



ARE FARMERS WILLING TO PAY FOR DROUGHT TOLERANT RICE? EVIDENCE FROM BIHAR AND OTHER POLICY RESEARCH PRIORITIES FOR CEREAL FARMING SYSTEMS IN SOUTH ASIA

AUDIO TRANSCRIPT

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PRESENTERS

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Patrick Ward, International Food Policy Research Institution

Julie MacCartee, USAID/BFS (moderator)

PRESENTATION

Julie MacCartee: Good morning everyone. We are ready to get started. All right. Thank you all.

I apologize for the delay. We always have some hurdles to jump through sometimes here in the M17, M18 room with Internet connectivity, but I'm really glad to see that everyone here in person has been chatting and networking. And I hope that you who are joining us online have been doing so as well.

So welcome. My name is Julie MacCartee, and I'm a Knowledge Management Specialist with the USAID Bureau for Food Security, and welcome to our February Ag Sector seminar entitled *Are Farmers Willing To Pay For Drought Tolerant Rice? Evidence From Bihar and Other Policy Research Priorities For Cereal Farming Systems In South Asia.*

This is, just happens to be the third Ag Sector council in a row for which we've had some sort of snow delay or closing, so we've been a little bit cursed this winter, but we've been delighted to have a steady following, especially of our online participants. So thank you all for being here today.

The basic housekeeping issues - please remember to silence your cell phones. But if you are a Twitter aficionado, please do feel free to use those cell phones, or if you're joining online to Tweet, and our hash tag is #agevents, which is up here on the screen.

For the online participants, please feel free to share your Twitter handles, your networking contacts, your personal or professional websites. We love to see that sort of networking going on.

And last but not least, we are recording this session, so we'll have it posted on Agrilinks in about a week, and make sure to send the recording to all of you. And as part of the implication of recording is using the microphone to help us get everything recorded. So when you're asking a question, please remember to state your name and to just wait until someone's passed you one of these handheld mics to make sure that that's recorded.

So without further ado I will pass the mic on to John McMurdy, who is our International Research and Biotechnology Advisor at the Bureau for Food Security, and he had been great in helping getting this particular session set up. So thank you John.

John McMurdy: Thanks. Thanks Julie, and thanks everyone for making it in this morning. I think for once we can be proud to be in D.C. that we didn't shut down the government with a little bit of snow. So good for us that we pursued.

I think this is another good opportunity to highlight the work we do in sustainable intensification, highlight the work we've been doing for a little more than five years now in South Asia with the program called the Cereal Systems Initiative for South Asia. David's going to talk a little bit more about the, kind of some of the overarching themes of the program, but I think we, it's probably safe to say that we've used the model that's been developed by CSISA as a data to inform many of our other new and sustainable intensification programs.

So I think it's really been kind of at the forefront of how we've been thinking about how we, how we approach some of these challenges. And I say that to mean it's not just the, it's really a focus on a comprehensive program. It's not just a breeding program, it's not just an agronomic research program, it's not just a policy research program. It really an activity that synthesizes those all into one sort of coherent, coherent activity.

So I think what you'll hear today is a very interesting example about, very interesting example about how we make the, how we make the case for more private sector involvement.

So maybe to step back a second. So we've talked a lot – you've probably heard in the past six, seven, eight months now, maybe even longer about the scaling of technologies. You've heard Dr. Shaw talk about the scaling of technologies. You have Andy, who was in the room, was leading our scaling effort for quite a while. And as we know, we're not going to get to scale without the real heavy involvement of the private sector, the heavy involvement of the, of industry, to mean local industry and international industry.

And I think a lot of the questions that the policy side of the CSISA program are looking to answer are, what are those business opportunities. What are that, what's basically going to – what's going to be an opportunity for an entrepreneur? What's going to hold up the ability to really push innovation and scale it?

And then a lot of this research, the policy research under CSISA looks at answering some of those primary questions. So I think that will be a bit of what you get today from David and Patrick.

And I think the addition to that is a lot of this work can really inform governments, can inform governments of where, where are very discreet policy opportunities, where are very discreet areas where frankly they're getting in the way, or frankly they could make technologies more, more scalable, release some of these barriers to adoption. So another kind of discreet goal.

And third, certainly the interest in rice technologies for us, this is an area where we have a lot of investment, USAID, the U.S. Government in South Asia in developing a lot of new rice technologies. The hybrid rice, a lot of work on antibiotic stress tolerant, both through conventional and advanced breeding methods. So this is a pretty, pretty important question to us. We're spending all this money developing all these technologies, but are farmers willing to pay for it, pay for drought tolerance, pay for hybrid.

