One thing I would like to point out about this particular project is that – and I don't want to steal Tushe's thunder – is that this project started out really at a basic level. We've trained several scientists with Ph.D.'s during the tenure of this project. When this project started when I came on in 2005/6, it was inconceivable that would ever have transgenic bananas in the ground during the period of ABSPII. This particular project was set up as a capacity-building one rather than a commercialization one.

In 2008, we had transgenic bananas in the ground in Uganda. We actually were successful in working with the regulatory setup to get these transgenic bananas brought in. They were built by Ugandan scientists but in Belgium, and we actually had those bananas transferred to Uganda and field trials have been done, and since then there's been multiple field trials done. But the success we've had in Uganda is unprecedented. It's just unbelievable, and the mission is very satisfied with that because they actually extended our project out, more projects and more money out to 2017. So we're very proud about that.

Papaya ringspot virus resistant papaya in the Philippines – this also is a very nice project. This is a project that's very similar to the work that Dennis Gonzalez has done in Hawaii. It's a technology that has basically

restored the papaya industry in Hilo in Hawaii. This technology works and it works very well. We have several events that have been selected through field trials that are showing very high levels of resistance. We are currently in the process of bringing in a dual or another technology to put together with this so that we can restore the papaya industry in the northern islands in the Philippines.

It's almost impossible to grow a papaya in a plantation in some of these areas in the Philippines right now because of this virus so this is an example of where the public buying has been good. We consider USAID money for this one to be almost seed money because in the end PICARD, which is one of the big research institutions from the agriculture system in the Philippines, has come in and funded this project in a big way, and they would never have done that had it not been for the initial work that ABSPII had done. And ___ ____, I don't know if you're going to talk about that one or not? No? You won't? Okay.

So, now I'm going to move away from the projects. These are the projects – oh, and I should mention – well, I'm not going to get into Mali right now. I'll get to that later. I'm going to talk a little bit about the successes we've actually had, kind of gloat a little bit about the some of the things that we're doing. The technologies that we bring in are in fact working. These are not just toys. These are not just things for researchers to play with. Our Bt eggplant works. We have over a 95% control rate. We are down to over a 40% to 60% reduction in pesticides, insecticides. This technology works. Farmers want it. Politics is holding it up. It will succeed eventually

The late blight resistant potato, once again the technology's remarkable. We do have potatoes, when it's crossed into or put into the right germ plasm, they are immune to the disease. It doesn't mean they're going to stay immune but they do not show any infestation at all in both India and Bangladesh and Indonesia, we have varieties.

The virus-resistant papaya – we have two events that we've selected that literally are immune to this particular – not immune but they're very highly resistant to ____ products still moving on. Some of the other ones we're working with are drought- and salt-tolerant rice projects are looking in a laboratory to be very promising and we'll be seeing those in the field soon.

So the technologies we're working with do in fact work. These are not just things that are going to be put on the shelf. In every case, the socio-economic impacts and following up on the successes we've had in the

field trials, the data that we get from the field trials has demonstrated that all of our exanti socio-economic data has been accurate even when this is done by independent sources, not our own guys. Many of these are being done by the economists independent of our own work, so we feel very proud about that.

And we also know that there's times when project terminations are necessary, and this is where I'm going to talk about the project in West Africa, in Mali. We had a project there that was working on virus resistance in tomato. We had put together an unbelievable consortium of countries, the NARs, to first of all bring germ plasm from the industry – because once again, the public/private partnership – they were looking for germ plasm that was resistant to the tomato yellow leaf curl virus. That's a devastating virus in that part of Africa. You cannot grow tomatoes in West Africa because of this virus.

So we found about a half-a-dozen varieties that were resistant to tomato yellow leaf curl virus but historically, poto viruses, a different type of virus, was the major problem, and the genetic engineering technology we were working with was to protect against poto viruses. Well, we did a survey, we couldn't find any poto viruses. The tomato yellow leaf curl virus had become so severe, and it kills the plants early on, that the poto viruses could not be found any more. That's a late-season virus. We couldn't even find it. So how could we justify doing a project when the technology we were developing is going for something that doesn't exist any more?

So there comes a time when you've got to pull the plug and so we do that. There was another project we were working in cassava earlier on where it turned out the technology also wasn't working, so you terminate. So it's important to know that we do terminate projects if it turns out not to be good, which is important. Termination is also as important as going forward.

Field trials – we've had more success with this project getting field trials on the ground in more countries than any company or anybody else out there. It's the first time we've had field trials in Uganda and Bangladesh, two countries that are very difficult for those type of technologies. India – it's the first biotech food crop field trials using domestically-developed technology, the Bt eggplant there.

In West Africa, I just mentioned the things with Mali, the key to that project that I'm very proud of is that we had the NARs from Mali, Burkina Faso, Niger, Benin, Togo, Senegal – and one other. There's seven. I'm

skipping one – all working together to test these germ plasms. We had over 100 different germ plasms given to us by all these different tomato-breeding companies around the world. Mali John from Cornell University at the time was very important in pulling all this together for us and that alone was quite a monumental task.

We did this in collaboration with ABRDC. Unfortunately when we left the project, it did fall apart. The consortium did fall apart. So that's just another thing, Ronnie, where having the right people at the right place and having things being managed properly is paramount to the success. After we left, it fell apart, the whole consortium, and I feel really badly about that; but it was one of those things where getting that cooperation together was very rewarding.

It's also, we've just been successful in many places where others have not. This is a map around the world that just shows you some of the places where we have field trials: Central Africa, South Asia in both north and the southern part, all over Bangladesh, the Philippines, Indonesia. We have many field trials going on all over all the time, and we have a skeleton crew, really. We don't have a – we're not a multi-national company.

When I worked for Syngenta, I ran all the biotech cotton stuff. I had probably 30 people that worked for me and I still traveled a lot, but this project I have our group in Cornell and we have our regional people. It's an enormous task to get this thing done and we've been very successful at managing it. It's been a very great pleasure to do that.

We're going to hear more about biosafety later on but I thought I'd better mention something about it here. ABSPII has actively participated in the development of biosafety guidelines in several countries. The one we've done the most work in is in Uganda. We would never have been able to get those bananas, those transgenic bananas, into Africa without an enormous amount of work going into that. Bangladesh we've done a lot of work.

The Philippines already has a system in place but that's all been done by the multi-nationals. Des and Randie Hautea will tell you how much work it is to deal with their own homegrown system to help develop and mature their regulatory system. It's been very cumbersome. It's been a very educational process of that.

The hardest part is that we have to work within the existing policy frameworks regardless of how cumbersome they may be. In India things

change all the time. Just as soon as you think you've got something going, they change a law on you and this happens all over a lot, so it becomes extremely difficult to handle this.

We've been noted for our high-quality training programs that we put on. We work with a group called PBS, Program in Biosafety Systems, which is sort of our sister group, and we work closely with those people to develop these systems. We don't work in a vacuum. We also work with SABP in South Asia and in other groups that are working on biosafety-related work and compliance.

ABSPII field trials are noted for being extremely high quality. We had people from other individual institutions that are independent from us go and look at these things and in every case they're very impressed by the quality of the work being done, and how professionally-managed these particular projects are. We don't have a single incident of non-compliance. We've had people break in and destroy our trials. We've had one in Los Banos in the Philippines where the Green Peace People decided they wanted to decontaminate the region. They had to break through a fence but they're being prosecuted for that right now, I think.

We also had a mayor in Mindanao in the Philippines decide that she didn't want the trial there and so she had one destroyed. That's quite an interesting lady. She actually made the national news for punching a sheriff and having – international news, I mean; a very interesting lady. I've met her a couple of times. Anyway, we do have field trials going on in Mindanao so we won battle. Anyway, we're very proud of the fact that we've been able to run all these trials all over the place without – we've been accused of many things but we've been found innocent with all these non-compliance-type issues.

International property and licensing – we are known for getting very thorough international property assessments. We work with a group in India called Sathguru, a consulting group that helps us with that. We also work with ISA. We work with the companies themselves where sometimes we're getting the technology, Monsanto for example or WARF from Wisconsin.

Some of the noted ones were the BGA plant with Monsanto. The late blight I just referred to was with WARP. The PRSV is from Monsanto in part, and then AUTUM is a – I forget the acronym. We've been awarded twice in that now for our technologies that we've been working with as being very innovative and the intellectual property being managed in a very good way.

Product development – I can't stress enough that that's what this project is all about. We have to understand our products and our end users. We're like a company, in a way. If you're going to run something you have to market it. It has to be done properly so that means we have to understand what we're dealing with and we have to understand who our constituents are, who are politicians for example, and those people are going to be the farmers, are going to be the consumers, are going to be the scientists, are going to be the extension people. It's going to be everyone involved in that commodity.

The C tracking system which I mentioned earlier, very important, and in India we've developed a computer system that could be used almost anywhere we go. We haven't had a chance it yet because our Bt eggplant isn't there and available yet. The idea too is to establish linkages with the local seed industry to get buy-in by the seed industry because we don't want to just be the only ones distributing the seed. There are countries where they have developed seed industries and we want those seed industries to be in a position to take those on and partner with us and make that available in their own germ plasm, whether it be hybrid or whether it be conventional open-pollinated material.

Communication and outreach with the growers and the consumers exist but it has to be strengthened. What happened in India is a good example of us not being prepared for the anti-GM movement to come in as strongly as they did. Sort of our objective there or – well, it's not really our objective but our strategy – was to kind of keep low, keep under the radar, slide this thing through. They knew exactly what they were doing. They waited until it was just right and they hit us hard. They hit us really hard and it made it very difficult for us to win that battle. There's a movie out there called "Bt eggplant – Poison on the Platter" that was produced by one of India's most famous movie producers. This kind of stuff – how do you fight this and where does our money come from? It's difficult.

Capacity building and biotechnology – this is also a major component of ours. Uganda – Tuch is that to talk the most – this laboratory is a state-of-the-art laboratory now. Everybody in African wants to work in Kawanda because of the facilities they have there. We've done the same thing in Bangladesh. I mean, when we started in, there was no one doing genetic work. Now it's just common; Indonesia the same way. Philippines was already pretty well doing molecular work but we've done a lot particularly in the area of some of the more advanced technologies that are there.

We've built state-of-the-art greenhouses around the world. We've put in confined field trial areas around the world. We've trained Ph.D.s, Masters people. We've done a lot of big capacity-building in the biotechnology level.

This is also very important. I did mention at some point where ABSPII kind of is at a seed-type thing, sort of like a starting point; and in South Asia, particularly in India, ABSPII probably gets a 10-to-1 leverage now. For every dollar we spend, the DBT and ICAR is spending about $10, right, Vijay? And we figured that in Southeast Asia, particularly in Indonesia and the Philippines, that for every one dollar we spend the government there is spending five dollars in this area.

And USAID, as I mentioned in Uganda, we are getting a lot of support from the government of Uganda but not necessarily monetarily yet, but we feel that that will be coming. So the whole idea is just that we're getting political buy-in. People are supporting us in these countries, and that's one of the things we wanted to have happen. We're not working in a vacuum here. We want people, the governments, to realize that investment in this area is very important and in most of the countries we're working in, that is the case.

The anticipated benefits by the time this project's all done – when we walk away, when ABSPII leaves these countries, we want to know that they have the ability to do the research, their own research, or with the ability to license in technology that they become aware of, and to be able to communicate the right things about biotechnology with hands-on training. We want them to know that they do have access to the technology and we're willing to help them get access to that technology, okay?

The idea too is to deliver the highest quality seed to the resource-poor farmers. We want these guys to have access to this technology so they can improve their yields, reduce their production costs, with the ultimate goal of reducing poverty and eliminating the hunger in these places. That's our ultimate goal. We want to reduce pesticide use dramatically. This is a problem in these countries and most all these technologies that we're working with will actually do that, so we're proud of that.

But ABSPII – it's really the people that have made this whole thing happen and I'm going to go through a few slides just to show you. This is a photograph I took a few weeks ago in Uganda. We started out in Uganda with what, about half-a-dozen people? There must be 35 people

in there now that are working on these ABSPII projects. We're now working on not only black sigatoka and nematose. We've added bacterial wilt. We've added fusarium. We've added a whole lot of more people to this project.

And in this group there are several people that have already received their Ph.D.s. Four or five of them are already going to get their Ph.D.s that are in this photograph right now so this is a remarkable accomplishment that we've done in Uganda, and it would not be successful without Tush leading this group of people, and it's a wonderful group of people.

The Philippines – the Philippines know how to have fun. The country's model is "It's more fun in the Philippines" and it really is in almost every capacity. This is one of our team-building efforts that we had. A lot of these people have moved on. They've gotten their Masters degrees, they've graduated from college, and they're no longer working with ABSPII, but they had training through ABSPII and we're extremely proud of that. I think five of these have Masters degrees now, right?

So this is one of my favorite groups. And this is both the papaya project and the Bt eggplant project people. They've done a remarkable job with pulling this thing through. And oh, by the way, these people are under a lot of pressure right now because, you know, the Green Peace has gone to the Supreme Court on our Bt eggplant project and so the stress that these people are under can be enormous, so we have to have fun like this once in a while otherwise we'll go crazy.

Here's the Bt eggplants at _____ University in India. Once again, these people have done an enormous amount of work getting that through to the point where it is. I feel very disappointed with what's happened in India because these people have worked so hard. We've done everything right. It's a safe product, and all it takes is one person, one individual to stop things. That's how it can happen in certain countries. It's just very unfortunate.

And here's the group at Dharwad, the Bt eggplant group, in another area that's just working with us, one of our partner, our public partners. And here's Bangladesh – here's the potato team. This area is unbelievable, ____ _____ ____. This is where they produce their potato seed. Can you imagine 500 hectares being under a net? – 500 hectares? It's unbelievable. They grow the potatoes under a net to keep the insects away so that they stay virus-free. This is an early material, and they really switch it, one year apples and potatoes and the next year it will be in

wheat. It's a remarkable thing to see. Anyway, this is under one of those tents, but they'd never seen the potatoes there.

And here's the late blight resistant potato team in India. We worked in a beautiful place up in the mid-range of the Himalayas called Shimla. This particular picture is from _____, I think, just outside of Delhi, but it's a beautiful place up in the Himalayas and it's an area that's kind of Toluca in Mexico where late blight is severe, and so it's a fantastic place to test for late blight in potatoes. This group has done very well. As a matter of fact one of our guys there is now the director of a different institute – and he's not in the picture. I'm looking. I'm thinking about Sirup and he's not I the picture.

Now here's us. Here we are in Bangladesh going somewhere. Were we going to see the Prime Minister? – I can't remember but anyway, we got rear-ended by a truck in our car, our van, so we're stuck on the side of the road. Ronnie's in there, KV is in there; myself in there, GP Doss and Vijay – we had to hop in cab, one of those dinky little cabs they have in Bangladesh, to race us off to another place where we could get in a bigger cab and get to wherever it was we had to do.

Anyway, it's the people who have made this happen. I've worked in companies where we didn't have such success because the management teams weren't working well. ABSPII has put together a fantastic management team across South Asia, Southeast Asia, and Africa. I'm very proud of being a part of that and with that, I suppose I'd better stop. I think I'm running out of time, and ready to field questions. Okay? Thank you very much.

Lessons learned from ABSPII: A decade of taking a product-driven approach to capacity building in agricultural biotechnology research and product development in emerging markets

Frank Shotkoski (Director, ABSPII) Presentation Q & A

Ronnie Coffman: Thank you, Frank. The crowd has accumulated here since you started talking. So, any questions for Dr. Frank Shotkoski?

