



## Headlines of the Future

A podcast by Bayer

Episode 5 – The State of Food Security:

**Kate Hayes (host):** Welcome to Headlines of the Future. Brought to you by Bayer.

Fascinating clues to help solve some of the most pressing global challenges from climate change to feeding a growing population to curing diseases can be found through science and innovation. I'm your host, Kate Hayes. In this podcast, we'll hear from visionary scientists, thought leaders, and entrepreneurs to learn more about how the science of today could positively impact our lives in the future.

In this episode, we're going to discuss a topic that is always important, but is especially so right now - the state of global food security. As the war rages on in the Ukraine, the devastating impact on its citizens and cities have been heartbreaking for the world to watch. At the time of this recording, tens of thousands of Ukrainian civilians are still trapped with little food or running water while millions more are facing serious food insecurity.

And to make matters much worse, the ripple effects of this war extend far beyond Ukraine's borders to every part of the world and could push hundreds of millions of the world's most vulnerable people towards starvation. As the executive director of the UN World Food Programme recently stated we are on a countdown to catastrophe.

My two guests today are going to help us understand what's going on, how this affects the global food supply chain and what role science and innovation could possibly play in helping food systems to recover. I'd like to give a very warm welcome to Julie Borlaug and Natasha Santos. **Julie Borlaug is the associate director of external relations at the Borlaug Institute for International Agriculture.** The Borlaug Foundation continues the legacy of the late Dr. Norman Borlaug, who was Julie's grandfather and the fight against global hunger and extreme poverty through international agricultural development. Dr. Norman Borlaug won the 1970 Nobel peace prize for his work preventing mass hunger and starvation in Mexico, India, and Pakistan.

In fact, he is credited with saving a billion lives. And if you've never read his three-volume biography, which was my personal introduction to agriculture, I would highly recommend it. Julie, welcome to the program.

**Julie Borlaug:** Thank you for having me. And I want to thank Bayer for this opportunity. I love talking with anyone who is passionate about agriculture and especially situations that are going on globally right now. But I'm Julie Borlaug. I am the VP of external relations at Invaio and I'm also president of the Borlaug Foundation. And it's great to be here. My love is agriculture and international development. Hunger and famine are some of the things that I love talking about as well as youth and the next generation solving these issues.

**Kate Hayes:** Wonderful. Well, I'm so glad that you're here. ***Natasha Santos is Vice President and Head of Global Stakeholder Strategy and Affairs at Bayer's Crop Science division.*** Natasha has more than 17 years of experience in food and agriculture, sustainability, and life science industries. She's led various industry association groups and sectorial alliances and has positively contributed to policymaking and collaboration. Natasha, thank you for being here.

**Natasha Santos:** Thank you so much, Kate. And what a pleasure to have this conversation, especially with Julia and you, particularly in the times that we are living. I decided to work in agriculture because of the many farmers, like my father that I had in my life, and work on global advocacy and partnership because of the inspiring life that my mom has shared with me as an example. So, I am more than happy to share more on how we can do more, scale things, and think about partnerships and innovative ideas to help. There was a need for most parts you can on the times that we are living in. So, thank you.

**Kate Hayes:** Absolutely. So Julia and Natasha, before we dive in further to what's happening in the world right now, I did want to give our listeners a chance to hear from both of you a little bit more about your backgrounds, your connection to food, and food security. And you both kind of started talking about this already, but let's take a little bit more time to just get to know you. So Julie, to start with you, obviously, you were born into a family with a strong food security legacy, but did you always know that you wanted to work in this area as well?

**Julie Borlaug:** Well, I like to say I come to agriculture genetically, but, you know, I had started working in nonprofits like the American Cancer Society and the Salvation Army and doing development and fundraising for them and all wonderful causes.

But I knew I always wanted to do something about famine and agriculture because of my grandfather and what greater cause that affects so many innocent lives at such early ages is - other than I mean - hunger. It was just compelling to me seeing my grandfather. Hearing his stories. So that's how I really came to agriculture.

And I had the opportunity to go back to my undergrad, alma mater, Texas A&M. And they were forming the Norman Borlaug Institute for International Agriculture. And I got to come in as external relations and development director for the Institute and work with my grandfather.

