PLANTING NEW SEEDS: INNOVATIONS IN GLOBAL SEED SYSTEMS

PRESENTATION AUDIO TRANSCRIPT

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Zachary Baquet:

Okay, good. I was trying to test with the transcript and didn't see it moving just right then, so I'll start again now that I'm unmuted. Greetings everyone, good day, good afternoon, or good evening depending on where you are on the globe on behalf of Feed the Future and the USA Bureau for Resilience and Food Security, I welcome you to our webinar Planting New Seeds: Innovations in Global Seed Systems. I'm your host and friendly neighborhood, Senior knowledge management Advisor, Zachary Baquet with the Bureau for Resilience and Food Security, I will facilitate today's webinar, so you will hear my voice periodically, especially during our question and answer period later on. Before we dive into the content, let us take a moment to go over a few items to orient you to the webinar. First, please do use the chat box to introduce yourself, ask questions and share resources with others.

Zachary Baquet:

Peer to peer learning is a key part of these events and so we are excited to have a great crowd today to be able to share and exchange experiences. We will collect your questions from the chat box throughout the webinar, we will have our Q and A after the presenters have spoken. To enlarge your screen, if you find it too small, you can click on the arrows in the upper right of your screen, this will make the presentation larger, you can click on the arrows again to shrink it back to normal. Lastly, we are recording this webinar and we'll email you the recording transcript and additional resources once we have them ready. We will also post these on agrilinks.org on the event page, that you used to register.

Zadhary Baquet:

Thank you for your attention. Now onwards to our presentations and discussions for today's webinar, Planting New Seeds: Innovations In Global Seed Systems. Let me introduce Rob Bertram. Rob is the Chief Scientist in USAID's Bureau for Resilience and Food Security, he serves as a Key Advisor on a range of technical and program issues to advance Global Food Security and Nutrition. In this role, he leads USAID's evidence-based efforts to.

Rob Bertram:

Thank you, Zachary and greetings everyone. It's exciting to see all the names popping up, people all over the world, people go so much about this important topic we're going to be discussing, so welcome to everyone. I'm going to leave the details, of course to the speakers but I just want to say a few things before turning it over to them. Crop productivity, now that wasn't all about genetics, it was also about information and water and fertilizer but together that was a history changing event that continues to this day and has done so much to promote inclusive economic growth well beyond the agricultural sector and for example crops represent about two thirds of the value in agriculture with animal agriculture being the other third but we know that... and such they are a huge driver of productivity days.

Rob Bertram:

And just last year, the World Bank came out with a study called Harvesting Prosperity. [inaudible 00:04:45] agriculture led growth is up to four times more effective at reducing extreme poverty and the poorer the country and the more effective it is, and of course this is really important and significant for an agency like USAID in terms of trying to achieve outcomes, embodied in the Global Food Security Act and Feed the Future around improving nutrition, reducing child stunting, reducing extreme poverty, doing so sustainably and in ways that it has resilience. I think the point when we talk about the green revolution, we think, Oh the 20th century but what we're going to be talking about today is more important than ever as we face the challenges of climate change, as we see emerging pests and diseases like fall armyworm, positioning farmers in raised and who hold food systems in ways to adapt to these challenges is absolutely critical.

Rob Bertram:

The last point is that we're living in a time of a blossoming of science, where we're learning how to analyze genetic diversity and use and deploy it in ways that we couldn't even imagine just a few decades ago, but at the end of the day we don't have seeds that are getting into farmer's fields, none of this matters and that's why the topic for today's seminar is so important. Seed systems are absolutely must have part of achieving the potential and the vision embodied in the Global Food Security Act and the Sustainable Development Goals and looking towards a climate adapted prosperous, peaceful world. So with no further ado, I want to just briefly mention our speakers. First, we have Gary Atlin from the Bill and Melinda Gates Foundation, Gary has been a longtime champion of investment in crop improvement, both in the CGIAR System and more recently at the foundation.

Rob Bertram:

We have Michael Quinn, Michael leads the Excellence in Breeding Platform of the CGIAR, which is spearheading work across the whole system to improve and modernize breeding approaches such that we can develop better products faster and see them get to farmers fields through functioning seed systems. Then we have Nora Lapitan, Nora is the Director of our work on Input Systems and she leads our research community of practice here in the Bureau for Food Security and she has been USA's lead on crops to end hunger. And then finally we have Simon Winter, who's the Executive Director of Syngenta Foundation for Sustainable Agriculture and Simon Winter has been someone who's been on the translating end of technology, of science in ways that meaningfully impact people's lives on the ground. So it's just a terrific panel, welcome to all of you and Gary over to you.

Rob Bertram:

I see we have the slides of our speakers, let's go ahead and advance through those. I'm sorry, I didn't have them up when I was introducing each of you very quickly. We go to the next slide for Nora Lapitan, or are we going now... I think we're going to stay with Gary because he's our speaker now, maybe let's go back to Gary, we will slide as we go through. Well, however you all of you watching this webinar, sorry for this glitch.

Gary Atlin:

Right. I suspect we're on a timer. It'd be good if we could advance them... the slides ourselves is... Can one of the organizers tell us if we can do that. Adam?