So it's a pretty fundamental question that hopefully you would have thought to ask earlier on, but we're asking this question now, and I think it's an important one.

My last comment before I stop yammering up here would be, I've heard, I've heard David give some of these talks before and I really find it kind of interesting, not being an economist, but the way that, the way that these things are set up. So I very much find it – I don't know how to describe it – cool economics maybe. I don't know. Maybe there's an uncool economics, but this is definitely cool economics.

And from the, from the engineer side in me I think it's pretty fascinating. So with that I'll turn it over to our speakers. Maybe I'll introduce both you guys and then David, you're going to go first? Yeah.

So David Spielman is a Senior Research Fellow with the International Food Policy Research Institution, IFPRI, where he focuses on agricultural science policy, seed systems, and community driven development. David previously was based in Adis, and earlier in his career he's worked on development topics for the World Bank, Aga Khan Development Network in Pakistan, and several other organizations. He has his Ph.D. in economics from American, Master's from the London School of Economics, and B.A. from International Relations from Tufts University, and is a child, son of a USAID guy, I believe, if I remember correctly.

And Patrick, Patrick is, Patrick Ward is an Associate Research Fellow with the International Food Policy Research Institute. He's based in New Delhi, India. His research focuses on policy and behavioral issues related to risk management and new agricultural technologies and practices to promote the sustainable intensification of cereal systems in the Indo-Gangetic Plains of South Asia. Patrick has his Ph.D. in Agricultural Economics from Purdue, and before this was a visiting researcher with the International Center for Climate Governance in Venice, Italy.

So great, I'll turn it over to David then.

David Spielman: It's always a pleasure to present our work today. [*Microphone turns off* 7:28 - 7:59]

Julie MacCartee: If we hear duplication we'll tell you _____.

David Spielman: All right, that's a lot of things to hold, but okay. Sounds good. Everyone okay. This mic is okay? Great.

Okay. That's okay. Is that better? Do you have the sound? Okay, perfect.

So the work we're going to present to you today was conducted under the auspice of the Cereal Systems Initiative for South Asia. CSISA's overall, overarching goal is to increase food, nutrition, and income security at scale in a _____ manner in South Asia through sustainable intensification of its cereal based systems.

So the project spans from the Punjab of India and partly Pakistan across the Indo-Gangetic Plain to Haryana, Uttar Pradesh, on over to Bihar. You go down into northern Bangladesh and southern Bangladesh which is the Feed the Future zone, as well as the Indian state of Odisha.

There are some notable states that are left out in that sort of geography, Chhattisgarh, Jharkhand, and West Bengal among others. Nonetheless, this entire area is what we refer to as the Indo-Gangetic Plain or Plains, and it's an area where wheat, rice, rice wheat systems, rice other crop systems, and rice systems are prevalent, and it's an intensively cropped area. I think many of you have either worked there or are familiar with it.

It is, in parts, especially in the Northwest, the breadbasket of South Asia. But a lot of that production is shifting or will shift eastwards towards places like Bihar, towards places like the eastern side of Uttar Pradesh that are relatively underdeveloped in terms of infrastructure, in terms of productivity, in terms of technology. So these are areas we're focusing in on – Odisha, Southern Bangladesh and other area.

So, like I said, it's being implemented now in three countries. There are two donors to this project. USAID is one of them. The Bill and Melinda Gates Foundation is our second donor. We've completed the first phase of this work, which was really I think exploratory, setting up a sense of what technologies we were going to focus in on.

I presented in the past with my colleagues on laser land leveling, one of the CSISA technologies that is particularly interesting. In phase two we're scaling up a lot of this work and reaching a large number of farmers, and still doing some very good I think adaptive research.

The impact challenge is obvious. Catalyzing durable change with millions of small and medium scale farmers. The scale is enormous, the challenge is enormous, and figuring out just how to do it through a blend of good systems agronomy, crop breeding, policy change or policy reform, and private sector investment along with the public sector seems to be the way we have to put things together to make this happen.

I should point out that the project is motivated in part by USAID's own sort of larger portfolio of investments in agriculture development and sustainable intensification in small holder systems. So what we're talking about today, drought tolerant rice cultivars and hybrids really plays into USAID's own sort of long, long standing portfolio of investment in Ag research.