So, that's really how I started my career in agriculture. And the great thing was I got to travel with him. I got to see him work with students and not all - there are five grandchildren - and not all had the opportunity to do that. So that's something I really treasure.

**Kate Hayes:** Oh, I bet. So what do you currently do in your work, in the context of trying to support food security around the world?

**Julie Borlaug:** So currently I'm with Invaio and we're working on plant health. So let's talk about citrus greening. Citrus greening would be the COVID of citrus trees and we're losing pretty much about 100%, almost 100% of all trees in Florida have citrus greening. We have not found a solution to this. It causes the leaves to turn yellow. It causes fruit to drop. It ruins the entire growth. Once a tree has it, you can either try to spray tons of pesticide to see if it'll go away. Typically it will not. And then you have to burn the tree. So we're about to lose our citrus industry here in the United States. And that's what we're working on. In my past life, I was working in gene editing, which is exciting because it can be a new way that we develop drought-tolerant, wheat that needs less fungicides and less other inputs that provides greater stability and better quality seeds for those in developing countries. So that was what I've been doing the last five, six years.

**Kate Hayes:** Okay. And I'm glad that you mentioned gene editing as we're going to really start to talk a little bit more about the innovation that is behind the agricultural industry in just a few minutes, but Natasha first, let's get to know you a bit better. Tell us a little bit more about your background and how you ended up in Crop Science at Bayer.

**Natasha Santos:** Thank you, Kate. And I was talking about that actually this week, as I'm having conversations with some of our stakeholders. I'm a political scientist and I've been in political science and international relations since the late nineties and early 2000s.

And I remember - this was a few years well, a decade after the Berlin wall was, you know, done and gone when, you know, after hyperinflation and horrible economic times in my home country, in Brazil, I come from Brazil. That my family, basically, my mother had to reinvent herself five or six or ten times and build things from scratch over and over again because of bad government and bad policy. And honestly, I never thought that in 2022, we would see a country invading other countries in Eastern Europe. IT is just unimaginable. And it's hard to believe that we are living in. But, we are. So we need to do everything we can to change that. So I wanted to share that because it's part of why I got into agriculture.

I've seen what agriculture can do for rural communities. I've seen what agriculture can bring in terms of prosperity in my countries and the challenges that we continue to try to overcome. So that is what inspires me. What inspires me is to help others give voice to the voiceless, and help others to advocate for what matters to them all over the world. And I feel that the private sector in the company, like Bayer with our commercial footprint, can really be a powerful partner in the economic development that does individuals, and nations, for better livelihoods. I've seen how the private sector help in my own family. So I'm more engaged than ever. My whole family, my grandma, and my grandfather all moved from Europe to Brazil because of the war.

So, it's more than ever very personal, I think for millions and millions of us, but it's very personal and so happy to have the chance to be talking to you and Julie today about that and what else we can do and what we are doing, how we can connect other organizations should do much more. So, that's me.

**Kate Hayes:** Thank you, Natasha. And yeah so, let's dive into the topic of what's happening right now and what needs to be done. So, Julie, I saw that you tweeted a few weeks ago that the independence of Ukraine matters to food security, to human rights, and much more. So can you help us understand how and why the war in Ukraine is affecting the food supply around the world?

**Julie Borlaug:** Well, I want to comment on something that Natasha said that she never thought you'd see another war in Eastern Europe. And one thing my grandfather always taught me is history repeats itself. So we have to unfortunately remember things can always come back. The problem with Ukraine is people who wanted to be independent and live their own lives. We have farmers who were doing amazing, and of course, I love wheat. So, I'm going to talk about wheat. farmers who were successful. Farmers have now had to flee, or their farms have been taken over and the export between Russia and Ukraine is – I believe - 30% of wheat and other grains come out of that area of the world. That is 30% of the entire global supply that will not be in the system anymore.

What that does do to everyone else? Yes. We in the United States are self-sufficient, but we're going to have to ramp up more to export. And when we talk about shipping right now and distribution, we have COVID issues still that are delaying shipping. So there's a lot of chaos and things beyond just agriculture research, beyond the goodwill of the people that are holding necessary aid to get to Northern Africa and other regions of the world.