Gary Atlin:

Invest in public... deviate poverty by increasing the yields of small holders, basically because our theory of change is that productivity increases lead to poverty alleviation and a reduced environmental footprint for agriculture and we're increasingly focused on effective and constant adaptation to a changing climate, and it tends to find cropping systems and for plant breeding and seed systems to contribute to climate change adaptations, farmers really need to replace varieties regularly, the benefit from breeding investment.

Gary Atlin:

And so that's what... I'll focus on some of the issues, both in breeding and in the systems and in the handover of breeding products to seed systems that impede for a developing world, we face a stasis or a blockage and varietal replacement that... some people refer to as the stalled Green Revolution and I describe the situation in terms of first-generation Green Revolution varieties really sold themselves due to large invincible plant type differences in the cereals induced by major dwarfing genes and a second cohort of Green Revolution varieties sold themselves to farmers as a result of highly visible quality and disease resistance improvements in issues that were problematic in the first generation and relatively easy to fix.

Gary Atlin:

But those second-generation varieties really... in many places got stock in farmer's fields in the late eighties and nineties and were really difficult to replace. Alright, let's see if we can get this slide advanced, there we go. And generally, there are two reasons you can think of why variety replacement might stall or has stalled and they're both true to some degree, new varieties may not be accepted because they're not sufficiently superior to old ones to induce farmers to adopt them and in this case, it's a really a problem, the breeding system, new varieties have to be both higher yielding and acceptable to the market and... The other potential reason is that there's lots of new varieties that are available, that are superior but state and private seed companies have no incentive to market them. Replacing varieties is really expensive and time consuming both for public and private companies and in non-competitive markets, private sector producers really have very little incentive to replace a variety that has good market share, in government seed production organizations also need incentives or support to invest in replacing an older variety with a newer one.

Gary Atlin:

And one of the important criteria for making that replacement is really high quality information showing that it's worthwhile investing in the new variety, that it really is superior, is likely to be superior by enough in farmers... under farmers management in the future and in climates that are coming to really warrant the investment and we don't have online farm testing system in most developing countries now to support that decision, so two basic reasons are the breeding programs delivering high enough gains, or do we have a lot of good varieties that are sitting on the shelf?

Gary Atlin:

These two areas are sort of encapsulated and key performance indicators and metrics that the Gates station uses for investment in crop improvement in seed systems and that have been really adopted by the crops to end hunger initiative that is one of the overall crop improvement system, and these are the rate of genetic gain delivered in farmers fields. This is typically measured on research stations and there's not much data to show rate of genetic gain on farms, especially in Africa, but really in South Asia as well. These rates of gain range from zero to 1% in most CG and national breeding programs, usually less than half a percent per year on station when measured and we really have no idea what they are on farm.

Gary Atlin:

And the other metric that really indicates the effectiveness of the seed system and getting out new products is the average area weighted age of varieties and farmer's fields, this was originally developed in the early 90s by Derek Bailey and Melinda Smale most varieties in farmers fields we found through DNA analysis and surveys of breeding programs and our... In South Asian Sub-Saharan Africa are over 15 years old on average, usually much older, whereas in Western Europe and the US commercial varieties of Cereal Soy Maids are typically less than four years old.

Gary Atlin:

The situation... irrigated rice breeding program is quite typical, I don't mean to particularly pick on the area here, it's not very different in the number of other programs, although there's a big variation in the rain measured in terms of improvement in breeding value since the early 1960s, we see that there was a pretty quick rate of improvement for the first 10 years or so and then things slowed down substantially, this is work by Jessica at Costco showing an average linearized rate of gain in additive genetic breeding value of about 13 kilos per hectare per year, or about a 0.3% annually in that program, at the same time they made good gains in disease resistance and quality, so it's not that the program was entirely ineffective but it was a very [inaudible 00:17:50] improving yield.

Gary Atlin:

And the reason we think that this was the case was that this figure shows the average length of a breeding-cycle turnover of a general... a complete generation in that program obtained through pedigree analysis by Jessica Rutkoski and Josh. And the first three breeding cycles, let me see if I can put a pointer on here. The first three breeding-cycles in the early 60s through the mid 70s were quite quickly completed and then there was a really... a very long cycle where a lot of crossing back to the same parents occurred for something like 35 or 40 years and a push on short leading cycle didn't really start until in the last 10 years, and this is really resulted in higher rates of genetic gain from that program.

Gary Atlin:

And this problem of not paying enough attention to the length of the breeding-cycle is pretty consistent across public plant breeding programs around the world. It's really important to think of plant breeding as having a sick population improvement component... I don't seem to be able to get a pointer, Oh, there we go. Okay, a cyclical population improvement component and where you select the best parents, intermate them, generate new lines, test them as quickly as you can and then from... you introduce through a trait pipeline, New Haplotypes [ALS 00:20:00] for high value traits that don't exist in

this elite breeding population and every cycle or two you... let's see if I can get the pointer back... you draw off commercial candidates and get those tests released and into farmers fields then you try to have market research information feeding back into the product profile, the product design that drives these breeding-cycles, and it's really the length of that breeding-cycle that... this breeding-cycle determines the rate of genetic gain that a breeding program will deliver.

Gary Atlin:

It's not this process of extracting and testing and multiplying up commercial products, although that's critical to getting the product into farmers hands and it sets up a pretty natural division of labor where you could have a core centralized hub managing improvement of an elite population in collaboration with testing and variety dissemination organizations in the target environment that are very close to the end users.