Female: ____ ____ _____. I'm real excited to see how well things are going, and regarding the organic eggplant in India, to be ____ ____ program. I'm sure the opponents of the technology don't want to be seen as advocating that very high spray regime so they must be presenting some

alternative which they think is feasible or they claim feasible. Can you tell us what that might be and whether you think it would work?

F. Shotkoski: Well, one of the things that they promote is the use of a spray from peppers, hot chili peppers. The work that we've done on that where we actually went in to test whether or not these different organic regimes work is that in every study that I think we've done, the peppers actually had the worst infestation, so the stuff being sprayed with the peppers. In no cases were we able to demonstrate that any of the organic things actually work. Now what some people do is they actually grow the eggplants under netting and that works very well. The only trouble is you can't grow too many acreages under netting – it's not feasible.

What people do is they just – not every single eggplant is going to be infected and so what they do is – as a matter of fact in India, in the rural villages, consumers will actually want to buy an eggplant that has at least one insect hole in it because they know that that one has not been sprayed with too much insecticide, or probably was not sprayed with too much insecticide. The ones that have no insect holes on them, the very pristine ones, they avoid because they're a little bit worried about there being too much pesticide on them. But there really is no "conventional-type" control method for this insect pest. It's really a bad one.

Ronnie Coffman: Dr. Anna Marie Thoreau had asked that question, and when you ask a question, if you could please identify yourself. That would be helpful to the audience. Any more questions?

Male: We have a question from online.

Operator: This is a question from Jeffrey Polloni who is the Chief of Party for the USAID Wula Nafaa Project in Senegal, which is a Feed the Future project. He has a two-part question. He first asks if you could explain a little bit more about where the Bt gene comes from; and he also asks, "With the unsettled political and civil situation in Mali, will you be working with another country such as Senegal where I am where USAID has education and research in agriculture projects?"

F. Shotkoski: Okay. Well to address the – you said the Bt gene, right? The Bt gene is Cry 1 AC, which is a commonly-used Bt gene that we use in Bollgard cotton and other transgenic approaches. The gene that we are using in the Bt eggplant was actually donated to us by Monsanto originally. It's the same gene that's in the Bollgard cotton. Now Bollgard cotton has been taken off the market and replaced by Bollgard II, but Bollgard II also has the Cry 1 AC gene in it in addition to others. So it's a gene that's been

in the marketplace and very well-characterized for along time and has a very clean safety record.

We left Mali on our virus-resistant tomato project several years ago once we identified that the technology we were using wasn't going to be of value for the area. You're right, there's an unsettled situation in Mali right now. It's very unfortunate. We already were work in Senegal. Senegal was one of our partner countries when we were doing this project with the NARs.

ABSPII is on phase-out actually right now. We're winding down, and that's one of the reasons why we're giving this webinar; but one of the reasons we're giving the webinar too is for missions in these countries to identify and understand what we do do and what the potential is to go forward, and we would welcome to work in Senegal if we had the right crop with the right technology. Senegal with virus-resistant tomato was a target. I don't know that you have any other crops. We haven't visited Senegal in a long time so I don't know exactly what the constraints and what the opportunities would be, but we'd be very much welcome to look into it.

Female: Good morning. My name is Patricia _____ and I am a Professor at Georgetown University. My question is in relation to the adoption and also the communication component. It looks like this project, the length of the project, can afford to look into a long communication and the study of how people adopt these new technologies. My question goes to perhaps the ____ the small farmers, ____ small farmers that we are trying to reach. How do you look into the rate of adoption by men and women farmers? Have you looked into why they will adopt or not this kind of technology? I'm not talking about any specific crop but I would like to know if there is any gender analysis ongoing or if you have conducted any gender analysis of the rate of adoption of a biotechnology crop.

F. Shotkoski: Good question. Agricultural biotechnology is one of the fastest adopted technologies in history. There is no technology that I know of that has been – even mobile phones and these little laptop computers has not been adopted as quickly as agricultural biotechnology. The best example is India with cotton. That was legally brought in 2005, I think, or 2006. That went from a 1% adoption to over 90% adoption rate in less than five years, and the acreage has gone up almost nine-fold during that period of time.

Brazil and Argentina with herbicide-tolerant soybeans – it's essentially 100% adoption in a very short period of time. And even in America, we're at the point now where almost over 95% percent of the soybeans, where about 50% of the corn is transgenic; almost all of the cotton is transgenic. What we do know with the technology that we're working with, when farmers see it – especially the Bt eggplant and the late blight resistant potato – when people see it, they beg us for seed. They want the seed and they want it now. They say, "When can we get this?" They're going like, "Oh, my God. We have to have this."

So I expect the adoption rate to be very, very, very high – but those studies will be done. That's part of the socio-economic studies that we do. We try to assess what the adoption rate will be, and as a matter of fact that's a function of the formulas that are developed, but we expect it to be very high especially in these kind of demand-driven products.

Max Rothchild: Max Rothchild, USAID in Iowa State University. So it appear at least that the science is taking care of itself and that the real problems are technical approval by the government and some type of branding. I mean you could make the argument that negative branding relative to some of the companies that your partners with has really made it difficult for you. Maybe you could tell us what percent of the funds are devoted to science, policy, and branding in terms of trying to make these things work.

F. Shotkoski: Well, that's probably been part of the issue I don't think we took the communication and the branding part as seriously early on as we probably should have I'd say that right now we've probably spent 10% of our project money on that effort and 90% on the technology development and product development. We're changing that a little bit now especially after what happened in India, and in the Philippines and in Bangladesh and in Indonesia in particular, we're spending a lot of money on communication. We're partnered up with ISA, Biotrope, the different communication – you know, Proplife itself which does have an industry tie-in. We feel that an industry tie-in is important and so we are trying to stay in that route too, but we did not do it as thoroughly and as well as we probably should have.

Denba: Thank you. My name is Denba. I'm initially from Senegal. I'm based here right now as a part of a journey promoting our products and all those things that has been said and done over the last decades of development, and basically what happened is that over time we've seen initiatives like this from USAID, or the Cornell University actually had some interns in Senegal back way in 1997, '98. There's a lot of work that has been done on the ground, local and private institutions, local entrepreneurs, but of

course the government is definitely lagging behind and that's why what I'm doing is under the guise of the private sector, that got me to here, and I think the best thing to do is to bring visibility over the achievements that have been done by our people and that's the only way we can link that potential from the ground to the markets and maybe trying to get them there. That's why I'm here today, trying to see if we can definitely have some partnerships going on to revive some initiatives like this in Senegal in West Africa. Thank you.

F. Shotkoski: Yeah, that's part of our goal is to get involved in as many countries as possible.

Female: I'm _____ _____. I have another two-part question. You've mentioned that you believe, despite the impasse in India on Bt eggplant, you think that there's going to be movement, so I was wondering what evidence you have that there is going to be positive movement in that direction; and also what kind of efforts is ABSPII doing in trying to avoid the same kind of issues with the potato program?

F. Shotkoski: Okay. The reason we feel confident that India is going to eventually release this is number one, we feel that very confident that in the Philippines and in Bangladesh, that it will become available; and when farmers see it and they want it, there will be movement from the farmers themselves, the buy-in, the demand. We see that as already been happening.

There's been a change. Minister Ramesh has been moved to a different role. We have a new Minister of Environment and Forestry now. The scientific community in India continues to very much support the technology and continue to vocally make it known that this is a mistake. As a matter of fact just last week there was a major article that came out refuting this moratorium and suggesting that it's the wrong thing to be doing. So we're doing the work that we can do in India right now to try to educate the people who make these types of decisions.

And the second part of the question is dealing with what are we doing now? Well, when it comes for example in the Indonesia and Bangladesh where we have the late blight resistant potato, and in India, we are talking much more about the technology now and we're making it more visible. When it was with the Bt eggplant, we didn't embrace the farmers enough, the people who really were going to benefit the most. Anyway now with these other projects we're working with, we're making it a point that the actual people who are going to benefit from the technology get on board early on. As a matter of fact in India, there were

farmer organizations that actually were against the technology because they hadn't seen it, so we're trying to make sure that something like that doesn't happen again. We're trying. It's just that it's a funding issue in a way. We don't have a lot of money to do it but it's become a priority, put it that way.

Peter Davis: All right, Peter Davis, U.S. Department of State and Cornell University. You sort of glossed over cassava. Can you talk a little bit about the problems with cassava and why you decided not to make this one of your projects?

F. Shotkoski: Well the cassava, this is the early days. This was back when we were working with the project. It was in collaboration with the Danforth Center in Kenya, and we had a technology. It was in an event called Y88. It was a technology where we had an event that actually was resistant to one of the viruses, this cassava mosaic virus, and it was quite resistant; but there was a problem with the event. There was about fifty copies of the DNA of the transgene in this plant, and the reason it probably had become resistant was there were so many copies, there were probably inverted repeats, and so what was happening is you were producing an RNA molecule that was inhibitory to the virus.

And from a commercialization perspective, is what we do. We do product development and commercialization. It just became clear that that was an event that you could not commercialize. It would never make it through a regulatory process. And so at that point we elected to say, "Okay, you guys go back to the drawing board. You produce a new event that's working, that works better, and we'll be happy to get back in." And since then, that particular event did silence, which we expected it to do. It didn't work anymore. It didn't last long and it lost its resistance.

But now the technology – it isn't that the project stopped. The cassava project's very much going on, as a matter of fact Larry Beach is very much involved in it with the Danforth, and there's two viruses they're after. It's just that ABSPII is no longer helping manage and direct that particular project. So it's still going. I hope I didn't give you the impression that that project stopped. It's definitely not stopped.

Ginny Athmen: This is a question from Ginny Athmen of the Bureau for Food Security, Technical Division. "Thanks for an excellent presentation that highlights the accomplishments of this important investment and clarifies the number of issues and challenges still before faced as the project winds down. You rightfully emphasized the accomplishments of the building

human resources. What is the indication that the governments of the host countries have or are prepared to make the investment in institutional strengthening necessary to absorb and properly utilize this critical and valuable human resource? For instance, where does the Indian Council of Agricultural Research stand on the issue of biotechnology and has it incorporated biotech research into its structure and advocated for adequate research funding levels?

F. Shotkoski: Okay. The second question can be probably better addressed by Vijay and he will address that in his talk later, so I'd really rather not go into that one. But what I can say is that in all the other countries we're working, we are getting political buy-in in almost all cases. Indonesia would not – I mean, that project originally for us had stopped, and the reason it was reinitiated was because the current government is very pro-biotech and they see biotechnology as being a primary driver for that country to each food security. So Indonesia is particularly interesting.

The Philippines has been quite pro-biotech in certain circles. We have a very interesting thing going on in the Philippines because there's a strong organic crop movement but there's enough people there that have an economic background well enough to understand that organic cropping is not going to solve their issues, and so biotech is being supported. In Uganda – Tush is going talk about it – President Museveni himself has actually asked Tush to improve and build that project so, I mean, when the president of the country actually comes to you and tells you to do that, you know you're doing something right.

So in all countries we are seeing a greater acceptance than it was before we started. As a matter of fact a lot of these countries really weren't real happy that we were there but that's pretty much turned around in all the countries where we work.

K. Vijayaraghavan: This Vijay, regional coordinator for ABPII in India. In India there has been a substantial surge of investments ever since we started investing in ABSPII in the last ten years. The first significant surge is by the private sector themselves, which is to me at the lower level of our $100 million right now in biotech products in about 14 crops. The Indian Council for Biotechnology Research and the Department of Biotechnology together have invested as much as $100 million, so I think there's cumulatively about $200 million in about 14 crops. So this is a huge surge, as we see, and there all these 14 crops in the pipeline at various stages of development today.

Ronnie Coffman: Any other questions, either online or from the audience? We still have several minutes here we can use.

Marcella Shemanki: Hi. I'm Marcella Shemanki from the U.S. Department of State. I was wondering – I'm sorry, I missed some of your presentation so if you covered this – there's no work being done with pulses, is that correct?

F. Shotkoski: With ABSPII, no, but that doesn't mean we're not. Larry has a big cowpea project going on for it with insect-resistant cowpea that's going on in Nigeria, right? Yes.

Marcella Shemanki: Is there any interest? – I was just thinking in India because that would be something that I don't think they produce enough of. Why not pulses in India?

F. Shotkoski: Well you know actually in Bangladesh and in India, there's a lot of pulses that are being grown and there really is one insect that's really the devastating one, this moruca. It's the same insect that's the problem in West Africa. And the idea there is that once this technology is developed in cowpea would be to use this technology maybe in other pulses. You can cross them in. I mean, it isn't just a cowpea project for West Africa so hopefully this can be brought in to particularly Bangladesh and India where there are some very serious constraints on growing pulses. Larry, I think, has a comment too.

Larry Beach: This Larry Beach. USAID is funding a project through the Africa Agricultural Technology Foundation to get insect-resistant cowpea, and that technology is a Bt gene. It is transformation being done through a CSRO in Australia and partners in Burkina Faso, Nigeria, and Ghana. It has been shown to be very effective. Under moderate moruca pressure, it gives double yield and protects the plants very successfully. However it has only been tried in Burkina Faso and Nigeria.

Moruca is a big issue around the world and this could be transferred to other regions in terms of places where cowpea is grown, and there's something called yardlong bean which is actually the same species of plant and that could be effective against the moruca that's there. So that is a technology that when approved and released, could be spread further. Was that the extent of your question?

Marcella Shemanki: Well, kind of – why eggplant over something else, I guess.

F. Shotkoski: Ah, yeah. Well, this goes back to the priority-setting thing early on. In India and Bangladesh and in the Philippines, eggplant is the number one

vegetable crop. One of the reasons we elected to work with that project is that the technology was already being developed by a company. It was being made available to us at no cost and no cost recovery. There was an opportunity to have a regulatory package done for free. All the elements were there for this to be a high-in-demand-driven product that we could do with the money we had. Okay?

That was really a lot of the driver of the whole thing because we had to look at the timeframe. The original timeframe for ABSPII as five years, or the second five-year addition which we didn't know about whether it would come through, so that was part of the decision-making process. Can we actually get this done in the time?

Pulses were definitely on the list it's just that at the time, the transformation system for doing work in pulses didn't exist. Soybeans still is a very difficult plant to transform. Larry can tell you that getting the gene into cowpea was a monumental task. I mean, he was working with one of the best scientists down in Australia who's been working on pulses his whole life and it still was very difficult to get that gene into that crop. So we had to take all of those kinds of things into consideration.

Male: _____ _____ _____.

F. Shotkoski: Ah, yes. In India we did have – we had insect-resistant chickpea, _____ _____.

Male: The chickpea project is ongoing primarily funded by national institutions right now.

Female: This is _____from the USDA again. My question is a lot of companies hesitate in moving into some of these countries because of liability issues, so how does liability, which is kind of a merging issues now, fit into your comprehensive, holistic approach, since these are public sector servants that are doing this for the good of the whole?

F. Shotkoski: That's a very good question. Liability and redress is a difficult issue. Now the deal here is that we're trying to bring these things in through public institutions through national programs. The idea is that if we're going to commercialize these, it's going to be supported by the national governments, and so if someone's going to be liable it's going to be the government themselves; and there aren't too many people out there that are actually going to – first of all, the government's don't have a whole lot of money. The thing is that the reason you see the liability issues against the Monsantos and the Syngentas and the big multi-nationals is that

everyone thinks they have really deep pockets, so it's a business to go into this suing thing. But if it's owned by a country, it's less likely that these frivolous-type lawsuits and things will happen.