So it's going to take a lot of negotiations and support in trade and how we're going to get the wheat and other grains to where it needs to go as well as remembering that we need to feed the Ukrainians who have no food. So it's a really complex matter that just goes beyond research. And I know a lot of people look at it and say, "Well, we have enough wheat. Why can't we get it there?"

Well, distribution, um, getting places that don't have roads. There are a lot of complexities, as I said, and with 30% of the wheat supply now, no longer in the market, it's devastating for all.

**Kate Hayes:** Absolutely. So we have two countries who are responsible for feeding a large part of the world. And now that grain is not coming out of those countries. And I understand that Russia is also a major supplier of the world's fertilizer. So, Natasha, I'm wondering, what else can you tell us about the current state of food security? Of what's going on? Who's most at risk here and what's at stake?

**Natasha Santos:** Thank you, Kate. And I think, Julie started us off with very important data and concerns, particularly on wheat being the Black Sea provider of wheat and it's so important for places like North Africa, the Middle East, and other places around the world. Honestly, I think what this situation, this war brought to us was just more and different, additional risks to all the regional and global food systems. Right. So it's that triple C - COVID, conflict and it's the climate - that we have been trying to find solutions and working with farmers towards climate mitigation and resilience. So I think as we look at the global food systems, honestly have provided us with more safe nutritious, affordable food per capita than ever before. But those additional risks really create the concerns and the disruptions.

And as Julie mentioned, particularly for the ones that are more vulnerable without forgetting the situation of the Ukrainians of the war, right. So you mentioned about Russia, I think, particularly on the fertilizer basis. And then it goes on all the inputs on food systems. So availability of inputs. The prices of inputs. The pressure in terms of costs. When you look at energy to produce those inputs, it's about availability. It's about the cost of production, that energy, which as well, Russia is a big exporter because of the gas puts more pressure on the food systems, as we see in more pressure in terms of overall food prices around the world. So I think there's a big concern on obviously fertilizer, of course, nitrogen, there is a big concern on potassium.

I've seen public information, for example, from Brazil, with concerns of the availability of potash or country like middle-income countries, like Brazil with the availability of fertilizer until August, for example, and looking for new resources or new places to be able to have fertilizer at all. And then without fertilizing and seeds, it will be impossible if we look at the next season for us to really make sure that the resilience and food production in countries like Ukraine. And then thinking about farmers, Bayer, we at Bayer have done this year, everything that we could to make sure inputs were provided to farmers and we have varied farmers in more complex places in Ukraine planting today. As well, as looking at the future and the next seasons and looking at next year. So how can we make sure that those inputs are there for Ukraine, but as well, they are able to export and they are able to sell the product as well? And then Julie mentioned in terms of logistics and supply chain. What is the ripple effect? When we look at the midterm, right? The immediate impact, for example, supply on places on, on the Middle East, like Yemen, like the World Food Programme Executive Director has said over and over again that their costs are going to increase and that they are already suffering so much to provide food on places where acute hunger and famine is so complicated like Yemen, but then what other countries were highly dependent on imports, particularly wheat. How can we help those countries now? But how can we help those countries in the midterm? In terms of helping them, not only to find alternative sources, but helping them to produce more, produce sustainable of course, but produce more.

And how are we going to close that yield gap that exists, particularly in places like Africa in the African continent, and regions like Africa that still they'll have access to true technology or an environment, for example, that will allow a proper seed system to be able to develop local seed companies, for example, and to be able to develop technology that will help them to produce more with less, but being able to produce for their population as well?

So I raised a lot of topics that we can, we can discuss on these exchanges. I think we need to look at the whole complex and the wave of impacts that this war brings on top of COVID and on top of climate change that we have been going through in the past years.