Gary Atlin:

What are the key changes needed in the international crop improvement system to accelerate varietal turnover, both from improved breeding and effectiveness standpoint and helping with the handoff to the seed system? The first one which will be elaborated, I think in more detail by Michael Quinn of the Excellence of Breeding platform is the use of carefully designed product profiles, traditionally breeders have been in charge of designing varieties, in public they're breeding but successful private sector programs use formal product profiles that are designed with the support of marketing teams in the case of CGIAR programs that would be with the support of social scientists to collect a market intelligence preference information from end-users farmers, processors, and carefully incorporate the knowledge of both male and female farmers and this market intelligence is integrated with agronomic information from the agricultural, the biological scientists into detailed descriptions of the trait thresholds that are needed for commercial success. The job of the breeding team is to deliver varieties that conform to that product profile and.

Gary Atlin:

... varieties that conform to that product profile. And they use product profiles for selecting parents for the next breeding cycle and for product advancement, from each cycle for commercial release and deployment. And the EIB, the Excellence in Breeding Platform and Syngenta Foundation are really supporting the implementation of a much stronger product profiles in the international crop improvement system. In terms of breeding effectiveness, we need to help CGIAR and NARS breeding networks to accelerate and improve the accuracy of their breeding. Typically, public sector breeding cycles are at least 10 years, often longer, if you calculate them properly from the pedigree. And the plant breeders error, I call it, is really failure to separate the breeding process into those two components I showed you on the previous slide with a population improvement component, and a product extraction component. Only population improvement results in genetic gain, there are many new scientific opportunities to improve population improvement.

Gary Atlin:

And the Excellence in Breeding Platform is helping CG programs model and redesign their pipelines based on quantitative optimization. Genomic selection and speed breeding technology should allow

breeding cycles to be reduced to three or even two years in many grain crops. And one of the important results of this type of analysis is that small, fast-breeding programs are really more effective than large, slow ones. The final change that we need in the system is really to improve on-farm testing at scale, particularly in Africa. It's a missing link in public sector breeding. This is just an example of... I'm using a previous name of the company, Corteva, because that's when this work was done. When Corteva introduced a new product line called AQUAmax, they tested the final selection candidates on about 3000, 3500 sites in the American Midwest for three years.

Gary Atlin:

Whereas the SIMIT, amazing program in Eastern and Southern Africa, tests on an average of about 40 on-farm trials a year. So we really need to step up on-farm testing, so that we can be very sure when we recommend to a ministry of agriculture to a seed system, that a new product is going to perform better than farmers are currently growing and justify investment in it. Just to make the case for these accelerated breeding systems, I'll try to do that with this rather difficult to read slide. I've got here, for six breeding schemes, the genetic gain in genetics standard deviations per cycle plotted against size of program. This red arrow points to a scheme that test F4-derived lines advances two generations a year, and does two years of yield testing before selecting parents. This scheme, I think it's in orange here, tests F4-derived lines, advances three generations a year and does one year of testing, cutting the breeding cycle in half, and at every population size, doubles the rate of genetic gain. And an interesting feature of these faster programs is, at a population size testing 100 entries, this faster program delivers a higher rate of genetic gain than the slower program, which is still a pretty aggressive program for a public sector breeding program with 1000 entries. So much smaller programs working much more effectively if they're fast.

Gary Atlin:

What will it take to help CG and national networks achieve faster, more accurate breeding? Well, it'll take adoption of a population improvement mindset, implementation of integrated breeding and genomics information management systems. Michael will talk more about that, as well as about mechanization and digitization of population management and field testing, adoption of rapid generation advanced systems, permitting three and perhaps even four generations of advance per year in pure line crops, and genotyping of all selection candidates entering replicated testing to permit genomic selection.

Gary Atlin:

This will cost to implement these changes, but the capital cost of modernizing CG research facilities will be modest. I would estimate about three to five million per breeding network, and the annual operating costs may actually be reduced through mechanization and a switch to single seed descent, rapid generation advance. That's been the experience of [Erie 00:00:28:41], which introduced formal product profiles, cut the breeding cycle to 4 and is working on three years, reduced adopt a single seed descent, reducing line development costs by about 90%, outsourcing genotyping with the support of the Excellence in Breeding platform, increasing multi environment testing and centrally managing breeding operations that are mechanized and digitized. The CG NARS breeding networks for rapid cycle genomic assisted breeding, these networks are critical to the function of CG breeding, operate in different ways. Some of them are basically schemes for testing products of CG programs. Others like PABRA are highly collaborative in terms of product profile design and advancement decisions, but they're also perfectly

situated to introduce rapid cycle population improvement, opening up new possibilities for CG NARS breeding collaborations.

Gary Atlin:

These networks need to jointly design product profiles, select parents and make advancement decisions, but the CG programs have a really strong comparative advantage for managing rapid cycle genomic selection. Most phenotyping needs to be done at national program sites in the target population or environment at stage one in the agrinomic testing step. I think I'm running over, so in the interest of time, I'll skip that slide and just jump to the conclusions. The varietal replacement is needed for climate change adaptation, but it's happening very slowly in most of Sub-Saharan Africa and South Asia. Low rates of varietal replacement are due to poor product design, low rates of genetic gain and lack of incentives for companies to replace varieties.