Ronnie Coffman: Any other questions for Frank? Anyone else? One back there.

Eli Carve: Hi. My name is Eli Carve with _____ University. I had a question about, overall, what do you see the landscape as far as public and private actors going towards the end? You mentioned, and as we know with a lot of these events, their effectiveness wears off over time or it's adapted to in the populations that you're dealing with. And starting with public/private partnerships, like 10 years out, 20 years out, where do you hope to see a lot of these? Which actors do you hope to see taking the leads 10 years out, 20 years out?

F. Shotkoski: Well, in a lot of these, particularly in the developing countries, you're going to see the companies coming in more. For example you're seeing already India and China setting up companies in Africa and putting together consortiums that are going to bring that technologies in. China, almost all the biotech that's being developed is through the public sector – very little private sector. India has both, both private and public. The United States is primarily multinational, and in Europe too, they're multinationals.

10, 20 years out, I hope there's about a 50/50 mix. I mean the big biotech companies, the big multinationals, they're going to be the gene discovery people. They're the ones that are going to be developing the stress-tolerance genes, the genes that can have the heat and salt tolerance, the genes that are for nutritional purposes, for bio-fortification, for example, because that's where the profits are going to be. My hope is that in many of the cases, they're going to make these technologies available for people working on crops that "don't have the marketability." For example the eggplant, you know, was very easy to get the Cry 1 AC from Monsanto because they see eggplant as being something that's going to be a financial driver for them. So I'm hoping that once these companies get past this liability and redress issue, which we just talked about, they will be more willing to donate this technology for "the orphan crops." We're already seeing a huge change in both the United States and in Europe on the patent laws and what can and cannot be patented in these types of technology. The industry will argue that it's the worst thing in the world; the public institutions say it's the best thing in the world. It depends on who you're talking to. I think we'll find a happy medium somewhere in 10 to 15 years, or 20 years. That's my hope.

Banana improvement project in Uganda: Supporting agricultural research through Feed the Future and strong Mission involvement

Presentation by W. Tushemereiwe (Uganda National Agricultural Research Organization, NARO)

Male: – that he's held since 2006. He's also an adjunct professor at the Centre for Tropical Crops and Biocommodities at Queensland University of Technology in Australia. He's headed the Banana Research Programme of NARO-Uganda since 1997. This position, he directs all research projects in bananas in NARO, including the ABSPII Banana Project in Uganda. So Tush, please. Welcome.

[Background talk]

Male: Thank you ladies and gentlemen, and good morning. My presentation is a continuation of a topic already introduced by Frank, and it's about the banana improvement project in Uganda, the supporting of the cultural research through Feeding the Future, with a strong involvement of USAID Mission in Uganda. And the partners are represented by the _____ which you see down there. And by way of introduction, let me say the project I'm going to talk about is supported by USAID through grants _____ awards and an associate award of the Uganda USAID mission. And with this support, we now have a highly successful program with world-class facilities and executing world-class research in banana biotechnology.

Let me start by giving you some background information about Uganda and crop, and specifically in case some people have forgotten the location of Uganda, it's _____ country, a very small land-locked country, as you can see. More information about Uganda, the population of the country is about 32 million people, and the main agricultural activity in this country is – the main economy activity is agriculture, which contributes about 20 percent GDP and 48 percent of exports. The main export crops are coffee, tea, cotton, and flowers, but in terms of food, the priority food _____ crops are bananas, maize, beans, rice, cassava, potatoes, and an assortment of fruits and vegetables.

This morning, I am going to concentrate on bananas, and the mark on the sideshows areas in Uganda where banana is the main crop. Each of those small dots represents about 500 hectares of bananas, and you can see that the concentration of banana is rising further in Uganda, but the areas which are not dotted, also want to grow bananas if the production constraints that prevent growth of the banana can be dealt with.

Let me quickly go into the reasons why Ugandans like growing the

banana. To Ugandans, it's the most important food security crop, and the reasons given usually are its perennial nature. A perennial crop which is a staple, has many advantages, but the banana itself is a returning crop that fruits any time of the year, giving you food. And that to rural communities is very, very important. Communities tend to produce and to sell all their produce going hungry. The banana will not allow you to do that. It will give you piecemeal fruits which you use, and life continues.

Food – it's in the food crop earliest disturbed by erratic rainfall, and I _____ climate change in Eastern Africa for us, the major problem is unequal distribution of rain. It rains anytime, and all of it comes in one month, and it stops. Timing when to plant is difficult, but the perennial crop like banana will already be there whether the rains _____ or come too late, it's irrelevant. That makes the banana a very important food security crop for communities in our region.

Then the all year round provision of food which I've already talked about _____ the fruits – a banana is a crop which fruits anytime of the year, giving you all year round provision of food. In areas where the banana is the main crop, people never face hunger. We will not have famine in areas where banana is the staple, the southern areas of Uganda which I showed you.

And in terms of production, we produce about 10 million tons a year and the most of _____ 98 percent a week is consumed. The _____ consumption _____ about 250 programs person a year. The banana diversity. Most of the bananas we grow the one I've named East African cooking banana, the bigger bunch you see on the left, and in the extreme is the plantain _____. I want to bring to your attention a _____ in which you will find _____ usually compiled by FAO. FAO calls the East African _____ banana a plantain. So when you refer to FAO data, the data will show that Uganda produces mostly plantain. Actually, Uganda produces only one percent of our production is plantain. All the rest is banana, but 80 percent of the bananas we produce is the East African island cooking banana.

This important crop has challenges. The challenges are the short plantation life. The complaint farmers will tell you when to go to them, that plantations are lasting a very short time, but they used to last 50 to 100 years, but these days they last less than 5 years, and that's a concern to farmers which reduces their production. And low productivity potentially you can harvest _____ per hectare if you have a very good plot. But the early product _____ in Uganda now is about six tons per

hectare. The yield _____ is so big, and that is what we need to increase. And because _____ diseases _____ the decline and the banana itself has the limited genetic diversity by nature of the way it's propagated. It's _____ propagated crop.

And this is slides I intended to show you the places I talked about. Too many pests which we are dealing with in our research. The banana weevil on the left, and the nematodes on the right. And _____ the banana _____ eats the core, reducing the life of plantations. When farmers complain of short plantation life, it's the weevil to blame. And the nematodes also cause _____ of bananas, also contributing to shortened plantation life.

The other constraints that have priority is the banana _____ which causes rotting in fruits and wilting of the plant. Then black sigatoka in the _____ which dries the leaves before the banana can _____, and the Fusarium wilt which is a disease of _____ bananas.

The interventions we have tried since we noticed these problems are several, and we started research into these crops around 1990, and we started with what we considered _____ to do. We focused on developing coping strategies, mainly sanitation and better _____ to manage this problem _____ diseases. Later, we added a breeding program, but by the year 2000, we had noticed that these efforts are not going to give us what farmers would take.

For instance, the breeding program was not succeeding, largely because the sources of resistance _____ bananas and when you make crosses, you get hybrid which have the resistance, yes, but the fruits are unpalatable and less acceptable to consumers. And farmers have a _____ demanding that _____ hybrid is _____ good. They have the resistance that we need, but the test is not what we want. We want original banana. And by 2000, we noticed that we needed another strategy that would give farmers the fruits that they want to eat.

So that's when the ideas of using transgenic technologies started coming in, and around 1999, an opportunity presented itself to us. The president of Uganda directed that he wanted to see NARO acquire and apply modern cutting edge scientific techniques in agricultural research. In fact, he went ahead and he offered some money to be contributed by Uganda to the _____ group international research. Uganda contributed as a member so that we link up with the scientists and _____ system and we bring this technology to Uganda.

We particularly link to _____, and in 2000, a project was created on banana biotechnology, and bio banana was just started crop which would be used to later acquire the technologies and later expand the other crops. Then that project which we have started was coordinated by INIBAP. INIBAP is an international network for improvement of bananas and plantains, a department of IPGRI, and they were selected to coordinate international partners.

In 2002, they approached USAID and the Rockefeller Foundation to give a hand in the supporting this _____ program which was struggling without resources, and the initial resources from Uganda government Rockefeller Foundation and USAID, we have used to develop the first biotechnology lab in Uganda. And this laboratory was _____ by none other than the president of Uganda in August 2003. The _____ you see _____ is the president of the Republic of Uganda, _____ the lab that was put up in 2003. And with the support of the government _____ and USAID and the other partners who are being invited, ABSPII who went ahead to spearhead the program that I am going to talk about now.

And _____ the support comes through _____ award from Washington here, an associate award from the Ugandan Mission. And the project was designed to offer comprehensive capacity building, integrated with the research in biotechnology. The idea was to develop – to use – to acquire capacity and use this capacity to develop products as Frank earlier described. And the Ugandan project, therefore, had those two key elements, capacity building, _____ infrastructure, and the human capacity, and using that capacity to develop _____ resistance for black sigatoka, nematodes, bacterial wilt, and Fusarium wilt. And those are the activities we are working on since 2004.

And I will now quickly take you through the highlights of this program. To get the picture clear, I won't summarize where we were in 2004, and where we are by 2012. In the 2004, when the ABSPII came in, we had ambitions to apply biotechnology, but we didn't have a final functional institution to regulate what we are going to do. We didn't have structures to manage _____. We had just had the molecular biology lab and cell culture labs, but they were very poorly equipped.

We needed technologies from advanced institution which had them, but we didn't have the capacity to access them, and we didn't have capability to carry out transformation which we very much wanted to do. And we didn't have facilities like contained facilities where we would handle these crops if we generated them. So in terms of capacity, we were at zero, and that is 2004. And fast forward to 2012, we now have a strong

_____ and _____ system in the place. This is not only for banana; it's a national system that is in place to regulate all transgenic crops in the country.

We have a _____ office to _____ the office of the National Council for Science and Technology to regulate, to manage the _____ system. We have a fully equipped lab _____. We have at the capability for technology transformation. It is now routine in our lab, containment greenhouse _____. We _____ by now we would say we have a biotechnology lab that is considered one of the best in the world for banana transformation, and it actually is the only one for the East African cooking bananas. And this lab has attracted many people from the region and from other parts of the world to see how that things can possibly be done even in a third-world country like Uganda.

Now I think I'll show you a few slides to highlight some of the achievements I will talk about. One of the first achievements we had was convincing government to remain on our side as we were going for biotechnology. Around 2003, there was a lot of bad publicity for biotechnology in Africa in the Zambia, in the Zimbabwe, in the all countries around us, and the government started wavering. So we used the opportunity over the capacity we had acquired in our lab to invite the president of Uganda and the key members of his cabinet to visit us at _____ and we explained to him what we intended to do in the biotechnology, and how useful it was going to be for the country.

That picture is not clear, but the person you see in _____ and the white jacket is the president, Yoweri Museveni, again, listening to the scientists, learning about biotechnology. And after this meeting, he went and announced to the world that he was _____ support biotechnology and some leaders in the region started also _____ saying, "It may be there is something President Museveni is seeing." They started relaxing their stance against biotechnology. We consider this a very big achievement.

In terms of human capacity, we've trained many scientists, six scientists we have now nine PhDs going, and _____ we have special greenhouse _____ to for handling transgenic materials and this was given to us by USAID, through the ABSPII program. Here, we have the minister of agriculture and the USAID mission director in Uganda at the opening ceremony of the _____ greenhouse I have just shown you. And that's continued participation of _____.

In the interest of time, the achievements we have I'm going to summarize them in a few sentences. I'll not go through all the bullets. Let me say

that _____ to establish a banana transformation system. With this system in place, we can access any genes that evaluation, and put them in bananas and _____ to them. We have moved to a stage where we've _____ the generated plants and our greenhouse conditions, and we've moved a step further and _____ and field conditions and confined field trials, and we are now already making selections to go onto the next level.

And I'll quickly take you through, again, a few highlights. This is the first confined field trial that we did. It was planted in 2007. It was the first of any kind in Uganda, and it helped us to put the _____ system in place, and to give the research team capacity to make applications and also to assist other researchers in making the applications. For instance, we assisted _____. We assisted cassava, and in making applications, and we are assisting several other programs in doing the transformation.

This is the current confined field trial for bacteria root resistance. It's an interesting one where we have – where we selected 11 lines that have good resistance, and this one we are going to – we are preparing to test them in the _____ if we get permission soon. And we consider this our most advanced step now.

I am including this slide to confirm that Uganda government is still strongly behind what we do. Recently, again, President Museveni, after hearing about our achievement with the bacteria wilt resistance gene and the problem we have with the controlling bacteria wilt, he wrote a letter to the farmers. I have picked sentence from his letter where he says that experts in field of genes of pepper into the banana in order to make it resistant. They are now trying it in different situations to see how it will behave. We hope we shall soon have a _____ which cannot be attacked by the banana wilt. That was the president writing to the farmers. So we solidly have him behind us, and we are happy with this _____.

In our next step, we have hundreds of transgenic bananas where we've inserted resistance to nematodes, and we've got approval to do the next confined field trial.

In conclusion, let me say the project has created significant impact in Uganda and has made NARO a leader in advancing ethical capacity to conduct biotechnology research and development. This success is attributed to the following factors. Number one, the innovation of the two USAID awards, the leader and associate awards that complemented each other to create the kind of results you see. Previously, we've had small disjointed awards which are not complementary, but in this case,

the two awards that are complementary and the results _____ achieved when awards are complementary you can see.

Number two, the synergy created by partnerships between a well-facilitated lab would consider our _____. We are well-facilitated _____, and a international institution. There is a synergy when we work together and what you are seeing is the result of the synergy of local institution working with the international institutions to achieve the results you are seeing.

Then strong support for biotechnology in Uganda by politicians. The political support we have has been instrumental and we cannot underestimate the contribution it has had. Then comprehensive capacity building integrated with research. Previously, there were efforts to train us, and in most cases, people would _____ that they would be trained in the European or American universities. You can train on wheat, and then you go back to work on bananas. This one was unique in that the training was directly linked to product _____ and you can already see the results we are getting. And I think this is something that _____ continue to happen both in Uganda and in other places.

Then strong government commitment – that one I've already _____. Long-term international partnerships. When you are dealing with a long-term solution, the partnership needs to be supported _____ long-term. In most cases, projects from government to government projects are very short, four years and they exchange it to a different area, but when you are dealing with a long-term technology, you need more – we need more long commitment. Then sustained funding. This funding we've had – we have succeeded _____ because of sustained funding. And I hope this sustained funding will continue.

And I have a feeling if in other places the funding was sustained like has been done in Uganda, the results like we have, would be seen. Finally, the _____ local institution. I think here credit goes to Cornell the way they've handled our project. Cornell came in deliberately to empower us to do everything. The decision. They are providing a backstop _____ and giving us an opportunity to do what we feel needs to be done. And in the process, we've got empowered and I have a motivated team which is willing to continue and continue until we get all the results we are capable of getting.

Finally, I wish to thank the funding agencies, USAID, Uganda government for the contributions that have brought us this far. But in this funding, there are others who are funding some different activities in the lab

which complement the support we get from ABSPII for this particular project. For instance, the equipment that we use, if a project – some of the project supported by the Bill & Melinda Gates Foundation _____ and equipment, we all use it, and we find that complementary, and we thank them for that input, too.