**Julie Borlaug:** And I really liked some of the topics you brought up because I think it gets to what we need or what people need to hear and have a discussion about. And I think when you look at what COVID did and how countries had to shut down trade in between each other. Now we have a crisis where we can't get anything exported from continent to continent. And when you look at self-reliance, that is what is so important about agriculture research. And I have been a part of public-private sector partnerships either through Texas A&M University and Bayer or USAID and, and the Gates Foundation. It's so important that we provide the know-how or truly extension so that we teach those in local areas. So whether it's Northern Africa to be self-reliant and its innovation and technology, but along with that, as you said, it's the distribution of inputs and fertilizer and fair prices and all of that. So, I think through COVID we all can relate to how being self-reliant within a country, whether that's manufacturing or most importantly agriculture, is one of the key cornerstones. And I know that all of us were working hard in international development to get countries to be self-reliant because when you're self-reliant you have a more stable and peaceful population, healthier of course is the most important. And you get to become part of the world economic system. So that helps with poverty as well.

**Kate Hayes:** Julie, it's really fascinating to be talking to you and hearing you say these things because as I listen to you talk, I hear, you know, I think of your grandfather's voice. As I read it through the history books, talking about, you know, the need to do the same thing for, you know, countries in the 1960s, you know, as the world was facing this impending famine that was expected to kill hundreds of millions of people due to the growing population and the food production capabilities at that time. And most people believe there was no way to avoid this, but, you know, thanks to Norman Borlaug, agricultural scientists applied his knowledge and, you know, worked for years to figure out how to make crops better. And then he was able to dramatically increase crop yields and also teach the local farmers and local agricultural industries how to do this better. And it was about using technology better using the innovation better. I know that all became known as the Green Revolution.

And, you know, people may have heard that term, but don't really understand where that name comes from. So, I wonder if you could tell us a little bit more about what you know about how your grandfather was able to help people help themselves and where that whole Green Revolution term came from.

**Julie Borlaug:** Well, the Green Revolution was actually coined by the USAID director in the 60s and then into the 70s. My grandfather was sent down to Mexico by the Rockefeller Foundation and the Mexican government, but the U.S. government was concerned about the plight of agriculture. So, he went down to develop a new wheat variety that would be, what it ultimately became was, it was a shorter stature, so dwarf wheat which could be done in drier climates. It was disease resistant and it produced a higher yield, but most importantly, it wasn't as photosynthesis sensitive. So light was not as big a deal. And that was called shuttle breeding. And what that meant is it could be taken to different parts. So it could be in the highlands one season and the lowlands in Mexico and another, but that's what made it so transferrable to other countries.

India had seen this. Pakistan had seen this. They asked my grandfather to come over and see if it could work. He brought, then scientists and young farmers, down to Mexico to train them. And the important reason why he trained them in Mexico was he wanted them to be taken away from their cultural norms when it came to farming from the systems they had used. And especially from elders in their community who weren't necessarily open to new ways of farming and new systems. So we taught them in Mexico. He sent them back with seeds and they grew their own plots and test gardens. And with that came, the Green Revolution and India and Pakistan were able to become grain self-sufficient within three years of each other. Had that not happened, people like Paul Ehrlich and many others were saying there was going to be millions who would be starved between the two countries, and a potential war could break out and cause disruption globally. And that is how he got the Nobel Peace Prize. It was through the window of peace of what he was able to develop. But, I think the most important part of what my grandfather did that had been different was he realized there had to be three stools to the solution. And that was, of course, the research innovation in agriculture.

That was being politically involved, you had to talk to the politicians. You had to get a change in the economics. You had to provide fair prices to the seed, access to credit, and make sure that the government was getting involved in infrastructure. India and Pakistan built roads. They helped with irrigation. They really rose to the challenge.

And the other part of it was supporting the farmers. So that's kind of why he was a little different than most researchers at the time. He understood that you have to have the governments behind you and the government support as well as training of the farmers and the research to truly transfer a successful change.

**Kate Hayes:** So Natasha, as I know you work in policy-making, does that still ring true today?

**Natasha Santos:** Definitely. I was so inspired by the answer and sharing the story of Julie's grandfather because we need more than ever a policy environment that supports all those items as Julie just mentioned. Particularly in terms of innovation. Particularly in terms of helping farmers and farming communities. Populations to contrive economically. And honestly, what I have learned in the past years and brainstorming with my team again, the amazing team of experts in partnerships and from our partnerships and investment on the ground, I think one very important piece that this beautiful example of Julia's grandfather, they inspire us is that he was trying to solve real problems in the real world, in real life, which sometimes policymakers or some, some stakeholders in the international development community sometimes, maybe far from the ground forget.