Gary Atlin:

Genetic gains delivered by the CG and national partners have slowed since the late green revolution, often due primarily to slow breeding cycles and a lack of emphasis on accuracy for quantitative traits. Delivering high rates of genetic gain will require CG breeding programs to adopt a population improvement focus, breeding pipelines will need to be formally optimized for the rate of genetic gain delivered per year. CG cereal and legume program should immediately aim for a three-year breeding cycle and transition to two-year cycle as soon as they can, and which should be doable within five or six years. This will take modest investments in the facilities needed to advance three generations a year in most crops, and possibly four in controlled environments. CG breeding networks need to be restructured so that product profiles are designed collaboratively. Stage one testing is done primarily at national partner sites in the target environment and advancement decisions are made jointly. Thanks very much. (silence).

Michael Quinn:

Can people hear me? I'm wanting to present, and touches on many of the issues... (silence.) But it's about strengthening these networks and having these clearly defined roles within network development, a centralized breeding operations unit that provide operational support to this CGIAR's network is something that we're really working strongly to emphasize and to strengthen and going forward, it'd be great to see CG be able to provide more and more support to the operational side of that network. Many national programs have infrastructure in place. They've got good breeders, but they really struggled for the operation budgets, and so if this can increasingly be coming from that network, that'd a really great thing. So moving on to improved targeting, this is the piece that the [inaudible 00:38:02] is mentioning in terms of product profiles and defining market segments, and being very clear about who we're breeding for and making sure that all breeding decisions are starting with the end in mind, and really looking to replace variety so that we achieve that goal of driving down the age of varieties in farmer's fields.

Michael Quinn:

So Excellence in Breeding is working for CG and our breeding programs to characterize the market segments that they're breeding for, and it's important to be very deliberate about targeting specific

market segments with specific breeding pipelines. This means being very demand-led and starting with the end in mind. In this case, the end being the replacement of currently grown varieties. So it's important to be focused on the traits and trait combinations required for the targeted market segments, and which is the product profile? Which you're going to hear more about yet from Nora Lapitan in the next presentation. And having well characterized market segments, together with focused pipeline can result in a pipeline investment case, enabling prioritization of limited investment funds, and to ensure that investment funds or the funding for breeding across national programs in the CG is really, particularly in CG, is really targeted to work, going to have the most impact. And again, I think Nora Lapitan is going to explain more about that.

Michael Quinn:

So in terms of how this looks different to... What does this mean in terms of a difference? This means not having breeding pipelines that are extremely trait-oriented in the same sense, it's really about trait packages and being very clear about what those packages are, and that's the product profile. And that's the target of the breeding pipeline, is the product profile. There may still be trait integration pipeline, but they're deliberately servicing the cyclical population improvement process that Gary mentioned in his presentation. Moving along here. So we've got a whole module working in that whole area within Excellence in Breeding.

Michael Quinn:

So what are the other areas in which we're working? So from here, the rest of the presentation is about addressing, accelerating the rate of genetic gain. And this is really about getting the fundamentals right, and then with the appropriate use of modern technologies and approaches... So this means optimizing breeding schemes with the applied quantitative genetics principles, and I'll go into each of these in just a little bit of detail. So I'll just run through these now quickly. So that phenotyping is more accurate, lower costs, faster trials, genotyping, data management, and metrics. So if I look at each of those in isolation, or just go into a little bit more detail onto each of them, so we've got a whole module on optimized breeding schemes, and it's led by Eduardo Covarrubias, you see his face there.

Michael Quinn:

And on the slide there, you see some of the examples of the things that this part of Excellence in Breeding is really trying to address. So the first dot point there is shortening the breeding cycle times, and Gary made some really nice illustrations of how effective this is and using Erie as an example. So where this is a really important target for Excellence in Breeding, using a selection index can support that to be successful. Optimizing resource allocation, for example, replication within environments, sampling versus sampling more environments. That is the size of the program. How can you take a limited amount of resources and make sure that you're really optimizing that rate of genetic gain via the decisions that you're making in these different areas. And that last dot point there is the use of genetic resources, more focus on elite by elite crosses and really ensuring that germplasm is recycled.

Michael Quinn:

And that means making elite by elite crosses and then taking those progeny as quickly as possible, and then putting them back into the pipeline rather than going back to older material, or worse yet even,

wide sources of variation, perhaps from the gene bank, and strategically and systematically bringing in new sources of high value germplasm in elite backgrounds. So this is about separating out the process and that's what this next slide actually is about. Separating out the process of trait discovery and trait deployment from the population improvement piece. So there's a lot of detail here, and really, I just want to say that the trait deployment side can be in the blue box on the left, and then population improvement is the middle box, the reddy-orange box, and by separating these out and [inaudible 00:43:08] that if you're trying to develop a variety, or at least the population improvement cyclical side part that Gary described in-variety spinoff from, that should be entirely elite by elite.

Michael Quinn:

Moving along to phenotyping, this is another area which we're really focused on, and this is about more accurate efficient trials and rapid turnover of data. So some of the examples are consistent irrigation, soil management, agronomic practices, increased mechanization and digitalization, and that can make huge leaps forward in terms of accuracy and efficiency. Continuous improvement is something we're doing across all aspects, but phenotyping is so process-oriented that it's a strong push in this area. And of course, health and safety. We have a focus on genotyping, and this is a really nice example of the shared services that we're looking to provide access to, and I think Gary mentioned this a little bit as well. So three extensions to high throughput genotyping project, Excellence is Breeding is aggregated demand across the system for genotyping, so that we can drive down prices and negotiate lower cost genotyping and provide it in a standardized way in a centralized manner, so each individual breeding team's not having to have their own marker lab.