And there are such partners who are listed, Cornell, University of Leeds, Katholieke Universiteit Leuven, _____, Venganza, and IITA. These are our technical partners who are directly involved in the ABSPII project, but there are also others like Queensland University of Technology, _____ University who are _____ that we apply when implementing the biotechnology – the ABSPII activities. There is a lot of complementary in the lab, and I thank you very much for your attention.

Banana improvement project in Uganda: Supporting agricultural research through Feed the Future and strong Mission involvement

W. Tushemereiwe (NARO) Presentation Q&A

Male: Thank you, Tush, and thanks for your leadership. You're really what makes this such a success in Uganda. Were there questions for Tush? Question online? Oh, sorry. Right. We've got to – any questions for Dr. Tush? Please, Peter? Mike's coming.

Male: Peter Davis. Can you indicate the source of the genes for the resistance to fungi bacteria and nematodes? You mentioned one gene came from pepper. The other question then is how was this gene identified in the pepper?

Male: Yes. The gene from pepper was identified by a Chinese institution, the Chinese – Taiwan. It's a Taiwanese institution, and it was accessed by the IITA through AATF who has arranged a license for us to use the gene. And we've accessed it and we are applying it in bananas. We are not the one who isolated it. It was isolated by the Taiwanese institution. And the other genes also came from different institutions. University of Leeds has given us some of their nematode genes. We have some genes being developed by Venganza. It's a private company here in the US.

Female: *[Inaudible comment]*

Male: Okay. My question really is what organisms did these come from apart from the pepper gene? Where does the resistance to nematodes come from, and what is its molecular basis?

Male: Can I ask Frank, is part of the team to give a hand in explaining this?

Male: All right. The genes that we're using for the bacteria wilt resistance is two of them. They're both from peppers. One's called PFLP, a protein-like _____. What it does is prevents the bacterium from picking up iron and it _____ before they have a chance to infect. The other gene is called HRAP, and it's in effectors and it's basically an R gene. Both from pepper. They're remarkable. These plants are essentially immune. I mean I've seen them. Larry's seen them. I've been following this project for a long time and it's a project being done by a young woman named Leena Tripathi with IITA.

The genes for nematode resistance we're using a myostatin gene that's well known to control nematodes. Another gene is a antifeedant gene. And what we're doing is we're stacking these. We're putting these together. And then this _____ as an interfering RNAI technology. Those are the ones we're interested – and then we're also doing _____ resistance _____ interfering RNAIs technologies.

And those genes are synthetic. What we're doing is those are being made and targeted against pathogenic genes that we could put in the plant that will prevent the pathogenicity of the pathogen once it's infected into the plant. That's the methodology there. Does that help? And they're very specific to those pathogens which is very critical 'cause we don't want to be controlling non-targets.

Male: Other questions? Yes, please.

Female: My name _____ from the USDA. Aside from the biosafety aspect of the research and bringing the product to commercialization, who is doing the food safety aspect of it for food safety approvals in these countries? And that's one question.

The other question is I know a lot of these products, and this is I guess not just Uganda banana _____, are for domestic use only. But is there thought about applying for approval elsewhere aside from the domestic countries?

Male: Again, I will give part of the answer and if, Frank, you will supplement. But the food safety studies we haven't started on them yet. But apart from selected genes which are then screened are known not to have problems. And your second part that whether the product would develop will be used in other countries, yes, like other countries in the

region, like Rwanda, Rwundi, _____, who grow bananas. Definitely our products will go to those countries. We expect them to flow to those countries, _____ grown in Uganda will automatically be picked by farmers in the neighboring countries. _____ those countries _____ in Uganda we'll go to other countries. Frank.

Male: – aspects. We really want to get down to the point where we pick our final events before we start spending a lot of money on that kind of thing. But what we've done is the proteins we're working with, we've run them through all the codex type things. We're looking for allergenicity and any other things we've done, simple tests to see just how quickly they digest away _____ gastric fluids, those simple kind of things at this stage.

So far, yeah, we have no red flags or pink flags or anything on any of these proteins. They look pretty good. But we're not going to spend any money doing any regulatory work until we're down to the two or three final events in all of them. And the idea there is we have a lot of projects going on in banana in Africa. It's not just ABSPII. We have biofortification projects. We have other projects of concern. And the idea is, is to coordinate all of these projects. Once we have events so that we do this kind of in a coordinated manner to minimize the expense. It's going to be expensive. It's just like. It's just that we have very burdensome regulatory system and we have to do it just to make people satisfied.

Male: All right. I might add, you mentioned going to other countries and, clearly, there's regulatory issues with respect to that, and one of the things that USAID is funding is to help with regional coordination in terms of regulatory, which we see happening, and starting to move along. So I think as something like this could get released, there will be regulatory systems in place that can make it so that each country where it goes to will have systems in place to properly regulate.

Any other questions either from the audience here or online? Nothing online. Please send your questions if you have a chance. Larry Beach wants to make a comment.

Male: This is Larry Beach, again. Tush is always not usually touting his own thorn here. I would like to. I would like to make a point of it was said in several ways, but the reality is what has happened in Uganda is this group has led for the rest of Uganda and other crops, and he mentioned that the people in cassava and cotton and other crops have followed their lead and have had some help. This comes down to the point of when they have to start trying to apply for approval for combined field trial, the scientists from Kowanda have sat down with the scientists from _____

working on cassava and sorted out how to do that. And now the scientists in Namalingi that are working on cassava are completely capable in doing confined field trials. They're on their third or fourth generation of confined field trials and its ability.

There are scientists there that are now about ready to plant nitrogen use efficient rice, NERICA rice, that is part of a project with AATF that we're also helping to fund. There's scientists in collaboration with SIP that are ready do a confined field trial in sweet potato, and there have been scientists working on water-efficient maize for Africa, all being able to do field trials in Uganda because of the leadership that occurred in Kowanda.

Tush mentioned the other funding from other agencies, Bill & Melinda Gates Foundation, Gatsby Foundation. This is really significant. What has happened now is they are working on other projects that are also making very good success that have built on all of what they've done on this project, and they're getting a lot of money to be able to do that. So now we have a problem. We have a possibility of having a high pro Vitamin A banana being produced because of that work, and maybe increased iron and zinc. I'm not sure when that's going to be available. But I've seen some really colorful bananas being produced by this group.

And how many different products should be coming out? I think one of the issues that we have that is a good issue is that maybe we need to combine these traits and have them all together. Those kind of discussions are ongoing and what makes sense – what is it that makes sense in terms of the Uganda farmer? So there's a lot of progress here.

Female: Marcilla Schmansky from the state department. So what is the government thinking – the regulatory people? Are they thinking about stacked traits already?

Male: I think the – this issue has not been discussed, but usually what you would do is to find out we follow those who are ahead of us, particularly in the advanced countries, like US if they were stuck and the technology is working and is acceptable, then we will be allowed to do it. As long as it has been done somewhere else, we will be allowed to do it, too. I don't know whether that answers your question. Frank, you can supplement.

Male: Yeah, and Larry just mentioned that there's a lot of different technologies going on. We have, for example, it's weevil – there's a weevil resistance project. There's a nematode-resistance project. There's the Sigatoka, the Fusarium, and the bacteria wilt, and possibly the biofortification

projects. The idea is, is to have many varieties bananas that have all those traits. So, yeah, the idea is to stack.

Matter of fact, the RNAI stuff, and the nematode stuff, the vectors we're building now already have all of the genes in them. We're not building vectors that have individual genes.

Female: So the government is thinking – or the regulatory system people are thinking we're going to have to regulate stacked traits, and we're getting ready for the that.

Male: Yes, they are. Matter of fact, the transgenic cotton workers – I don't really want to get too much into it – is for Bollgard II with Roundup Ready Flex, and those are stacked. The idea going into Uganda with a single gene type of transgenic probably isn't even being thought of right now. Larry.

Male: And the nitrogen use efficient rice in the NERICA rice has, in addition to nitrogen use efficiency, it has salt tolerance and drought tolerance. So there are stacks already that have been brought together in addition to the cotton to the regulators. They have looked at them. They've already approved the field trials. So they're starting to look at this. And I think there's going to be situations where because of the uniqueness of the crops and the constraints that the regulators are not going to be able to look elsewhere to what has been done to find out what the best thing is to do. And part of the capacity building is also amongst the regulators where they are learning what they need to deal with. But they are, and, in fact, the National Biosafety Committee is a very responsive committee that in most cases, gets back pretty promptly about issues and asks good questions.

Male: Peter, please.

Male: About 15 years ago, researchers at the Boyce Thompson Institute at Cornell put resistance to human hepatitis virus into bananas. And at that time, touted it as a great advance in health care for Africa and similar countries. Did this go anywhere? Has there been any interest in putting vaccines into bananas in a practical way? Okay, if you can't answer it, it doesn't matter _____.

[Crosstalk]

Maybe somebody on the Web can provide an answer.

Male: But I've heard about that study, and I've also heard the challenge was – if it continued, how would you control the dose that people would consume in these bananas? Using a food to administer a drug which requires a dose was challenging and I think _____ have not going to go anywhere. And I think if that was introduced to Africa, it would be straight away rejected. I think what the technologies that are being introduced now, people quickly see the problem _____ and the people are more _____ about it.

But we can hear others who have heard about this technology, what do they have to say.

Male: Tush, I think that's the correct answer; it was discontinued. In fact, I think all uses of food crops for carrying drugs is pretty much discontinued. Everybody realized that it was non-starter, that you may have problems.

Male: Thank you. Demar from Senegal. My question is about outreach and communication. Is there beside your entity, any formal structure supposed to be doing the outreach to disseminate information over the outcome of your own research in helping other parts in Uganda as you can see in _____ areas down in south area that other people can – or groups can use those outcomes and just disseminate the work in other fields to increase the production of banana, for example?

Male: Thank you.

Male: Yes, we – our department, the National Agricultural Research Organization, has a communications unit which links up with another communications unit in the _____, and then one time they are studying these sorts of things we are doing both in research and other areas, and selecting what information is suitable to pass onto which group. Yes, we are linked to those communication groups and everything possible is being done to make sure that people who must know, know, and those who don't need to know at this time, they don't expose too much to them.

The communicators will decide who they want to inform, which audience is suitable for which information. I see you frowning, but _____. Let me clear. I'm _____ information dissemination, because as I say, this is a very strategic information. At some point, trying to _____ sensitivity. But because it's meant to be furthering the development or the expansion, the production of bananas, which as we describe through the presentation, something that is used to really counter all those famine-

related threats you might have _____ and stuff.

I understand. But definitely in the _____ there is a sense of selective information dissemination. Then may you be clearer in identifying those hands onto which you wouldn't want the information just to be prevalent over while those – yeah.

Male: Maybe. _____ I didn't present myself correctly. It's not selective dissemination. It's selective forecast. If we don't forecast on getting the information to you, you might not get it. There are some groups, they will forecast _____ people who must have the information, people who must know. Then there are some people if they _____ information _____, but the forecast is not on them yet. That's the categorization I am talking about _____.

For instance, like government officials who can stop the work from continuing, they must know what is happening. The groups of farmers who are waiting for a product, and we don't have a product here, we don't have it to go to them to inform them we are planning to develop a bacterial wilt resistant banana and it will be transgenic, when you don't even have – you don't have the selected line yet. You don't need to bother the farmers to give them that excess information. But the planners, the government officials, they need to know what you are planning to do.

Male: This is Larry Beach. Tush, you might want to talk about how the regional scientific exchange helps that communication, also, and you have had students, I believe, from other countries in your labs, how that might also help in terms of regional communication about the science.

Male: Yes. In terms of region at the scientific level, we do a lot of interaction. We have some excellent students. Like right now, we have two from DRC, who are working – DRC is the Congo – two students from Congo who are working with us on developing this transgentics, learning the science, and what goes on. And when they go back, they can be our link people in the extending _____ knowledge to them. But we've also held regional workshops, and we invited people whoever is interested to come and he or she is taken around to see what is going on. Through those workshops, _____ programs, information is being disseminated to our neighbors.

Male: Peter.

Male: Seeing that Frank said that there's no way that these bananas are going to be release until they have stacked traits, what is your projected timeline for the release of these biotech bananas to the farmers, assuming that the field trials are successful?

Male: Though our strategy is to finally have stacked traits, but simultaneously, we are looking at the individual traits and where we get a good product to move forward with, even the first stacking we will plan to leave it. For instance, on one of our projects on biofortification, where we're have a Vitamin A banana, we've already decided now we have the _____ timing of 2019 to relieve it to _____, and the first line to be relieved, will not be a stacked one. That will be a single line having only Vitamin A, but behind will be developing other which you will be having stacked genes where gene is stacked to the important economic traits that farmers want. It's a two-pronged strategy stacking and singles being released at the earliest possible time.

Male: Any other questions either here or from online? If not, going one, twice, we'll move onto the next presentation from Dr. Randy Autao. Thank you, Tush. Thanks very much.

[Applause]

Lessons learned in communication: The challenges of communicating about agricultural biotechnology and the importance of public outreach.

Presentation by Randy Hautea (ISAAA)

So our next presenter is Dr. Randy Autao from the Philippines. I'm fairly familiar with where he was educated. He's a graduate of Cornell and, in fact, he was my PhD student. Neither one of us want to say how long ago. And he's going to talk about the challenges that we're facing in communications. Randy, please.

Male: Thank you very much, Ronnie. And good morning, once again to everyone. It's my pleasure to join you in this Webinar. I'm with ISAAA. I work with ISAAA, and we've been an original partner of ABSPII as a consortium member since 2002. And over the past ten years, of course, we've enjoyed all the interactions with ABSPII and all the excitement that came project development, all the challenges as well. And we hope to continue with that interaction.

I've been asked to share a few information or insights on the lessons learned in communication, simply because the area of communicating

biotechnology as it regards the different projects of ABSPII is one area where ISAAA has been working closely with the project. And there's been repeated several times since this morning, I think that if people would look at biotechnology as probably one that's probably _____ technology that's most rapidly adapted in recent history. It's probably fair to state as well, there's probably not other agricultural technology in recent history that has generated as much controversy ad modern agricultural biotechnology, especially genetic engineering or genetically engineered crops.

Let's make no mistake about it that while technology people do invest substantial resources into developing new biotech crops, maybe in the _____ of millions, maybe in the 100s of millions of dollars. Our colleagues from the other side of the discussion about biotech I think equally spend about the same amount of resources to at least make sure that the global discussion about the technology continues to be up an agenda of everyone.

Now these challenges, of course, have to be collectively addressed by ABSPII with all the available resources and partners _____. And this is one area where, of course, science-based communication is considered to be a vital element. Let's just take a recent example of the kinds of challenges that projects partners face in the case of ABSPII projects. This one is Bt Bringal in India. As you very well know, in 2009, ABSPII happily made history by having the first product approved by a regulatory body, _____, in no other at the time in earlier part of ABSP has there been a product that has passed the scrutiny of a national regulatory body.

Unfortunately, of course, the final decision _____ not with the regulatory authority, but with the minister of environment, the minister himself, who personally intervened in this process. And, of course, eventually decided against the near-term commercial use of _____ gel. So what appeared to be a product that was very highly promising, ready for commercial use. In a country like India which after the US, we have considered like a model developing country and there is obviously progressive use of biotechnology with eight year at that time experience about Bt tochin, solid _____ experience. All the elements were there that should have given everybody or most people the confidence that the technology would make it. Unfortunately, it did not.