And I think it's really, really important to think when we are trying to design more solutions, scale solutions, or design new ideas, we really need to focus on, let's say the complexity and what effect aspects of the solutions that we want to bring. In my opinion, the three areas Julie mentioned three areas are so, so important when we think about resilience and food. Infrastructure. Sometimes we forget about the basics of infrastructure. I didn't know it was a team member of mine that recently shared with me. Did you guys know that, for example, the Sub-Saharan region, they have one of the lowest roads density in the world?

I wonder why don't we, you know, develop many international organizations that actually help governments to invest in basic things, right? Like roads for basic logistics or infrastructure as well as investment in ICT. Right? There's an inspiring initiative called SERCOMM in many African countries, including Kenya, but many different African countries. It's about investment to lay hundreds of thousands of kilometers of underwater cables for faster internet access. This is a powerful example of transformative investment because it's internet access that enables so much more. Right? In terms of, and for agriculture, if you think about digital agriculture, which can create marketplaces, which can help to accelerate innovation, research, and innovation and help out for farmers to predict better for them to manage their farms better, big and small.

Here are things like going on innovation, things like innovative startups. That's nowadays startups are locally developed and they're seeking to solve real problems on that bottleneck approach and demand-led process. I think that that's the way that we need to think about solutions and investments from a public and private point of view.

So, of course, policymakers can help and they should help us imagine creating that policy environment that supports innovation. For example, I think one point was an individual drive, right at research and drive that could see and inspire others to go with him. We should not forget the foundation of rights let's say that unleash that human ingenuity. Through those fair systems to those open competitive systems that can guide, can induce those actions and then in the long run, growth and wealth creation for the majority. So I think we should never forget that we are here to solve real problems in the real world. And then we need to understand what those problems are because solutions in India might be completely different than in Ethiopia, for example. But there are basic areas that we can collectively invest in as public and private companies.

**Julie Borlaug:** I think Natasha when you talked about roads, it's so important. I've spent a lot of time in Sub-Saharan Africa and a lot in east Eastern part of Africa. And, there are no roads. Once you get off the main cities, there aren't roads to get into the villages.

So when we're trying to get farmers' crops to the markets, a lot of it is lost because they can't get it there on time. And when we try to get things into them, whether it's through World Food Programme or others, there are no roads to get it in. So it's a slower process and I'm always asked if there are a few things you could do for Africa, what would you do? One of my first things is roads. And when people question me about it, I remind them, and this is a U.S. example, but why do we have farm-to-market roads in the U.S.? Well, that was during World War I and World War II when we built roads from the farm to the market to get out supplies, to feed our military and other allies.

So that is why infrastructure and roads are so important and they cannot be overlooked and it often is overlooked. There's no reason why 4% of Africa is only irrigated in this day and age and that the road system is as bad as it is. So I loved your suggestion that you know, other NGOs or people come together and just support infrastructure, whether it's roads, whether it's irrigation, whether it's cold chain storage or dry storage, all of those areas are needed beyond the innovative research that we are all going.

**Kate Hayes:** So I'm hearing you both say there's a need for a lot of infrastructure improvements in countries that are currently struggling with providing enough food internally. Not relying so much on exports, but in this current situation, obviously, there's still going to be this shortage. And I wonder, you know, beyond the long-term outlook, what can a company like Bayer do Natasha to help right now to lessen the impact of what's happening in this war.