Michael Quinn:

And this means that we've got forward markers for around $2 per sample and meat density genotyping for genomic selection and generic applications for around $10 per sample. Data management is super important, so the utilization of new breeding tools that I've been describing, such as genotyping and improved biometrics, are entirely dependent on the breeding team's ability to manage very large and complex data sets and bring them together into a single analysis. So Excellence in Breeding is developing a data management system, purpose-built for breeding called the Enterprise Breeding System. We'll work closely with CG and NARS breeding teams to support adoption of this system, but also other systems that are available and that might be more appropriate for them. So the goal here is to have all programs on a professional and personal data management system. And this is my last slide, the last area that we've got a strong push on, is in biometrics, and this is one of the cheapest ways to increase accuracy and drive better decisions. And integrating with purpose-built data management systems like I just mentioned, lowers the cost of entry for the current best practice trial designs and analytics. So...

PART 2 OF 4 ENDS [00:46:04]

Michael Quinn:

It's trial designs and analytics. So with that, I am aware that the time is moving along and so, I'll now hand it over to Nora Lapitan. Thank you, thank you very much.

Nora Lapitan:

Assigned breeding programs, accompanied by well-designed testing and delivery. So while the delivery is outside the scope of excellence inbreeding, as Michael pointed out. It's a critical piece in achieving the cropped and hungers goal of replacing varieties in farmer's fields would improve an adapted varieties. Later Rob will present a plan to link cropped and hungered generated products with these systems. So this next slide shows viewers a framework for our crop improvements and seed delivery investments. The different types of activities are informed by product profiles at the outset, and the different activities are integrated with feedback and forward loops, informing other stages to ensure that products develop, meet target product profiles, and have a pathway for commercialization and dissemination.

Nora Lapitan:

These various activities are carried out by different partners who bring unique comparative advantages. So for example, we take advantage of the advanced capacities of US universities, through innovation labs and they bring cutting edge technologies in the development of new tools, methods, and technologies, and the discovery of nutrients or new markers. For scaling and commercialization, we rely on public partnerships as one example. The coordination of activities among different implementing partners could be very challenging for a funfair like USA. So let's just look at peanut. We have a peanut innovation lab. We also invest in [inaudible 00:55:41] and we have separate investments in scaling and commercialization. These activities, they're often uncoordinated and consequently promising products and innovations in the pipeline can end up on the shelf for a number of reasons, including high cost of a product, unclear value, lack of market demands and absence of networks with scaling and commercialization partners.

Nora Lapitan:

So as a way to address this challenge, USAID is adapting the use of product life cycles which the private sector uses effectively to track the progress of innovations, make decisions and advancement and put plans in place for commercialization and dissemination. So my last slide shows USAID's product life cycle decision making framework. This framework shows the various stages of product development from initial design of a product profile, research, development, commercialization, adoption, and phase out of a product. And it's meant to capture the various investments that USAID makes and where our implementing partners contribute in the different stages of the framework. The framework has 11 stages, which are shown in blue arrows and the expected outcome for each stage in orange boxes. We recognize that many of the stages are cyclical and require feedback and forward loops. But for the sake of simplicity, the stages are shown as linear. By defining the stages and outcomes, we are creating a common language that we and our partners and other stakeholders can share.

Nora Lapitan:

The framework provides a standardized process to understand project status across multiple actors, including USAID stakeholders. It's also a decision-making tool for an advancement of products from one stage to the next. The traffic lights between each stage indicates that predefined criteria have to be met before moving from one stage to the next. By using this framework to track the progress of our various products, we would know what promising products are in the pipeline. This would allow us to plan and advance ways for uptake of research products, once they are ready. For example, by creating institutional arrangements or strategic alliances between researchers and mission implementing partners or the private sector. We will engage the community in the near future to get feedback on how

this framework can advance a collective effort in designing demand driven innovations and taking them to scale through commercialization or to the public sector partnerships.

Nora Lapitan:

So finally, to close, I want to highlight the importance of everyone, donors, implementing partners and stakeholders, working together to achieve reduction of hunger, poverty, and malnutrition. I have described a few ways to ensure that products developed from crop improvement investments reach impact. One is through a clear target of crops and product profiles and where breeding stops we need to ensure that there is a pathway for commercialization and dissemination of those varieties vetted through the product life cycle. Thank you so much. And now I'd like to hand it over to Simon Winter.

Simon Winter:

Morning. Good afternoon, everybody. So at Syngenta Foundation we kind of take over and compliment a lot of what you just heard about from Nora Lapitan, on the commercialization part of the journey. And we are in fact a public private partner of USAID and a number of other organizations in this process. So my talk today is just going to give you a brief snapshot of, that kind of a gap that sits not just in seeds, but in many areas of moving research and innovation into use in farmer's fields and how we at Syngenta Foundation are playing a small role in trying to bridge that gap and make that gap bridging professionalized and documented and data-driven so that it's not a happenstance exercise, but it's something that can be systematized by many actors and capacity can be built to do that systematization. Then massively we hope, expand the flow of new seed varieties and other types of innovations put them into use in low income farmers fields in the future.