So that decision in February 2010, was an important decision to the _____ commercial release of the product. And since that time, of course, _____ I think has moved forward in terms of Bt Bringal in India. It's still in limbo, maybe, as you call it that way, and still stuck with a few other

challenges including a host of other potential litigation or judicial challenges that are, again, _____. And _____ of all of this is that the product, which could have already contributed significantly to the livelihood of _____ farmers in India. It's now stuck somewhere and it's almost denied from being used by farmers in India who wish to utilize the chemical.

Now if there's any thought that India was an isolated case, _____ Philippines will show that the decision in India actually had some spill-over effect as well in the other side of the geographic _____ in Southeast Asia, the case of the Philippines. Aided partly by the fact the convergence of different events – oh, okay. In July 2010, which is the same year as the India decision, of course, was made, we had a change of government, and the newly appointed secretary of agricultural in his previous position was a congressman who as the principle author of the organic _____ to the Philippines.

So here was a situation that, again, you have a country like the Philippines, in fact, considered to be one of the more progressive small developing countries in Southeast Asia as far as the gene crops is concerned. Eight years of commercial experience in biotech corn, not cotton, corn, the only country in Asia that grows biotech corn is the Philippines commercially. Now facing a situation where the new minister or secretary of agricultural was probably not as enthusiastic about the biotech crops, because more enthusiastic about organic agricultural.

So, anyway, this confluence over the different events, the decision in India, the new government, a new minister in the Philippines led to a _____ in the Philippines against _____ sometime in the middle of 2010. And if there's any doubt, of course, that the Indian and Philippine campaigns are disconnected, I think that first picture on the upper left will dispel that doubt. There's the guy on left there is the Greenpeace campaigner from the Philippines. The guy in the middle is Greenpeace campaigner from India. Both of them watching and uprooting incident in the Philippines in February of 2011. So we have two campaigners from the Philippines and from India, both with the same – this incident at the University of Philippines Los Banos in February 2010 when Greenpeace vandalized a field trial of eggplant.

Anyway, this is just to I think reinforce the message that I wanted to convey earlier that the campaign against biotech in general _____ in particular, is not an isolated campaign by any group. But a coordinated campaign by many parties, not just in one country, but across countries as well. Okay. So what happened was that from a very relatively I think

very friendly environment for biotech in the Philippines for five years prior to February or June 2010. You started to begin getting old, the noise of some parties that are opposed to the technology and a lot of misinformation campaigns are going on. And all of those were directed against stopping the field trial in the Philippines.

So the difference between the India and the Philippine experience is what happened with India was that the campaign was against the commercial approval already, after all the experimental trials had been completed. The campaign in the Philippines was actually to stop it at the trial stage, because the trial stage is _____ step to potential in application for commercial approval. So that was the only difference in the sense of the stage by which the campaign was launched.

And most recently, of course, the people who are opposed to the technology that have gone one step further by going to the Supreme Court of the Philippines and asking that the court intervene to stop the trial. So you see, these patterns of using the different both legal and illegal maybe as they call it, steps at all stages in a campaign against a biotech product, again it's almost the same from both India side and from the Philippine side, all the tactics from local government campaign to the political pressure campaign to litigation, they're all there because all of them are expected to at least delay a decision or reverse a potentially favorable decision in favor of the technology.

So when ABSPII started in '02, in fact, it already had a communications strategy. Part of the design of the whole project from the very beginning is to have a communication strategy. That sort of flows through the product development process and addressing the needs of different publics along the product development chain. There was an earlier mention about educating government officials and policymakers, for instance, at the very beginning of the project and just really informing them about what the project is all about, what this _____, for instance, would entail, what is the importance of the project, who are the potential beneficiaries, how much will it cost in terms of investment and so on and so forth.

And, of course, as the product development moves along the chain, then expand the communication so that all the other important stakeholders and public get involved in the process. Now that whole strategy is what ABSP has really followed. But, of course, _____ situated in countries in different countries depending on how the national process goes as well. For instance, if you superimpose that in the face in the Philippines, and how the regulatory process proceeds, you will see that from the

contained trial phase up to the confined trial phase, in terms of legal requirement, the Philippine regulation actually does not require any public consultation as part of an information process. But you will see that even if that is not legally required, the project has to do information, a lot of it, even at that stage to reach out to stakeholders and different publics who need to be informed at every stage of the product.

And you'll see that much of the problems eventually that those opposing the technology actually trying to _____ once you go down to through these different stages to _____ multi-location field trials, that's when they start agitating for more public participation when all that is they are legally required is for the project to post a public information sheet and require a comment period. The legal requirement does not budget with the demands of these other people in terms of active engagement and participation in the outreach and communication.

Anyway, that brings us to the one I think lesson that we always should be cognizant of, that in many of these cases, the information and outreach needs and activities should really be localized. It really has to be adjusted into the needs of every national program or for every project or for every community or some of these activities will have to be _____.

So in the case of eggplant, at least in the Philippines, ABSPII sort of put together a set of activities that would address the communication and outreach needs. And just by way of categorizing the activities, a group of communication activities fall under the category of monitoring and public awareness, and knowledge and opinion about biotechnology in general, and, of course, of Bt eggplant in particular.

The second category is still a diverse group of activities that involve capacity building. That means capacity building in the different stakeholder groups in understanding and communicating biotechnology.

A third group of activities would fall under the category of say developing and distributing informational resources. This can mean different media. And the last category of activities involves increasing awareness about the project the Bt eggplant in particular, of course, ABSPII, in general, also. Just explain to the public what the project is all about.

Let's look at a few examples of these activities. This one is media monitoring on Bt eggplant articles in Philippines is the aggregate of all the national dailies, community newspaper, and online news over a two-year period within April 2010 to March 2012. The first year, of course, _____ to the left, and the second year would be _____ on the right.

I think it will be interesting to note at least if you want to look at the histogram on the left there, and that really captured the peak of the first year of the anti-biotech eggplant campaign. You're looking at something like 400 articles on Bt eggplant alone in one year. Not biotech, eggplant alone, Bt eggplant. So on average, one article per day in any of the major news outlets on Bt eggplant.

The second year, of course, half of the total number of articles which would indicate several things. One, of course, is that it could be that the whole controversy has died down, and, therefore, the attention of the media has simply died down. The other, of course, is that the efforts to sort of counteract the misinformation in the first year has sort of driven down again, the controversial nature of the technology that is no longer big news to many people. So the interest in terms of media coverage is about half what you see during the first year, which is the peak of the campaign.

And you'll see that we categorize them by favorable, positive, negative, and neutral. In general, of course, the positive news still has the edge over the negative news, but the frequency of negative there in terms of actual counts and _____ is way higher than what it was the year before. The year before, it was about 80 percent positive, 20 percent negative. This one is way higher.

So _____ just break them down by categories, the national dailies alone, this would be the picture, general one that you see with the aggregate _____, again, about half the number of articles the second year than the first year, but in general, still a more positive tone if one would look at the national dailies.

Look at the contrast if one would look at the community papers, at the local news. It's overwhelmingly negative in the local news. So where the field trials are located is where all the activities of the antis are concentrated and all the regional and local papers are all picking up the negative news and not the positive part. So, therefore, the effort for outreach from a national perspective or coverage had to go down to the grassroots level just to be able to address this imbalance in terms of what the community papers get as information versus what the project can provide in terms of correct information. And online use, of course, because most of these would be from urban areas in metro Manila, again, the positive side would be higher.

So the lesson is that not only do we need to constantly or regularly

monitor the public posts about biotechnology if one would gauge it from media coverage, but also to dISAAAggregate them sometimes to understand exactly where the differences are. In this case, the difference between a national and a community or a local level coverage so that we know where the needs would be and the efforts would have been continued.

We also continuously monitor the farmers' perception of the technology. This is just in one site, but the results would be reflective of what you'll find in the other sites. As a group of stakeholders, the farmers would almost always be positive about the technology. I mean there's hardly any farmer once you explain the technology to them, who will say no to the technology. More so in places like _____ where practically the whole province is a heavy adopter of biotech corn already. So farmers are probably less familiar as yet about eggplant, but generally familiar about biotech crops already, GM crops, because all practically everybody plants biotech corn. So as a stakeholder group, you'll see that farmers would always have a very high rating for biotechnology.

Capacity building is a second category of activities that we spend a lot of resources on. And this is really not capacity building in biotech per se, but capacity building in communicating biotechnology. And this can involve many different stakeholders. These pictures simply show two examples. One is a risk communication – or communication workshop _____ on regulators alone. The other one on the right is focused on multi-location trial partners.

Now regulators, the nature of their function should be independent of the technology developers, yet they are always the ones being asked by people about the technology, about the trial. The regulators are the ones being asked. So the only source of information that the regulators would have in many cases would be the proponent _____ who will provide the information about technology. That's why there's need regulators even if they are an independent body to be engaged in _____ technology developers in the area of community of communication capacity building.

Similarly, look at the multi-location trial partners and a similar situation arises. The people that will be asked about the project in every trial site would likely be the partners in the trial, and naturally the project leader in Manila or in Los Banos is too far away, but the people who are implementing the trial. So you need to equip them, not only with knowledge about the technology – and many of them have very good knowledge of technology already, but equipment them with the ways of communicating the technology.

Farmers groups as well, and, of course, different _____. So our activities on eggplant on a continuing basis involves a lot of capacity building to workshops, seminars, roundtable discussions, technology visits and the like, and we probably spent about half of our resources that time just as a continuing basis so that all partners of the different publics who call them continue to be updated and not only about the technology, but can communicate with confidence about the technology.

Media as well. This was just an example. This original media _____. The media as well, needs to be part of the process of capacity building to allow the media to understand the technology more, as well as link the media with sources of information about the technology so that every time the media people would need to have somebody to provide information about the technology they can do so.

Now information resources, like fact sheets in multilingual or a multimedia format is another set of activities that we continue to undertake. This one is just an example of a fact sheet in the Philippines, again, translated into local language to meet the needs of partners in the different regions. And you'll see that similar activities are being done in the different countries, in India, in Bangladesh, you'll find similar activities _____ information resource kits or resources are being developed and put together so that they are easily available to those who need to the information.

We do a few things like popularizing the technology. This one was last year just we call it biotech cartoons. Just inviting a few professional, a few amateur cartoonists to get engaged in designing a biotech toons we call it, and selected a few _____ for to feature in say a calendar, T-shirts, and others, so that when we distribute materials, materials will always come with some messages that are depictured by a _____.

I mentioned earlier similar activities. We do quite a lot in South Asia as well. It's not limited to Philippines or Indonesia, but also in India and Bangladesh. I think one other activity that we've learned to be important and have learned to do in the course of the communication activities in the project is to get engaged with the media people. Scientists – I don't know. Scientists everywhere by training are very media-shy, I would think so. Not just in Asia, I'm sure, but manage in the US maybe, because science people are usually just not trained for media interactions.

Unfortunately, or fortunately for them, the scientists are among the stakeholders with the highest level of credibility as feature as the media

people are concerned to talk about biotechnology. So eventually, they really have to appear and be engaged with the media. So we also needed – we had two, anyway, to help capacitate project scientists to risk communication trainings and the like, and help them deal with the media. So you will see a desk, for instance, with a TV crew on the left there, simply had no choice but to deal with the media to get the _____.

The biotech program director of the Department of Agricultural upper right there, the same. Some of the project stuff we have below there as well. So a lot of our activities and probably one lesson learned her you said that the capacity building for communication is equally important, probably more important in many ways, to focus first of all to project people, people who were on the project.

The other lesson, and one other activity that we actively pursued it's almost always replied to – or try to reply to any negative media _____ as much as we can. This is one example of that effort. When one paper, for instance, cites the secretary of agricultural will ban Bt eggplant, of course, it was a mis-quotation, but the media picks up the mis-quotation quickly. Well, not too long after, we had to get a statement from the Department of Agricultural itself, the biotech chief, not the secretary of agricultural, that says they continue to back the field-testing. So there's been one negative – you always match with another credible report from the same institution so that it's quickly clarified.

When one article says, "This town wants to suspend the field tryouts." Sometime later, we have a group of farmers say, "No, we want it. We continue. We like to have the trials. So one farmer say no, but department will say yes, so that it matches. And when the Greenpeace and their group, of course, vandalized the trial in Los Banos, we very quickly had the whole scientific community in the Philippines _____. So that did not even merit I think three articles. But the condemnation got _____ for 15 articles very quickly. So it's a quick balance so that the campaign from the other side will not go unchallenged, I think _____.

So, for instance, this one was fairly recent in May 1, because the court case was brought up late April in the Supreme Court of the Philippines. So a week later, the National Academy of Science and Technology itself that made a statement in favor on the continuation of the trials. So this paper, actually made a cartoon that had a scientist and the anti _____ in a dual using an eggplant with the title, "Eggplant War." It is _____ defending the technology, at least in the case of eggplant.

And finally, I think the big lesson that I alluded to already is really

localizing, going to the grassroots in terms of outreach. This may not be, of course, true in every country in every circumstance, at least in the case with the Bt eggplant in the Philippines, this became very important. After monitoring, of course, imbalance as I mentioned earlier, about the local understanding of the technology of the local coverage in media versus the national coverage, we had to embark on an extension local level outreach communication to the local government and policymakers in all trials.

Here's another example of that outreach. This one is very interesting because this gentleman is actually a legislature head of the committee on agricultural of the city of Daval. Now he's actually the author of *The Organic* _____ *Ordinance*. He's also the same gentleman who authored the first resolution prohibiting the trial in the inner city. So he became one of the early local legislatures who went against the trial. Of course, the project reached out to the local community. Now at the moment, he's the sponsor of the resolution already approved by their council to review and amend their local organic _____ to accommodate coexistence between organic and biotech crops.

This is another local government site briefing. Officials there in the first two slides – two pictures. And while they were doing the briefing inside the hole, there's another briefing outside that's going on from the antis. But a part of the continuing war. This is a similar activity in Bangladesh, _____ and famers. Again, the importance of bringing the farmers into the activity and the farmer _____ as well in Bangladesh.

Okay. So let me just summarize some of the few lessons I think that we've learned in the communication activities for biotech within the ABSPII _____. I think a key lesson if I would mention one is never be complacent. If you look at the experience of India and the Philippines in the recent _____, what you have are the two Asian countries that are really considered to be the most progressive countries in biotech acceptance in the whole of Asia two years ago. No other Asian countries come close. India with its biotech _____ experience very positive, Philippines as well.

But in both places, a simple change in some political leadership _____ the unraveling of many of the earlier _____. And in terms of activities, it's quite important to do a lot of outreach early, identify the needs, do them early in the process, and do them really quite – in a systematic manner. Many of local knowledge and context are key in this whole effort, and this kind of _____ remotely from somewhere, but has to engage the local stakeholders.

Very important to build confidence among the different stakeholders, scientists groups, media groups, farmer groups, about modern agricultural biotech. And maybe a lesson that needs to be put into action at some point is learning how to mobilize political support. It is not to say that the project has been able to do that in terms of successfully mobilizing political support. It's more a statement of need, I think, an identified lesson, something that needs to be seriously considered.

The constant monitoring of public polls is, of course, very important. But to say in English, keep your ears very close to the ground, because it always sounds like that may happen, _____ comes as a surprise.

Secondly, of course, is understanding that many of these communication issues go beyond the science issues alone, and, therefore, appreciating this other context, the broader context would be very important. Identifying the champions in the key publics and, of course, eventually putting investment in capacity building in science and communication. I did say earlier that if the technology developers spend $100 million to develop a product, the other of the opposite persuasion probably spend $100 million as well just to stop the project, which is a different way of looking at it.