**Natasha Santos:** I think what our organization is doing when you think about short-term, I think our complete focus should be the humanitarian situation in Ukraine, particularly. Right? So supporting organizations like the World Food Programme with logistics, with refugees relief or supporting organizations like Red Cross with the refugee crisis situation, which our organizations are doing. And we are actively engaging with other organizations to do the same. Of course, with operations in Ukraine, our first priority is the safety and support of our own employees, particularly in Poland, but other European countries providing shelter and support. So it's a humanitarian catastrophe that in the short term needs to be looked at as it is. A humanitarian catastrophe and all efforts should look at that. And then, even when you think about immediate impacts on other countries, I mentioned the horrible situation in Yemen that has been happening for so long, and then I'll reinforce World Food Programme again, but other initiatives to provide Food, possibly for those countries that are highly dependent. So I think in the short term, that's the area that we want other organizations and governments to support as well. And then, the challenge with world hunger and, you know, SDG2, it's something that you mentioned in the beginning, Kate. It's something that many of our world leaders have been talking about for a long time and that COVID even before the war now exacerbated, but COVID turned us backward on our 2030 goals of the decade. So we have been as an organization as well, we have been listening to that, and that is one of the reasons that one of our sustainability commitments is about smallholder farmers, right. It's reaching a hundred million farmers with innovation, but as well, partnerships and collaborations like the Better Life Farming, for example, those centers are something that we invested heavily in Asia. And now more recently Latin America, or for example partnerships like Baygap with the value chain companies, because we are thinking about the food system, right? So with upstream companies, as well to think about how to actually provide training and provide support for farmers to access markets to be able to get into value chain certifications, to be able to lower their costs, to be able to, get into those value chains certification, and then as well, be more competitive to reach local and international markets. We have so many partnerships on the ground as well. In Africa, for example, we are also funding progress in places like our project with the MercyCorps in Africa, and the ADF2 program, which is actually our Bayer foundation. That was already tested, doing the locust crisis, for example, in Africa, but it's a digital service to scale digital services and products to boost the productivity of 2.4 million smallholder farmers in East Africa, of which 38% of those farmers are women. And we know the ripple positive effects when we are supporting women. But what I have been engaging with stakeholders specifically in the value chain, let's make sure we, our collective actions are in the places where we can really scale

things that are already on the ground, things that are being successful, that will help us to accelerate. And it will help us with solutions in the short-term instead of thinking about completely new ideas that maybe will not solve the problem. So we have so many interesting and good projects on the ground, not only from our organization but others. So, can we look at those? And then, can we think about, which are the countries that are going to be more impacted and then scale things on those places? It is a challenge that we are living, but as well as an opportunity to accelerate partnerships. Right? And I'll stop here, but, for example, and we talk about it a little bit and go back to the seed sector. Seed systems in Africa, how can we help too?

This is so, so important. How can we with the Gates Foundation with other organizations with CGIAR, how can we help to better bridge? How can we help to develop local companies or local organizations that will develop their own hybrid? This is so, so important. Seeds are so, so important for productivity and thinking about hybrids, drought-tolerant hybrids, for example, so, so important for climate change.

So, how can we scale those types of things that will have a long-term sustainable impact on livelihoods and sustainability as well? I think we should look and join forces on where resources and foundations are. And then places where they are not, we need to partner with governments and we need to think about other organizations that do have a footprint and expertise to solve the real problems that exist on the ground.

**Julie Borlaug:** I want to segue into what you were talking about expertise and entrepreneurial spirit. Bayer has been a fabulous supporter of the next generation, who I call the young students and, and people interested in agriculture, whether it's science or policy or other things. The next generation of hunger fighters, my grandfather called his, his hunger fighters as well.

They need a seat at the table. We need to believe in them. They don't look at this problem of climate change and sustainability, or even the Ukraine crisis, and think the world's just, you know, going to hell. They think there are so many things we can do. We've all just got to come together, but it's up to us in the older generations to make sure we give them a seat at the table.

They have a voice and we actually implement their ideas. They want a million dollars for their research. All of us can play a part and really challenge and support and bring them to the table. And that's one of the biggest things that I'd like to come across today is let's really lean in on the next generation.

**Natasha Santos:** Thank you for bringing that. And we are very committed, particularly evolving, more partnership approach on the next generation work that we do. And I love that.

**Kate Hayes:** I hear you both saying we need partnerships to invest in better infrastructure. And then of course, obviously the technology and as a company, that's what Bayer does - is produce the better seeds and the digital tools that farmers need. I don't think I even realized that a seed was an innovation until I started working for Bayer. And then I realized, yes, they don't just exist. It takes plant breeding. That's when I learned about Norman Borlaug like it takes science to make seeds better so they can grow in these environments. All of these things are happening long-term but I just, I know we need to get back to a place where we can kind of look ahead to the future, and Natasha, I wonder, especially in light of the current fertilizer shortage, that's happening, like any other innovations that you can quickly kind of talk about, to talk about how we're thinking about the future and how we change the way we do things now and make them better.