Simon Winter:

So how does that look when we look at this product lifecycle. Nora Lapitan was just laying out. So the gray boxes are the partnerships that we have, and I'm not going to go through every single one, but PASTER, which sits right in the middle and it seems to be Africa is our partnership with USAID. That's the one down here. And, we also work right up in the beginning of the breeding process on something called Demand-Led Breeding over here, which is a partnership with the Australian Council for International Agricultural Research and the Crawford Fund In Australia, where we're helping on the front end to make sure that new breeds are being designed for use, for demand as the name implies. Not necessarily markets because many farmers are not necessarily marketing the seed or products that they grow from seeds, they're consuming them on their farms. But that notion of designing for consumers is a very important part of the product profiling remember you heard about earlier from other speakers.

Simon Winter:

Our co-work though is in this middle area of this transition from the research, from the breeding phase into the commercial hands of seed companies and that requires a lot of work with NARS. Whether those seed varieties are coming out of the CG system or whether they're coming out of USAID supported or other supported innovation labs or universities and so on. We also have partnerships with the Gates foundation and ICRESA this visa program is really focused on building the capabilities and capacity of organizations to do that. And then we're also working over here with AGRA on Seeds for Impact through the African Enterprise Challenge Fund, where we're then working with seed companies to make sure

that they have the systems and capabilities in place to actually produce and market and distribute these improved seed varieties. So, that just gives you a quick snapshot of where we're working across the system.

Simon Winter:

And what we're doing right now is we're taking all the tools and knowledge that we've been learning and developing what we're calling at the moment if we wanted a better term a handbook now, but it's not going to be a published handbook that sort of is done one sits in a library somewhere, it's going to be a dynamic interactive set of tools, that can then be used in order to have lots of organizations be able to do this translation process from research into use that I've been talking about. And we're working on this, not on our own, but we're working in partnership with organizations like AGRA, like this Crops to End Hunger Group, the delivery group that's been established under Crops to End Hunger Group and so on. Building off best practices that come from industry from large seed companies, as well as from the research community and will then be used hopefully in the future to guide a lot more capacity building, then, anything that's any of these individual organizations represented on this call can do on their own.

Simon Winter:

In order to do this we really need to understand the complexity of all the steps that are in involved in this complex interval set of processes that go from late development of breeds that are working technically, but not necessarily growing in farmers fields even in trials, to the trialing phase, having those trials then, be introduced through the NARS and through seed regulators, to be released and put into the market, put into the hands of seed companies. And then the business model is taken on by the seed companies and the growth sector to be able to actually produce the seeds commercially. One of the most critical things is what we call the Product Advancement Mechanism or PAM and how this process of translation gets managed by all the different stakeholders that need to be part of this and how it gets governed, in a way that is transparent and results in the best varieties, best performing varieties being released and adopted while others perhaps are not. And then handed off into the seed companies in the markets.

Simon Winter:

As Nora Lapitan said, this is not, although it's presented this way as a linear process, this is not a purely linear process. There's lots of data and lots of knowledge that gets generated in all of this work that then flows back into the breeding stages. And the aspiration, as I said of this handbook that we're working on is to have a more standardized process that covers all of these modules. Now that can be used by all interested stakeholders. Just to go into slightly more detailed and the kind of data that needed is required at each of these traffic light driven stages that we're talking about here. We have at each of those stages, then a variety review. And at each stage, the variety review data is slightly different, it's evolving as we go through these different stages from late development to the commercialization stage. And my next slide shows you just one example of how this data gets used to understand, how all the new varieties being compared with a product profile.

Simon Winter:

So you have a product profile here that is shown in blue, which is the ideal performance that we're looking for. And then you can see how a new variety here HDIP206, this is potato variety is matching up to an existing variety in use, Atlantic. And you can see that on multiple dimensions, the new variety is performing better. It has much higher yield, it has much better sugar content, it chips better, and is better for French fries. And down here in the diseases category, you can see it resistant to Late blight as well, which the existing variety is not. So, this kind of systematic assessment process and looking at the relative performance is absolutely critical. And my last slide just shows you how we think about this ... Whoops, too many slides clicked though, coming into a date as we call it a database.

Simon Winter:

And this database gathered all of this data. We've developed a field trial app, which is a mobile app that can be used on a tablet or a smartphone. Captures all the data from all of these trials, and can then very quickly be examined from a benchmarking perspective, as well as presenting that data in the right way for regulators or for seed companies in order to be able to use it to make their assessments about releases and about taking on these seeds for commercial production. And then we also look at the impact of all of this and look at, how do these new varieties perform in terms of bummer adoption in terms of business adoption and not just in terms of numbers, but also in terms of value as well. And there's lots more data that's captured in these two models, but these are the headline key performance indicators that we're looking at Syngenta Foundation, as we try and prioritize the kind of work we're doing and the focus that we have.

Simon Winter:

So hopefully that gives you a little bit of an indication of ... Those are some of the complexities, but also the fact that there are tools in development that can help to address those complexities. And all of this is going to be available for public use and back to Rob, thank you.