Well, ABSPII probably spends $100,000.00 to try to correct the imbalance, but what we lack in resources I'm sure we can always make up in term of passion for the work and a hope, maybe continuing faith in the technology and what it can do for farmers around the world.

So this is my last slide, and this is, again, another cartoon. I always like this cartoon. Now that the Bt eggplant case has reached the Supreme Court – the earlier cartoon versus the scientists and the protestor, but in a swordfight using – alone or the eggplant. Now this one is a Supreme Court Justice almost trying to _____ to whom he will feed the eggplant, to the pest on the right, or to his hungry countrymen on the left. And in many ways, this cartoon has elevated to the national consciousness, the bigger debate about where the technology fits in the whole development questions.

Thank you very much, and _____.

[Applause]

Lessons learned in communication: The challenges of communicating about agricultural biotechnology and the importance of public outreach.

Randy Hautea (ISAAA) Presentation Q&A

Male: Thank you, Randy. So we're ready for questions. In the back there.

Female: Hi, Jennifer Carsner, USAID. So I noticed that in your media strategy, there did not seem to be any sort of direct engagement or dialogue with Greenpeace itself. Did you try that and it failed, or are their objections based on the science or their social and _____ concerns that they have? I didn't pick up on that.

Male: We actually had a good opportunity to meet with the whole anti-biotech group, and this meeting was brokered by the secretary of agriculture, himself. As I said, the meeting was done in the Department of Agricultural, the secretary's office. It was a good meeting in many ways, but even before the meeting, we already know the outcome because in many of these outreach activities, the quote/unquote, the battle is really for the minds and the hearts of the people who have not made a decision about the technology or who may just be misinformed about the technology.

You never really will ever change the minds of the Greenpeace of the world or the Friends of the Earth _____ about the value of GM technology. So it was a meeting that was useful in the sense of having a face-to-face exchange, it's more maybe a venting the – venting out the opinion of each other and the concerns, but as expected, it did not change anything in terms position.

Is there any new issue about GM that is unique to Bt eggplant? In general, no. We still have the same concern about multinational control about the technology even if we insisted it is public sector project done by the University of the Philippines Los Banos and so on and so forth, they would still somehow relate it back to control. They will always have questions of safety which is a recurring question. And they will always have concern about some ethical considerations.

So all of those were vented out, and we were in front of a consumers union group, the Greenpeace, _____ and several others. It was a good meeting, I would say so, but one that was done without expectation of that.

Female: I was wondering, Randy, was there any lessons learned from the anti-biotech groups? Is there any middle ground, any area for that when you went into these discussions?

Male: Let me probably answer you in a different way by sharing with you some maybe historical background because we've been engaged with the communication aspect of biotech for several years already, even before the ABSPII start. When the Bt eggplant project started in the Philippines, we were actually told by the antis that this is one project that they can support – they can support. _____. They us that. They told us this, eggplant is a public sector product, they said. It addresses with a huge problem of pesticide control – misuse I mean. It's small holder product.

It's with UP, a large technology _____, and all of the elements that are in there that typically would not be found in commodity _____ like corn, for instance, that really gets their objections. So they did not even really touch us up until July of 2010. I would say for the first eight years of project – *[audio goes blank]* _____ until February. Then I think the resources maybe for the contain as _____ the whole group. Because sometimes we asked them, "Why are you focusing on a field trial of eggplant? There's 700,000 of hectares of corn right now by the corn, grown all over the country." If one would look at multinational technology, if one would look out _____ issues, if one would look at entry into the food chain in _____ there's 700,000 hectares here. 70 percent of all our yellow corn today is already biotech corn.

"Why are you picking on a 2,000-square-meter field trial in _____?" No convincing answer. No convincing answer.

Male: Randy, two or three times, you mentioned organic versus biotech. You didn't state it that way, but there was once when you dealing with the government officials. This seems to me to be one of the failings of the outreach by the people in this technology because this is one way of getting rid of the pesticides which the organic people claim is one of their important goals.

Do you think there would be any possibility of arguing that GMO, from your cartoon, or biotech, really, is organic?

Male: Well, we argue that all the time. *[Laughs]* But I think the legal stands, the thing is the _____ of organic products precludes use of genetically modified crops, so that other words if they are looking at the same standards globally to certify this organize, this has to be _____. So all this is just a legal argument that the law says the standard is this. So it's not

argument of where we can change the law or not, but to be consistent with the _____ standards, which is what everybody's using, then we have to do it.

Male: Okay. Next question, Randy. In ten EMBO journal last month, MBO being European Molecular Biology Organization, there was an article – and I don't have the exact title, but essentially it was the demand for continued field trials is a dead parrot. I do remember the dead parrot part. I presume they're referring to Monty Python. And I must admit, I haven't read the whole article, but the gist was we shouldn't or at least we should be ceasing all these field trials that they've been going long enough. No problems have been shown, that regulators should cease the demand for field trials from a safety point of view. Could you comment on that from your experience maybe in the Philippines?

Male: Well, I'm hoping that the continuing discussions in the upcoming _____ meetings, for instance, in _____ would at least have some agreement that some of these traits and genes would really should already be put in the exclusion list for regulation, _____ traits and genes that have been known for the last 15-16 years of commercial use that never really cause any environmental or health issues should now be on the exclusion list for regulatory coverage. And I think there's an ongoing call to stakeholders to submit suggestions against and changing that list is up for discussion. Things like insect resistance in corn, for instance. _____ what else should people look at in terms of field trials if you just move it to a different variety, move it to a different country. If that reaches the stage of maturity, I think, that kind of discussion _____.

I, frankly, will anticipate that the Philippines will lead an effort to that direction. In fact, it may even have to start in the US, for instance, coming from changing the event base approval system into things like _____-based approval. All _____ for instance _____, rather than every event that involves the Bt gene can be put in one box for regulatory. That can help a lot in other countries that look at the mature regulatory system in the US, for instance, as a model.

Male: _____ USAID's bureau for food security. I was wondering. You were monitoring both the sort of the national perception in the newspapers and media, and then also looking at community measurements as well. As you rolled out your sort of media campaign in your workshops and the like, did you look at sort of differences in say, a community that had the sort of media training that you were doing and then a community that didn't have that? And then see if you were having an impact in terms of ongoing perceptions of Bt, and then look at that in comparison to say a

national level, and see whether or not that's actually helping, or whether it's just over time, as information sort of leaks out, you're just automatically people are going to either lose interest or get informed or the like?

Male: It's not in a sense of say counter factual comparison, for instance, with or without intervention. But we monitor pre and post or baseline and then after. And if you break down the figure that I showed there, for instance in terms of months – a monthly figure there really is a big change in the community papers _____ the second year that the difference between favorable and unfavorable, in fact, that's almost diminished in terms of the coverage.

So we see a shift in the coverage, not just in total number of articles, but in the tone of the articles that come out. Now whether to ascribe that solely in the activities that we're doing, I think is something that we cannot really conclude, but, certainly, we do think that the activities with working with local media and others have helped a lot moderate that disparity between the misunderstanding about the technology, I think, and the coverage.

Male: We have a question from _____.

Female: This is – I'm Julie McCarty with the USAID _____ project, and I have a question about the vocabulary terms we're using. I've found that a number of different terms are used colloquially to mean the same thing, the bioengineering, genetic engineering, biotechnology, GMO, transgenic.

Male: Yeah.

Female: However, there are subtle differences that I've found in the scientific definitions of some of these terms. And do you think it's important for scientists and media and other stakeholders to use these words more carefully, and do you find that there are any translation issues when trying to describe different technologies along the spectrum of biotechnology from mutagenesis up through gynogenesis?

Male: Good question. We really on – well, from my side, we've taken almost the decision to not to use GM, for instance, as a term. We've really practically shifted to biotech _____ to mean genetically engineered _____. So we still are in the transition space. Maybe we use GM/biotech, for instance, so that people get the understanding that we refer to the same thing. But we almost have zero use for terms like

transgenic in our papers. Transgenic simply almost conjures a lot of – or even genetic engineering _____ we somehow veer away from it.

We understand, of course, it's the convention in many other publications or projects, so we use that only as appropriate as understood in the context of – like ABSP _____ genetically engineered product or genetically engineered – bioengineered _____ is the term that we use in ABSPII. So, yes, I think qualifying that is always an important part of _____.

Male: Can you give any insight as to where the Supreme Court is going?

Male: *[Laughs]* I don't really know.

Male: The Supreme Court in the Philippines, we're talking about.

Male: Yes, the Supreme Court of the Philippines. Just last week, the chief justice was impeached, as you may know. Oh, you don't know. Okay. So that's the first impeachment in Philippine history that came to successful conclusion, and it was the chief justice was impeached and taken out of office. That may have some bearing on the timetable of the Supreme Court.

But the current case that is pending with the court is under this legal remedy that is meant to be an expedited process. It's supposed to be decided upon in 60 days after submission for resolution. It's a special fast-track legal remedy. So if an when the case will be submitted for resolution, we would expect a decision in 60 days or within 60 days. So in many ways, it certain work both ways. In a way, probably it will not result in an undue delay in a project, because then you would expect a decision in 60 days, rather than a decision that may come three years from now. So that can work in our favor, if the decision is favorable, of course.

Male: Use the microphone.

Male: *[Inaudible comment]*.

Male: Okay, Peter Davis. Randy, can you just continue and explain the affidavits that were sent in, in favor of the trials?

Male: _____?

Male: Affidavits.

Male: Uh-huh.

Male: They were opened together at the biotech conference.

Male: Oh, yes.

Male: Can you talk about those?

Male: Well, yes. Part of the – the first action of the court was to ask all the respondents, including the ABSP project implementing unit to submit a response to the court. And part of that response was a good number of affidavits from senior scientists in the Philippines, basically, attesting to the safety of the technology and both _____ _____ and to the effectiveness of the regulatory system that _____ the field trial.

It just happened that I think coincidentally, there was a big biotech conference going on the same week that it was a deadline to submit the response to the court. So it was almost an ideal opportunity to get the support of the scientific community and the support has been overwhelming, of course. They executed a lot of _____ and those just became part of the response of the scientific – of the project _____.

I think one strength of the case in the Philippines as you must have noticed is that the scientific community has been very outspoken and very vocal in support of the technology.

Male: As a follow-up, this is Larry Beach, again, have you monitored and have any way of telling us about the positive and negative response since this Supreme Court action?

Male: I don't have the actual counts. I would hazard a guess that the positive ones would probably be ahead by this time than the negative ones. The first week of the court decision, a lot of negative and a lot of it because many people misinterpreted the court decision. Of course, they misinterpreted it as an order to stop the trials; therefore, it generated a media attention. But very quickly after that, of course, the sanctity community and other explained the position.

So now for the s time, both the antis and the sciences agree on one thing. They all say, "We welcome the Supreme Court decision." *[Laughs]* Yeah, because the antis say, "We welcome the Supreme Court decision as it gives whatever recognition to risk of the technology," and the scientific community says, "We welcome it very much so that we can elevate the

discussion to a point that the issues will be more clarified. So it's a good opportunity for the scientific community within that period to explain the merits of it.

So there's agreement on both for the first time. *[Laughs]*

Female: _____, this is _____ from USDA, again. I just have a question about when you had mentioned and a lot of people believe that scientists are impartial, trusted sources of information, but you can see that in the climate discussion, there's been this scientific – scientific as advocate. What's your recommendation from that preventing that from happing in a biotech discussion where the scientists can still be seen as a non-partial source of information instead of as a scientist advocate.

Male: In a more practical an realistic setting maybe, finally, if I may say so, in a small country like the Philippines. It would be difficult to find say a group of scientists who would be talking about the technology, who are not at the same time workers in the technology. So it's just a fact of life that the people who know regulations about biotech, or biotechnologies themselves within in the country. And there's probably only 50 or 100 of them in the whole country, anyway. So eventually the sheer limitation in the technical expertise would be such that one person would either be occupying or having two or three huts as a university regulator, as a researcher himself or herself, or as a member of professional society, also a spokesperson for the technology.

And I think this will be a similar case as long as that limitation is there. I think that it's incumbent upon the countries to make sure that at least whatever perceived conflict of interest is there would be at the barest minimum so that the credibility continues to be there, even if some scientists are perceived to be wearing multiple hats in the same.

Male: Frank Shonkofsty. Randy, can you comment on where that prosecution on those folks that decided they were going to decontaminate Los Banos?

Male: May 28th. When was May 28th? Monday – was it Monday? May 28th, they were finally arraigned in court, after all the delaying tactics. They were still asking for a postponement of their arraignment. But they said – the Supreme Court is already on top of the matter, and, therefore, the local court could not intervene. But the judge said, "Well, that one is a civil case. This one is a criminal case. And it's a separate case. So how do you plead?" *[Laughs]*

Three of them said not guilty, so the three people have been arraigned already and there are I think about five outstanding warrants of arrest which includes our friend from India _____ to visit so that they can serve the warrant.

[Laughter]

Because he has already, of course, escaped the geographical jurisdiction of the coverage of the _____.but if he visits, again, then the police will let us know.

Male: *[Inaudible comment]*

Male: Yeah.

Male: Any other questions for Randy? Anything from online? Nope. Well, that gives us slightly extended – Randy, thanks very much.

Male: Thank you.

Bt Eggplant for South and Southeast Asia: Potential Socioeconomic Benefits.

Presentation by Desiree Hautea (ISAAA)

Female: - tomatoes, potatoes, chilies and peppers. It comes in a lot of names, almost every country has a local name for eggplant, but in the West, is more, I think popularly known as aubergine, if I pronounced it correctly. And you can see edition of eggplant in the different countries where this particular crop is grown. When you cultivate eggplant, it is actually the fruit that is consumed primarily for food. It's very popular, particularly in Asia and it is economically important, as well as culturally important as a vegetable. It is a very healthy fruit. It is superior in terms of fiber, vitamins and minerals. It contains no fat and it only has 25 calories. Both rural and urban people like to consume eggplant and it can be prepared in a variety of ways. It could be boiled. It could be grilled. It could be baked and it could be a side dish or a main dish. I think the texture, as well as the taste of eggplant allows it to assume anything that you combine it with.

People have been asking, you know, why eggplant and why, in particular, in these three geographies that ABSPII work on? Well, in this particular slide,

these are the top ten eggplant producing countries in the world. Eggplant is grown worldwide but as you can see from this slide, it is predominantly grown in Asia. If China is the number one producer and India has been consistently the number two, and if you combine the production of area of India, Philippines, Bangladesh with China, it accounts for more than 80 percent of the total area devoted to eggplant in the world.

These are some of the statistics for the specific countries that ABSP work on. India, it ranks number four next, only to tomatoes, onion, and potatoes. In Bangladesh, it is third, next to potatoes, and onions and in the Philippines, it's the number one vegetable crop for the last 10 or 15 years.

Areas of production – just India alone has more than half a million hectares devoted eggplant and the volume of production, as you will see, it's more than 1 million metric tons, but all three countries produces the yield of eggplant in the three countries are way below the world average, which is about 25 tons per hectare. In fact, Bangladesh ranks as one of the lowest, in terms of yield of eggplant. This is a crop that is primarily grown by smallholders and as you can see from the slide, you know, the range is about .3 hectares in the Philippines and majority of the farmers are in that range, rather than in the upper range and overall, there are about more than 2.5 million smallholder farmers that cultivate this particular crop in the three countries.