**Natasha Santos:** Yes. Kate, for example, we have the great focus and the great R&D machine that our organization is, but as well, we have the opportunity to look much ahead with our investments of our LEAPS program, right? That is looking at a few areas, such as solutions and investments that can bring solutions for food loss.

I think about plant breeding innovation as well. And then think about other investments or alternatives for fertilizers, particularly alternative sources. Then we have recently invested in a company called JoynBio, which is an opportunity to think about in particular with all this pressure



what are the alternative sources and how we can in an innovative way of alternative sources for fertilizers. So this was an investment by our LEAPS group. And I think that's where probably wants you to go, Kate, on the opportunities you have to think beyond and think about innovation that may not be in our core portfolio now, but our innovation that will bring solutions to farmers for them to farm more sustainably and more productive. Farm more with less as it is part of our principles in R&D as well.

**Kate Hayes:** Julie, any other thoughts on this topic? The things that I know you talked about gene editing earlier, and I know that's another big part of innovating seeds for the future. Anything else you'd like to add about innovations?

**Julie Borlaug:** I do want to say how much I love gene editing. I think the potential is enormous. And we're working within the plant. So, we're not bringing foreign DNA into the plant. And it's all holistically within, whether we're working in trees, whether we're working in wheat or corn, hopefully, one day we'll work in trees, but it has great potential and we have to allow the potential to reach those who are most in need. The other thing I would just say is innovation and research are only as good as when it gets out to the farmers. So if you look at what happened with Golden Rice that took years all because of political fighting and a lot of NGOs that didn't even understand what the purpose of it was. We now have salt-tolerant rice. I saw that the other day and read an article on it. That is an amazing accomplishment because that helped with the sustainability of climate change and provides access to rice for so many more people. So we've got to keep pushing the envelope on innovation. And when I talk about innovation and I know when you all are talking about innovation, we know that gene editing isn't going to be the answer for every developing area locally, you know. Innovation such as appropriate tools for female farmers to use that isn't the size of what a male uses or instead of a tractor, a tractor that can be assembled and is easier to use and you could push. Something like that. That is all innovation. And that's all technology transfers along with when you think about gene editing. So we go from high to low, but that technology has to make it off the shelf and be transferred to the farmers. And the one thing I would like to add is that for all those who are listening, who are involved in agriculture, share your stories, share your personalized stories about agriculture, with those who aren't familiar. And then they'll start to understand the plight of agriculture and why innovation is needed and why companies like Bayer are doing good. So please talk to anyone and everyone, I always say, if you're sitting on an airplane next to me and you ask what I do you are in for a long flight, so please take it. So my grandfather's last words were taken to the farmer. I also add take it to the public.

**Kate Hayes:** Absolutely. And just to make sure that anyone listening understands what you're saying about getting that innovation to the farmer, getting it off the shelf, that's where the policy-making comes in. Right? Because if the public is afraid of technology and protesting against it. And then, you know, policymakers say no, then it never gets to help anyone. So it's about being educated, educating people who aren't involved in agriculture to help them understand why innovation is so important. So if we wanted to improve the current situation being caused by countries being dependent on other countries for not only their seeds but also, you know, fertilizers and the tools that they need to grow healthy crops, what kinds of changes can we work on as an ag R&D company to make those tools easier for them to use and more successful in the areas where they live?

**Natasha Santos:** Well, we mentioned it is really designing innovations that solve real problems and have always the farmer in the center of our thinking and the center of the solutions that we are trying to design. Because one piece we discussed a lot about infrastructure, about access. One piece, of course, is access to innovation and for farmers to have access to innovation first, they need policies that enable that innovation to get to them. And second, they need to be able to use that innovation, understand that innovation and use that in their farming and the farming system to solve their problems. The pests. The disease. The weed pressures that they have.