Rob:

Thank you so much, Simon Winter, and all the speakers for a great set of presentations. I think they all hung together. I just want to make a few comments because we're running late and I know we want to have a Q and A period. Just to say that I think it's really welcomed to see the fact both community, including the donors, are recognizing that investment in crop improvement needs to go hand in hand with investment in seed systems. Too often those exhibits separated. We're really bringing them together here. It all hangs together. If you thought about each presentation, you could almost line them up with an arrow connecting the beginning with the end and then coming back again. I think that reflects the fact that how the emphasis on the user community and our social science trying to really develop a product orientation that the private sector does very well, but we in the public sector have often struggled with.

Rob:

So the product profile discussion is really critical. The feedback loop. The fact that this has got to be data-driven all the way through both in the science end, but also very much, as Simon Winter just pointed out, in the user end in terms of what the market's demanding. Then the other piece is the fact that we're going beyond the CGI AR to the user community in all its forms. I think this is all going to be

captured in a white paper that's under development. So we're all going to have a chance to see how this is coming together through this delivery group. Ian Barker is spearheading that and we're really grateful to him for that effort. Two last comments. We had a recent presentation from PABRA about yellow beans in East Africa and it was astonishing to see the speed with which new varieties were moving through informal systems to farmers really fast and this was done using DNA fingerprints.

Rob:

So my point here is that nothing what we're talking about here is in any way at odds with the fact that informal seed systems continue to thrive. We're going to take advantages of all the opportunities out there, both the formal systems and informal systems and of course they connected very robustly. Finally, for all of us in the Ag and food communities, to keep in view that what we do is absolutely essential to environmental outcomes on a global scale. We have to use the land we already farm as sustainably and productively as possible in ways that prevent the encroachment into forests and wetlands, the loss of biodiversity and the negative climate impacts that go with those. When we step back and look at this as a global issue, this is as compelling in environmental terms as it is as some of the human outcomes that all of the speakers have discussed. So I'm going to turn it down to my colleague, Zachary Baquet, who's going to handle the question and answer period. Thanks to all this.

Zachary:

Okay. Thank you, Rob and thank you also to the speakers, as well. Gary, Michael, Nora Lapitan, and Simon Winter. We really appreciate your presentations today and jumping into the chat box and having a really rich discussion with those participants today. I would just take a moment to again, apologize for some of our technical difficulties for you that had issues joining. We really appreciate your commitment to participating in this and powering through to join the conversation. We are taking your comments seriously and we're going to look at ways to improve your experience.

Zachary:

So again, thank you for your patience and your continued participation. With that, I will start with the question that we've had submitted from Jose Gomez. How do you measure progress of varieties being released? Is your indicator global or by country? I think that would be directed to Gary, but perhaps others might have comments too.

Gary:

An issue to be addressed market by market, country by country. It's very important to understand that breeding programs have a clear target in terms of a cropping system, a population of farmers, and that they measure their progress in terms of the productivity gains, income gains, poverty alleviation gains that they provide in that target, not at some sort of theoretical global level.

Zachary:

We had a comment from Louise Sperling on the formal seed system. At this point, data show that the formal seed system provides 3% of the seed small holders and much of that is maize and some vegetable seed. It might be useful to look at other seed source options if a high impact is to be reached

for a range of crops. Kind of perhaps rewording the question or invite Louise to add a question to the chat box, perhaps it's along the lines of, are there other options to help small holder farmers access improved seeds given they are not successful accessing the formal sector such as a seed company? Are there other options? Is there any comments from the presenters? If not we can wait and see if Louise has a comment.

Simon Winter:

Simon Winter, let me just jump in with a quick comment there. I think there are many different pathways for seed production, from cooperative based more informal type seed production networks to large growing seed companies, producing seeds. I think we want to uplift the entire system and finding the right pathway into the market is part of what needs to happen in this commercialization process. There shouldn't be an assumption that necessarily we have to have very formally established companies be the only seed producers. But at the same time, we also need to make sure that the capabilities are there, that the business model is there. One thing that we didn't talk about too much earlier in the call is of course, seeds are only one part of a production system on farm. We need good agronomy, we need complimentary inputs, we need a good business case for the farmer to be producing, whatever they're producing, and so on. It's bringing all of those together on the delivery and that's important, not just making sure there's a direct pathway between the breeders and the seed companies. Thanks.

Gary Atlin:

On that question, in terms of serving informal seed systems, I think that the issue for breeding organizations and extension systems, people who want to get new varieties to farmers, is to move the formal informal interface as close to farmers as possible. So a deep understanding of those informal systems is required so that you can, first of all, make sure that your products are attractive and will move quickly farmer to farmer, as those bean varieties that Rob referenced in. Secondly, so that you can get small quantities of seed to initiate that process into the hands of influential informal sector actors as quickly as possible.

Zachary:

Perhaps a follow-up question on that comes from Stephen Walsh. Is there any role in seed delivery for an entity that is not a seed company? I know you had mentioned the informal sector versus formal. So, thoughts on that?

Gary Atlin:

I mean, there's a huge role for both for many organizations that are doing community development work at village level and disseminating variety. They do a terrific job of it in many contexts. National seed companies as well.

Zachary:

Anyone else? If not, we can go to the next one from Lawrence Kent. In Africa, is the primary problem the fact that farmers are sowing seeds of older release varieties or is the primary problem the fact that

farmers are sowing seeds that do not emanate from breeding programs at all and land acres? Could the problem be a simple lack of reliable access to seeds of improved varieties? Anyone?