So trends in production area and yield in India has been going up. In terms of the production, I think between 1991 and 2000, the production volume has actually gone up by more than 90 percent, area of production by 50 percent, although the yield has not gone up very much. So the increases in production is largely has been driven by increasing the area and as we have more and more people and with problems of diminishing land, then again, that would put a lot of constraints in production.

The same trend has been found in the Philippines. Again, there is increasing production brought about by increase in land area and, to some extent, with yield but if you look at the graph below, while production has been increasing, the profitability of eggplant production has been declining over the years. One of the main reasons for this decline in profitability is because of this very serious

and most destructive insect pest of eggplant, which is the eggplant fruit and shoot borer. It's a moth and it's most destructive stage is actually the larvae, which goes into the eggplant part within one hour after it hatches from the egg. It's very destructive because it actually affects during the entire lifecycle of the plant.

At the early stage, vegetative stage, it goes through the shoots and what it does is basically wither the shoots and, of course, that affects the growth of the plant. It also goes inside the stem and then during the fruiting stage, once it gets inside the fruit, then there is no way by which you can actually control the damage that it will cause. So at the very last end of the slide, you will see the amount of damage that the larvae will cause in the eggplant.

So if you have an eggplant like that, then definitely it's not going to be marketable or even fit for human consumption. So the problem with this particular insect is that it's very hard to control because if you use chemical spray, once it gets inside the plant part, then there's no way by which you can reach it and therefore, control it.

Because of that particular characteristic of this insect, then there is really a rationale for developing and alternative method for controlling it. As I showed earlier, eggplant fruit and shoot borer causes a significant loss to the yield of eggplant and the way by which it's being controlled right now is that farmers use a lot of insecticide, almost prophylactically, to control the insect because they want to protect their harvest and of course their income. Because of the application of pesticides, then the input cost due to pesticide application as well as labor that goes with it, increases the cost of production and so far, there has been no effective source of resistance to control this insect from commercially acceptable varieties of eggplant. So conventional breeding is not possible to control this insect.

Just to show you some of the statistics about spraying practices to control eggplant fruit and shoot borer; in Bangladesh, they spray 140 times in a cropping period of 182 to 200. So that's practically spraying it every day. This has been reported that in the Philippines, Dr. Picoy, who is an economist working with us, also made a survey in the Philippines. It's about 80 times in a

cropping season of about 150 to 180 days, so that's about every other day. As I said, the reason is that any time they saw a larva, they will spray because they wanted to make sure that they will ensure the crop. And in India, the number that I saw is about 35 times from the report of Colladi and Lesser in 2008. And of course if you have this kind of heavy pesticide spraying, then of course, it's already known that with these kind of practices then this is very – it's not going to be good for human health, as well as for the environment.

So, in addition to heavy spraying, there are also data that shows what type of insecticides are used to control FSB and these are not your favorite pesticides. So these are organophosphates, pyrethroids, and carbonates all known to be a cause of pesticide poisoning, as well as neurotoxic effects. This is an example of the data that came out from and an ABRDC publication, again listing the different types of insecticide and the thing that you will see in this particular usage is that they always exceed what is considered to be the recommended dose because if you follow the dosage that is recommended, it's not going to work.

So what's the alternatives? So the alternatives is Bt eggplant because we have seen the Bt technology in the case of Bt corn and Bt cotton wherein it's able to effectively control same borer type of insects that is infesting eggplant production in the three countries. So again, what is Bt? You put a Bt gene into the Bt eggplant and Bt technology has been with us for a very long time. It actually, the protein – the gene comes from *Bacillus thuringiensis,* it's a naturally occurring soil bacteria and the effective product that it produces is actually an insect control protein, so that is the politically-correct term.

Those who are in the opposite side will always say it's a toxin and therefore it kills and it kills everyone. But of course, for people who have known Bt technology as not in the GM form but rather as a biopesticide, then we all know that this particular product has a very long history of safe use. In fact, this is the recommended spray for organic farms. In this particular case, it shows you backflow. This is the biopesticide that has the Bt crystals and then that particular gene was put into biotech crops like cotton and corn and I think recently in soybean, particularly in the case of Cry1Ac soybean in Brazil. So this particular technology has a very long history of safe use and this is also part of the reason why we think that this is a good technology to bring and address the problem of fruit and shoot borer infestation in the three countries.

So simply, what has been done is that a donor line, an elite line of eggplant that is owned by MAHYCO was transformed using agrobacterium transformation, wherein a Bt Cry1Ac gene was put into the elite line and then the plant was regenerated and then when it was tested against the EFSB, the eggplant fruit and shoot borer, once the fruit borer ingest the protein, then because of the specificity in the presence of receptors specific for this particular insect, then the insect dies eventually. So this particular Bt eggplant was named – the event was called EE1 and this was the event that was used by the different partner countries of ABSP.

So basically, we have a common event, which is the Bt eggplant EE1 and this particular event has been tested for approximately ten years in India and the different safety studies are listed that has been conducted for this particular crop. This event is listed in the next two slides. So as you can see, it has both food safety as well as environmental safety studies that were conducted since year 2000 up to 2008. After all this testing had been done, these were the GAC, the regulatory system of India, approved the safety of this particular event.

There is only one event, or one transformation that was done and that was EE1 and the way we have moved forward in terms of ABSP partners is that we use event EE1 as the common transformation event and the way we have transferred this particular Bt event into the different lines of India, Bangladesh, and Philippine partners is by conventional backcrossing techniques. The public partners did not do a different transformation; we all used the transformation that was developed by MAHYCO and then do the conventional backcrossing. This is significant because different regulatory systems, for example in the Philippines, allows for data that are common, the data that are generated for particular events that can be presented and done in other countries and still be presented in the Philippines. So ABSPII supported regulatory approval of the common event and also the development and hopefully commercialization of products by the different public-sector partners.

So just to give you an idea where the three countries are in terms of where we are in terms of product development and regulatory status, I made this composite slide and on the left-hand side, pretty much these are the stages between the laboratory part up to market release and so you go to a contained

trial, which is laboratory or greenhouse and then you go to a confined trial. All three countries require multi-location field trial and then a safety assessment approval before market release.

In the case of India, it has completed everything and the only thing that's remaining or pending, is actually the decision to release the product for propagation. In the case of Bangladesh and the Philippines, we're pretty much at the same stage. We're both finishing our multi-location field trial and we hope that the regulatory package for decision of our regulators will be submitted this year. Hopefully, we can see the products in the market sooner rather than later. So just show you how the different products of the ABSPII partners in South Asia look like.

You can see that there are different preferences in the market. There are those who prefer green or you call it white and purple oblong and then the round ones and so we have developed different – we have put Bt in all these different types of varieties that is preferred by the market and you can see the difference. If you don't have the Bt, it's very obvious in the green one that it's full of holes and if you open it up, then you will see a lot of damage caused by the insects. So this is for South Asia. This is how it looks like in the Philippines. You can see pretty much the big difference between – with Bt and a non-Bt eggplant.

And we also made a comparison between sprayed and un-sprayed plot and as you can see from this particular slide, there is really no difference. Even if you spray, that really doesn't work. The spraying regime that we followed is the one that's recommended and as you can see, both from the photos as well as the graph, that there is really no difference. If the non Bt – the marketable yield of the non Bt, is very, very low and the fruit damage can go as high as around 95 percent. It really doesn't matter whether you spray or you don't spray.

So that's basically where we are in terms of the development of the products in the different countries that ABSP work on and what I would like to do is also present the work of our socioeconomic team. Earlier when Frank made his presentation, he made mention that right at the beginning, we were aware that we need to address the socioeconomic impacts of this particular product and so we have a theme of social economies which was led by George Norton so I

cannot speak like George, but I will try very hard to present what the team have achieved in the last years that we have been doing this.

So what we actually do is did an ex ante analysis right from the beginning and then over the years, as we generate empirical data from the field trials, then those data were inputted and so far, what we have seen is that what we hoped that will happen actually are realized as the data are generated in the field trial. So basically, we look at yield gain and reduction in insecticide use, benefits to producers and consumers, and reduction in health hazard and environmental pollution.

These are the types of data, the data sources that the economist used and also the methodology. This is not comprehensive and every group makes use of some and not the others. This was the earliest estimate for India. This was the ABSPII estimates, so the estimate there was 45 percent reduction in the number of insecticide spray; 117 percent increase in yield; significant reduction in cost, positive implication for health and environment because you reduce the insecticide spray; an estimate of 411 million per annum increase in net benefit.

Another work that this was done by the TNAU group in Coimbatore and again, the study concluded insecticide reduction, yield advantages ranging from 40 to 60 percent, depending on whether you're comparing hybrids or conventional OPVs. There is a net increase in income and they – the study predicted that the adoption rate would be as high as 93 percent in the east and about 78 percent in the center and south India.

There is another work, an ex ante work, that was done by Colladi and the publication, this was published and the publication is indicated at the bottom. Again, what you can see is that there is, if you compare the current versus the optimum, what you can see is that the current use of insecticide is way, way above what is the optimum condition. She made a computation based on those estimates and the savings are indicated, due to Bt, are indicated in the last column. So basically, what it says is that the results suggest that the Bt technology really provides a good alternative to pesticide use.

In terms of yield gain and reduction in pesticide use to Bt eggplant in India, this was a report done by Kumar, et al., this was after the GAC met. The government of India asked this group to make an independent assessment of the potential socioeconomic benefit and they used the data from the large-scale field trial, so these data are not data from surveys but actually the yield data coming from the large-scale field trials that were conducted as part of the regulatory requirement. And again, you can see that in term of insecticide reduction, you can see against FSB 80 percent reduction insecticide use, 74 for the second large-scale trial with ___ rates of about 77.2 percent and increase in marketable yield, so it's not just reduction but there is a real increase in marketable yield between Bt and non-Bt.

This work by Kumar, et al., also looked in terms of partitioning of benefits between farmers and consumers and this particular slide, you can easily see the increase in production, attributed benefits to farmers, and then the savings, the actual savings, from the insecticide and also the increase in net returns in different level of adoption from 15 percent to 60 percent. And they also computed that there will be benefit to consumers in terms of likely reduction in price because if the input cost is less and then the marketable yield is higher, then the eggplant cost for the consumer would be also reduced.

The group of the people from TNAU Coimbatore, working with Dr. Norton, also did an economic impact assessment for Bangladesh and again, the same messages; it will increase the yield, it will reduce pesticide, it will also reduce pesticide costs, and probability of success or adoption is high because every time you talk to the farmers and every time they see the field trials, then the next thing they will ask is, "When are we going to get the seeds?" So it gives them a gross return increase of between 37 to 64 percent, which means that it's an income to the farmers which they can use to support their requirements in their family.

In the case of socioeconomic impacts in the Philippines, again these same messages. This was done, again, also with Dr. Norton, who was working with Dr. Francisco and the messages are the same, positive returns both to farmers and producers. Positive impact on reducing poverty and they also computed aggregate benefits for human health, farm animals, beneficial insects and avian species, which pretty much reflect a benefit to the environment.

These are some of the data. This is projected changes in cost and yield with and without Bt eggplant and as you can see, reduction in pesticide is projected to be 55 percent less. Labor cost in the Philippines is also very high and because of the reduction in pesticide spraying, then they have estimated that it would also reduce labor costs due to pesticide. These are contributors to the production cost and with the increase in yield because the marketable products would be much higher, then the net income was estimated to increase by around more than 300 percent.

They computed the projected benefit in terms of health and environment and they express it in terms of risk avoided. WTP means willingness to pay and again, if you look at the table, these are all the benefits that will accrue if Bt eggplant is adopted. Dr. Francisco also expressed these benefits in terms of environmental footprint and basically the change in pesticide use can be computed or expressed in terms of reduction in environmental footprint by close to 20 percent. Dr. Norton also worked with them and this is a very significant calculation because they tried to calculate what would be the reduction in benefit if there is a delay in commercialization and as you can see, just one year delay will reduce the benefit between 12 to 15 percent.

In conclusion, when I presented the technology, we were able to show that since Bt has been a technology that has been proven and it has a long history of safe use, therefore, using it for Bt eggplant will potentially give us a safer alternative to the current pesticide-dependent eggplant production that you have seen. It's so unhealthy and to human health and the environment and the last few slides that I have shown in terms of the socioeconomic benefit, all the studies that were conducted by different people, all points to a positive benefit to both the consumers, the farmers, and the society at large by way of reduction of pesticide, increasing the income, and having a safer product that will help reduce health hazard and environmental pollution.

So that's all and I forgot to include an acknowledgement slide but I would like to thank everyone who helped, particularly the team from India, the team from Bangladesh, the team from the Philippines, and the socioeconomic team of Dr. Norton. Thank you very much.

ABSPII: Successful public-private partnerships in agricultural biotechnology research and product development

Presentation by K. Vijayaraghavan (Sathguru Management Consultants)

Male: The last presentation of the day. I'm going to be looking at three specific aspects of _____ here. The first one is focused on elements that really influence the need for public-private partnership _____ of biotechnology, the element that helps to constitute these partnerships and some of the issues and challenges that we face in those kind of frameworks there. Primarily, _____ the single largest public-private partnership in the world _____ biotechnology development because it brings together almost 30 partners globally from different parts of the world, Africa, Asia, and the _____ countries.

So that makes it the single largest public-private partnership anyone can think of for agricultural biotechnology, and, therefore, _____ a significant to really understand what drives this framework there. The fundamental driver is to address food security as no single country can today all by itself address the challenge of food security and nutrition security, and, therefore, we need to look at leveraging biotechnology to deliver effective and efficient solutions _____ device addressed by other technology means, by partnering and those partnerships can be twofold.

Horizontally, across the countries, 'cause like I said, no single country can address the problem of food security all by themselves, and vertically with partners from public and private sector who complement each other in many ways there. The innovation drivers for a portable solution to _____ cut across boundaries of public and private agencies there. They're not limited by boundaries of public and private agencies. I'm going to predominantly look at some of the models derived from the South Asian and Southeast Asian partnerships.

The products that we talked about from the morning, and predominantly it's also a big drive in capitalizing this south to south partnership framework with the public and private sector engaged in helping each of _____.and, of course, the countries in the south region working with _____ countries really to partner with in this _____ efforts. I talked about elements that are really _____ elements to look at public-private partnership and those are actually in part, the elements for us to look at. Let's look at them one by one.

The first is the access to biomaterials and technologies. Technology _____ is really getting a limiting factor in the world of biotechnology as every gene of interest gets perfected practically. And they rely on one entity as such, yet so fragmented across private sector, across public sector, and, therefore, unlocking the intellectual potential by combining intellectual property it becomes as the first driving factor there. When you unlock intellectual property limitations then responsible use of technology comes in and, therefore, partnering collaborate _____ becomes essential there.

When you look at partnerships, you also prepare institutions on the supply side as well as the recipient side to make them responsible providers and recipients in this process there. In these technologies that are provided are not ready to be taken forward as it isn't adopted in many countries. You need to translate them for relevance in those countries there. And, therefore, the translational research becomes a critical element and that's what drives the partnership collaborating with each of them _____ process.

The third element is the affordability factor. When you consolidate technology and apply it in different country context, it's essential that you find solutions that are affordable to small farmers there, and, therefore, the focus becomes in making these technologies really reach the small farmers there with the least of cost elements that gets into a recurring cost framework there. And that's the essential element or driver for these public partnerships there.

So when you look at technology access for public _____, we essentially get in the process of pooling available technologies through a structured licensing process so that every public partner receiving technology has freedom to engage in dissemination of technology. That's an essential factor there. And this is done through a structured licensing process that we go through the freedom to operate analysis of intellectual assets that are owned by these donors, and then make them available through the processes of licensing to recipients there.