But second, we need to design as a corporation, as we do, and others need to design solutions that are tailored for the needs of those farmers. Tropical agriculture is slightly different than agriculture in temperate countries. So that's why it is so important. That's why I'm so proud of companies like ours which understand that and design our R&D process and strategy in a way

that really accounts to solve issues of farmers, where they are on the climate conditions that they have along with the pressure that they have.

And I think this is more relevant than ever, particularly if we think about low and middle-income countries. If we think about regions like Africa and Asia. And as we discussed a little bit things, basic things like developing a local seed system. So you can design breeding innovations as well for the needs of those farmers. So I think more than ever farmers-centric approach is the only way we're going to solve the challenges of agriculture.

**Kate Hayes:** And do you think there will be a replacement for nitrogen fertilizer, which depends on natural gas? Like how else will farmers be able to fertilize their crops?

**Natasha Santos:** I think we can find alternative sources of course. I think countries could ramp up that production. And then second, there are innovative ways like JoynBio, or we can look at biological approaches. We can look at other ways to provide fertilizers and to provide that type of innovation to farmers.

**Kate Hayes:** So now we've talked about the current crisis and we've discussed lessons that can be learned from the past, but this podcast always comes back to a discussion about the future. Headlines of the Future.

So, Natasha, I'd like to ask you as we start to close this discussion if you look into the future eight years from now, is it realistic to achieve the UN Sustainable Development Goal of zero hunger by 2030? And if so, what's going to make that possible?

**Natasha Santos:** Thank you, Kate. Of course. We must believe in and do everything in our power to make it happen. Right? We talked about innovation today. We talked about partnerships and we talked about new ideas to solve the real problems on the ground, on the farms. So we shouldn't accept no for an answer, right? We should continue to challenge ourselves, others, and even our organizations. We need to continue to create those meaningful partnerships and have to mind those positive system transformations. Be the change that we want to see.

I believe a lot in that. So maybe going back on policy, I think, for example, the meeting of the G7 leaders in June this year is one of the most important in modern history, particularly for the goals that we have, particularly for the SDGs. So how governments this year decided to respond to that accumulation of risks that we discussed today like climate, COVID, conflict, and the higher food and energy costs. This will shape what is the immediate and future of the most vulnerable and the future well-being of all of us.

As we discussed, the action-oriented government should not act alone and they cannot act alone for us to think about that are more resilient, equitable, and secured food future we need to have the public and private sector know-how resources and commitment. So I think the headlines that I would like to see in the future regarding food security - always a question that made me think about my mom, my mother, like I started this podcast earlier- and you reminded me of the challenging time that we live in, and the terrible economic crisis and I cannot even think about what that would mean if it was exacerbated by war. Right? So, she fought so much. So I think the headline that I would like to see if I may is the one that, you know, those conversations and partnerships and my mom herself inspired me to share that is that all the daughters of our mothers or the granddaughters of our grandfathers have achieved the food system transformation that provides food that is both nutritious, environmental, sustainable, and affordable for everyone, for as men and women, boys and girls everywhere.

So I believe it, I think we can do it because we have organizations like ours, people like Julie, like us, that we'll do everything we can to make it happen. So yes, I believe we can.

**Kate Hayes:** So your headline would be something like women close the book on food insecurity.

**Natasha Santos:** Yes.

**Kate Hayes:** I like that. And Julie, what would your headline be?

**Julie Borlaug:** Well, my first headline would be, there are no famines, *no more famines*. It's all man-made so that we can end that right now. But one that I would like to see, and this is out there is *personalized seeds for farmers*.

And of course, that would go with gene editing or just regular traditional breeding, but that a farmer can know that he needs this type of technology, these type of traits for this part of his farm, whether it's one hectare or 3000 hectares and we can get exactly, almost a prescription, what that farmer's soil, how it goes to the climate and every other need nutrient need and we can have that exact seed for them. So I love to see that happen.

**Kate Hayes:** Thank you so much, Julia and Natasha. And thank you to our audience for listening to Headlines at the Future. We hope you found this dialogue interesting or enlightening, and that this episode helps you better understand the current state of food security and the challenges the world is facing along with the possibilities for solving them.

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