Simon Winter:

Yeah, I think it's a combination of both. It really varies from country to country. We have some countries where let's say the formal seed system has been a much more successful and is much more developed. Zimbabwe being one example and Kenya, you could say in [inaudible 01:19:44]. So those formal improved varieties tend to dominate, but then in other countries, Malawi, for example, land races exist in much larger numbers. The challenges from our perspective, it's a combination of both lack of access to improve varieties, which is sort of caught in a catch 22, then with the lack of a good business case for seed producers to start to produce the more improved and advanced varieties. So you have to see the market start develop to believe that you should be investing in seed production in a commercial way. And again, back to the important point, whether you're a cooperative, distributing just to your community or they have much larger growth aspirations, but if you don't believe there's that market opportunity there, you're not going to invest. So we have to remove that catch 22 through the kinds of things we're talking about.

Zachary:

Wait, there was a very rich discussion in the chat box around counterfeiting. David Spielman had put in a lot of the storylines around counterfeiting. Need to disentangle malfeasance by sea producers, retailers from other causes of poor quality seed, e.g. less intentional mistakes like poor maintenance, breeding, multiplication, storage handling, et cetera. What are the speaker's thoughts on counterfeiting or the issues around it? As noted by another speaker, counterfeiting has emerged as an issue for maize and vegetable seeds. Are there instances of counterfeit seed on a regular basis for other crops?

Simon Winter:

Again, it's market specific. There are some markets where counterfeiting is more of an issue, but it's certainly not considered such an inhibition that it's a barrier for formal seed companies in general to be investing. Many countries have now introduced measures to mitigate counterfeiting. Kenya, for example, has a mandate for a label on the seed package that farmers can scratch, send an SMS for a validation of the authenticity of their seed. We think those kinds of tools could be relatively easily spread across many countries.

Zachary:

Speakers? If not, we have a question from Margaret McKeown. What do male and female seed users consider when thinking about buying seed? Is it only the traits or other conditions influencing their decisions? If no one has comments on that one, I can go to another question.

Gary Atlin:

Very quickly, there's excellent work being done by several organizations. What I know about is [Summits' 01:23:37] work on women's access to hybrid maize seed. You know, when the Gates Foundation is designing investments in breeding and seed systems, we're really trying to ensure that our

partners design, analyze women's access to improve varieties and design programming that will help improve that access because there's no doubt that the access of women's farmers to improve products is less than for male farmers. But the Summit Social Science Group is doing some good work on in this area. I believe there are other groups as well. The crop improvement innovation lab has expertise in this area. I believe the USAID funded investment.

Zachary:

Okay, let's see. There is a question from Serine [Rajandron 00:01:25:07]. How do I ensure that farmers pay for quality seed when there are less commercialization of the crop in the market and free distribution of seed through various NGOs, et cetera?

Gary Atlin:

Go, Simon Winter.

Simon Winter:

I think it's going to be crop and market specific, but certainly if we're trying to move to a more modern seed system and more professional seed system, we have to have a level playing field for commercialization. If there are certain organizations that are handing out free seeds, it's going to be a very hard case for farmers to say, "Well, I want to go and buy these other seeds." Unless there's a clear performance difference between the seeds and at the end of the day, the farmers can make more money out of the prior seeds they're spending money on than the free ones. But in low-income communities in times of stress, free tends to win.

Zachary:

From Rastaffi [Fuyur 01:26:44] from Ramon Bangladesh. My major and most important question is why does most of the seed businesses fall down or face losses in their business? Or the thoughts on the challenges of having a seed business? Any last thoughts on this question?

Simon Winter:

I agree. I mean in our C3 impact program partnership with Agra and the African Enterprise Challenge Fund, we're looking at trying to help these seed companies that maybe have come out of initiatives like Agra's seed initiative that was previously supported by the Gates Foundation that led to the creation of 107, I think seed companies in Africa. Getting these seed companies to be fully commercially reliant and be able to raise their own financing and their own capital and so on. Because it's such a tough business, most investors and financiers tend to be a little bit shy of working with these companies. So again, we have to overcome this chicken and egg problem and really prove that there is a commercial pathway forward for this sector. Then we can persuade more investors, more entrepreneurs, and more financiers and so on that this is a sector where they have support. But we're in a bit of a [inaudible 01:28:30] at the moment where we're still trying to find those evidences, I think.

Gary Atlin:

Next session.

Zachary:

Yes. Well, again, thank you everyone for your participation today. Thank you again for patience. The recording of this session, the transcripts from today's session and the chat box discussion will all be made available and sent out to everyone who had registered for the event. We will also post them up on Agra links on the event page. Again, thank you for staying with us, participating and for providing for such a rich discussion. Thanks again to our speakers, Gary, Michael, Nora Lapitan, and Simon Winter, for providing us with such great points to discuss. With that, I thank you and send you on to hopefully a great rest of your day, or hopefully a good night's sleep depending on where you are. Thank you very much and we appreciate your participation.

Zachary:

One last bit. Please take a moment to fill out the polls and provide suggestions for our webinars in the future. We really appreciate your feedback. If you want, the slide deck can be downloaded on the file. Download pods to the left.