Now these are meant for very specific intended deployment then. _____ licensed technologies for recipients. The purpose is obvious, clear, well stated in this document. And, therefore, they _____ which are target products _____. They are meant for dissemination of particular _____ to make the product affordable and reachable to small farmers there. So these are the essential elements of this technology kinds of process.

Now we look at number of partnerships in the morning, in case of a

potato project as you have seen the technology donors are two very well reputed institutions, one from publics sector, and the other one from the private sector. So your converging, obviously, technologies from two sources there. And then the product developers are many fold, both in the public system as well as private system, across the countries there, and we have seen this morning how they transfer data, how they transfer biomaterials across the partnership structures to make seamlessly the work cost effectively carried out all through the development process there.

And then you also pull funding partners, essentially, not to put the stress too much on a single partner. You're bringing in national partners. We are bringing in USAID. We're bringing in private partners pooling their resources together. And _____ product delivery, again, you're having two modes of product delivery, the public system delivering seeds to farmers, and the private system delivering seeds to farmers.

In most developing regions, the public sectors still engage in the seed delivery for small farmers there because there is subsidized seed delivery system. There's also lack of private system penetrating every small village, and, therefore, there's a complementary public seed delivery system that really is essential for us to support _____.

_____ plan, the primary technology donor is a private entity, but then the technologies in adopted republic partners, the whole process of developing dossier as you have seen this morning, the public partners contributed a number of strategies, including _____ management strategy there, field validation strategy. So there is tremendous contribution of interdisciplinary skills that have gone in from public partners as well in this development process.

The resources are pulled, again, room several national governments. We talked about even leveraging by the _____ in the Asian region, by AID, as well as the public partner there. The product delivery also will be the same way, having to parts of the public and private sector delivering seeds to the farmer there. This is also true for the _____ rice partnerships that we have where the technology service co-developed by a private entity _____ and Cornell University as such. So there is a public-private partnership _____ development process itself.

So these are typically models that we feel will drive dissemination of technology across products in biotech arena. And this is not different from what the information technology industry has adopted today, to look at the _____ model, there are not awfully lot of companies who

invest in new chip technology. So the gene discovery is going to be limited to few entities in the world. Upstream research limited to large and very innovative small enterprises in the private sector. Some of the heartbreaking technologies from universities that are well funded having interdisciplinary skill set in them.

So the gene providers will be limited, but those who license it adopted _____ just as the electronic industry licenses the Intel chip. But that's the kind of model that's clearly evolving there, and in this context, I think there will be a lot more public-private partnerships that will drive product development efforts in biotech arena.

The second element that drives the public-private partnership is the research infrastructure. We have seen from the morning, including Uganda, that when countries start the process of developing biotech products they're very low on infrastructure. They need to pool infrastructure, share infrastructure, in a condensed time and choose speed and the whole deliver process and the development process by providing access to infrastructure to many partners there. So in case of BFT plant for _____ when we conceived this project in 2004, most public sector enterprise did not even have a confined greenhouse with them. In some cases, like Bangladesh. Even in India, one of the public partners did not have _____ with them, so we have to take the material to Mexico and do backcross breeding, bring back the seeds for the public partners _____ involved in _____.

The same literally a year in the process there. So in a number of areas where one can accelerate the project progress by judicious use of resources pooled _____ infrastructure. Human capacity is the third important elements. As we talked about the biotech _____ development is highly interdisciplinary in nature. Most _____ in their own resources capacity and, therefore, the essential that we really have private sector _____ and work with the public sector in complementary areas where they have competency there.

If you look at the potato project, we have very judiciously used a three-tier approach. Participants coming to US to really look at strategic framework of product development, working together on models that will help us accelerate the project progress. But then we have used India – it centers in India effectively for partners to get core skills in terms of development of the product itself. And then we have moved scientists to different countries for them to collaborate work in monitoring the product development effort. So looking at the different ways by which convergence of human competency can accelerate the project progress

clearly.

The fourth element is the capacity building for product validation. This is an important element there because you're stressing tremendous amount of resources investing a tremendous amount of resources in product validation in the case of biotech crops. And when you do that, it's essential that the extensive assessment was carried out are consistent with certain protocols that are co-developed or co-created by the partners complying to different country regulations there. And you pool all the scientific resources that are needed to do the validation process there. You need a _____.

You need a pathologist, entomologist who _____ specialist economist, statistician, the whole range of expertise that's needed for validation. No single entity even has it today _____. Even in the private sector it is limited to the top two or three. So when you're talking about accompanying need for public-private partnership, just a sheer breadth of expertise needed. It's self forces private sector to come to public sector, and public sector to go to private sector there.

We talked about product validation process in the morning, so all of them have this approach where we pooled human resources where we effectively engage in _____ product validation process. Driving of regulated dossier is the fifth driving element. We talked about a massive investment that goes in to developing the dossier. And these are not really very, very economical development for small acreage crops. A crop like _____ where you have not seen each plan we're having millions of hectares. You're not going to go in isolation developed a dossier. And never justify economic in this in these kind of crop. So when you're going to pool resources, get the dossier, that every country can adopt for a common event, I think you are looking at economic advantage being driven to small crops, and small acreages in countries which can really make it affordable for the small farmer there.

So the driver of affordability factor is just possible with shear cooperative process and dossier development. And information that you share across the countries, the regulatory framework, also builds the bondage of the regional cooperation in this process.

The sixth element is product dissemination mechanism. It's wonderful to get a great product, but if you can't reach the small farmer remote villages of India or Bangladesh or Philippines or Indonesia, you're going to have completely your objective unfulfilled. So it's essential that the mechanism available both in the public system and private system are

very well leveraged to reach the small farmers as much as we can. And they both have complementary seed disseminations system. Sometimes the public sector is very good in bulk seed production, foundation seed factor. Other sector's great in dissemination process, and they exchange themselves with this and on many countries just not within the private system. You have public system is stronger there.

It's much worse in other countries. So you need to combine these forces to ensure very successful product dissemination. So typically, the public research brings interdisciplinary strength, and the private sector brings the acceleration factor. And when they combine these two, you have very smart solutions _____ farmer in a very cost-effective manner.

_____ combining – there are many times argument about divergent objectives of public and private sector. If you look at _____ the public sector are engaged in public good, but their goal is to take technologies for commercialization clearly, and _____ retain and recruit good researchers, then get in hits produce. And the whole objective is to _____ economic growth within the national context and beyond that and then global context.

The private sector obviously look at return on investment of capital, but their goal is also reach technology as the markets there. So I think dissemination of technologies fascinating technologies for affordable solutions is the common goal for both, and while the private sector wants to protect intellectual property, the private wants to disseminate, make sure that intellectual assets created _____ we choose the beneficiary _____.

So I think there's a clear mandate that really runs across both these elements, the public and private sector to reach products to market in affordable manner to ensure that the benefit of technology that flows through and how they will leverage this common objective. It's only by creating a kind of partnership that's at three stages. The discovery stage, the _____ stage, and the dissemination stage.

Now since it's clear that they don't compromise on objectives the way is to take their objective across the nations. We can always work the public private partnership within each country, but when you stretch it across a nations, make it transnational, then the benefit is a lot more accelerated as well. So in case of cross-country partnership, that will have a certain changes which we need to really understand. As you look at easier processes of creating public-private partnership within each country, when you look at transnational partnerships, you need to respect each

country's regulatory structure. There or obviously sovereign factors that come in there. Each country has their own political relationships. There are _____ definitions clearly, and, therefore, these are elements that go into making a structure partnership complying with this cost _____. And there are also – and mentioned in biodiversity, some countries are members _____ enforcement, which is very stringent. Some do not have enforcement. The Anchorage Free Moment of Biomaterial has some – actually the Anchorage Biomaterial by structured process of _____.

So there are, again, limitations of some of the legislations which one has to comply, and, therefore, these global public-private partnerships _____ from a national level partnership as such. I think ABSPII success is in making these partnerships transnational, and thereby, making solutions affordable for each of the country to small farmers in their own way.

Now a lot of it is accomplished by what we call a technology transfer facilitation process. You need a clear element of partnerships that really bring those elements we talked about, and _____ them into a structured train work for partners who are bound by children rules and frameworks. And it's important to respect _____ that are really pulled in to this partnership process. It's important also to ensure organizational cultural integrity when the partners _____ co-creation of these assets. And it's also important to strategic address a common goal with all the partners there.

And, therefore, the role of technology facilitators are a project management team is so critical there to make it goal-oriented we ensure speed and acceleration in execution there. Now bring partners to a common goal is an easier process, but to adapt common processes across country are more complex there. You've seen the morning how countries different in terms of regulatory framework, and therefore, there are disparities and the level understanding of _____ the countries that we work with. There disparities on human capacity. There are disparities in aggressiveness of those who are opposed to the GM techies.

So the public-private institutions tend to have a kind of success rate that differs based on the country dinamix that we encounter in these kind of partnerships. And we need to really look at and customize some of the strategies to take care of those country dynamics there.

The major problem across the countries we see is that the great role of public partners is kind of marginalized. When the antis bring for the positive role of private sector in a very negative way, and that really limits

the benefit of public-private partnership _____ as such. So it's important that countries recognize the public sector contribution and bring to the old and thinking it in way _____ so the public perception about these partnership segments are positive there.

And in the case of BTA plan, it's been alleged in many cases that Monsanto is the beneficiary of _____ no interest at all, whatsoever, man, in ever delivering a _____ plant seed in any country _____. But that _____ and kind of limits the great contribution put in by public partners and these kind of _____.

So to conclude I would say that we need a very strong element of binding factor within public and private sector, and that they're only done by investors recognizing the benefit of such partnership, just not the donors, but every national partner need to understand and this is a _____ contribution that they are going to really derive from these kind of partnerships. There's a need for them to plant _____ and nurture it. There's a need for them to continue to encourage it, really.

And when we look at the pooling of people, resource, infrastructure, even the capacity really goes many-fold. There is no other way by which you can _____ with affordable solutions these days, unless you look at models where you pull in technologies into the public-private partnership. And this exactly helps _____ the timeline.

Each country has exactly bought on their own isolation. They were taken three times as such to come this far in case of media _____. And many of them will not even reach the first _____. So if you need _____ time, these partnerships are essential there. And from a cost perspective this is the only way to multiply the benefit of biotechnology. They have reached every crop that contributes to food security in the world. This is just the only way for it to make sure that technology flows through these cops and reaches the small farmer. Thank you very much.

ABSPII: Successful public-private partnerships in agricultural biotechnology research and product development

K. Vijayaraghavan (Sathguru Management Consultants) Presentation Q&A

Male: There are any? Group kind of _____ wearing down –

[Crosstalk]

Male: End of the day.

Male: Nobody online? We're seeing you at Cornell, again, so that's encouraging. That's great. We need one.

Female: This is Emily from USDA. I don't know if you can answer this question, but I was curious, _____ AG or _____ a company. They've already done a lot of the safety assessments _____. Do they also give you the access to the regulatory data or do you have regenerate that?

Male: To us, it's important to share the regulatory data. A true partnership would not _____ reinvestment of – recreation of the regulatory data. That defeats the very purpose of partnership and the cost –effectiveness we talk about. So long as there's no conflict there. There's no loss of a commercial interest for a company, we would look at regulatory data as part of _____.

Female: And the follow-up question, there's a lot of traits are going off patent coming up. So I think that's a great time for public sector to take advantage of that. But the private sector is trying to put together this consortium to figure how to get access to this regulatory data, 'cause that's the kind of – that's what is supposed –

[Crosstalk]

Male: – kind of models evolving there 'cause the off patent is clearly a case 2013 to 2017 there's a number of genes out in the open. And now with the current regime we have _____ restrictive in securing gene patent. They're going to have a lot more open access to genes as we go along unlocking the idea that – but there's also a clear case of private sector realizing that speed is essential for the very reason that patents are going out of protection, really, the speed drives many private sectors to partner with others. Even the prior system _____ as well as the public system. They're not gonna get them out into market. They just lost it.

There's a second driving factor. I think the third is that there are very number of smart young companies who are providing excellent third-party regulatory dossier support services. _____ outsource services and public and private are teaming together to make use of these services then. So _____ will drive partnerships _____.

Male: _____ BJ, you have a chance to visit with people in places like Bangladesh and other countries where – have you had conversations with them about the idea of being able to access the regulatory information that is

put together in the Philippines or somewhere else and whether they are receptive to those being able to do that? Do they understand that –?

Male: It's very important question. I think the great accomplishment we have seen here as countries recognizing each of these competencies and the frameworks within which these dossier _____. In case of Bangladesh, initial regulations required that we generate a base data for them to allow _____. And when we moved with that data both to India and Philippines, there has been recognition because we brought all the regulators together all the time in kind of consultation process. In taking the approach to regulatory dossier development in itself, that really helped countries to recognize each other's frameworks and within their own framework that add onto your limits, that they feel are mandated for them to cost effectively access these safety factor.

So I think there is a general recognition that we should respect each of the competency and look at _____ gaps that they feel in their country _____ for them to _____. So some of these studies on pure protein, for example, is common today in potato. The toxicology package is one single package for us, so that's really saved a lot of time and money for us. These are carried out all you see they recognize _____. Maybe in India, maybe elsewhere. So these are – that's why I think the competent third-party service providers today give us a common approach mechanism that countries can recognize these service providers results and then take them as unified _____.

And that really contributes to affordable solutions and _____.

Male: Any more questions? Looks like we're at the – and thank you BJ. So Frank wants to say a few words, but before he does I just want to thank everybody who contributed to this. We've got Larry and Jenny, of course, and Zachary, and his whole group. So thank you all for the good work. Thanks very much.

[Applause]

I really felt like it went well. So Frank, you want to make some comments?

Male: Thank you, Ronnie. Yes, I would like to make a few comments. This has been ten years of a lot of fun with the agricultural biotechnology is cutting-edge stuff. It's like I mentioned earlier in my talk, it makes for great a novel, and international intrigue. We've got controversies. We've got Supreme Court challenges. We've got cutting-edge

technology. It's all here and we've been successful in a lot of ways. Now we don't have a product on the market yet. We should, but we don't.

When we see that within the next three to four years, or so, we probably will. So the idea is, is that ten years of ABSPII will be coming up the end of September. We are looking at going into possibly a no-cost extension for the following year to keep the project going. And the idea would be to possibly keep this extended through to the point where we actually do have the Bt eggplant, the _____ resistant potato and some of the other projects on the market, okay?

And so with that, I'd just like to thank the people that work on the project. We respect every bit of it. We understand how hard it is and how frustrating it is especially when it comes to some of the challenges we have with the misinformation that can be disseminated out there. We understand that this is a controversy, but somebody has to do it. The multinational companies have decided they don't want to take on the anti-GM movement. It's not in their best interest to do that.

So, really, it's left to the public institutions to do so, and there aren't too many projects like ABSPII out there. The Bill & Melinda Gates Foundation is funding a few projects. Other than that, I really don't know anybody that's funding a big publicly derived AG-biotech type projects, and so we're here to take them on and we're here to get it out and so with that, I'd just like to thank everybody. I'd like to thank you for having the interest of everyone here that's listening to thank you for having the interest to find out what we're doing, and I hope that you found this informative and educational. Thank you very much.

[Applause]

Male: Thanks for your help in moderating my first Webinar. I appreciate it. Thanks and bye-bye.