This is the portfolio that I'm sure some of you know and may have been involved in that brought herbicide resistance _____ in West Africa. It brought out the BT eggplant, the insect resistance transgenic eggplant in India, which recently have been released in Bangladesh. [*Microphone cuts out*] not only with technologies but with better policies.

So policy research is one of several components of this big project, in this sort of umbrella project, if you will. And the idea is that better public policies are needed to improve the prospect for agricultural technology development and insemination, private investment in agricultural inputs and services and technologies. And ultimately, public/private partnerships that focus in on small and medium sized farmers.

Science alone, we argue, is insufficient. In our research agenda at IFPRI focuses in on two particular issues. The first is encouraging private investment and these partnerships in pro-poor technology development and delivery. And the other one is looking at, and especially in our second phase, this issue of changing labor gender assets and migration dynamics. So there's a lot of change going on in South Asia right now. A lot of men have moved to the cities, to the construction sector. A lot of rural labor has, if not disappeared, has started to sort of contract. There's a lot of feminization of farm work, farm labor, and these dynamics are creating a lot of change.

And understanding exactly how you deal with those things – I mean is it all about labor saving mechanization? Is it all about cultivars that are resistant to abiotic stress? And there's so many different things going on. Understanding those dynamics and not falling back on sort of the priors we all have about what Asian agriculture is or South Asian agriculture is, it's really important. Bringing new evidence to the table is really important.

So over the last four years we've done a lot under CSISA. We've been very busy. We've had a great time doing it as well. And I can roughly categorize the work we've done on policy reform issues into three areas. One are seeds, trades, and fertilizer. So we've looked at a host of issues – sorry for the microphone – such as industry structure in the seed and biotechnology sector. We've looked at the role of hybrid rice, which we're going to talk about in the context of this study. We've looked at stress tolerant traits in both Odisha and Bihar, and we're looking more at fertilizer now and how farmers deal with balanced fertilizer use recommendations.

We're really interested, like I said, in this machinery and equipment aspect. There's a lot of scope for mechanization in South Asian in agriculture, like I said, because there's a labor shortage in many areas. If so, what are the appropriate types of mechanization, especially with respect to machinery that can help conserve resources as well as increase productivity or yields on farm.

And we're looking at various crop management and risk management mechanisms, such as the combination between weather index insurance and things like drought and flood tolerant cultivars.

So that gives you a scope of all the different things we do and are doing. We'll be working on this for the next several years and continue to amass data. We present and interact with policymakers throughout South Asia. It's not an easy task. Policy change is a very complex process, and evidence based narrative we provide to policymakers and decision makers in the private sector is only one element that influence the decisions they make.

Witt that in mind I want to turn it over to my colleague, Patrick, and he'll go through sort of what we've learned about drought tolerant rice in Bihar from a choice experiment, and he'll give you a sense of the issues we're dealing with in more detail. Thanks.

Patrick Ward:

So David, as David mentioned the remainder of the talk today is going to focus on one particular study that we have done as part of IFPRI's contributions to the Cereal Systems Initiative for South Asia. The overall question that was driving this research is, are farmers willing to pay for drought tolerant rice?

As John mentioned, something that has received a lot of interest, and so we kind of took it upon ourselves to look at the feasibility of a drought tolerant, both tolerant cultivar and a drought tolerant hybrid within the context of a particular state in India, Bihar, which is one of the poorest and least develop states in the entire country.

So we had a couple of primary objectives that we're looking at when we undertook this study. First we wanted to estimate the demand for drought tolerant rice using a method known as discrete choice experiments, and I'll explain more about that method as we move forward.

One of the nice things about this method is it allows you to decompose a seed into its various traits. Not necessarily a seed; it allows you to decompose a particular good or commodity into its various traits, and then evaluate out the consumer, or in this case the farmer, feels or values each of these different characteristics.

Using a statistical method we were able to then look at how tastes and preferences vary across population. And then ultimately we wanted to analyze the potential for both public and private sector involvement in the research, development, and delivery of pro poor technologies.

As both John and David have mentioned, one of the only ways that a technology like this can really be scalable is if we have private sector involvement. To date most of the work that has been done has been done by public sector or even international research organizations. But there is a lot of interest in seeing the private sector get involved. Private sector is generally more efficient and able to bring things to scale at a much more rapid and sustainable rate than the public sector.

So this raises an interesting issue. How do we combine the efforts to incentivize the private sector with the efforts to reach small scale resource poor farmers, which is ultimately our primary objective in bringing about these kind of technologies. And there are a couple of examples of how this has been done in the past.

One would be humanitarian use exemptions where the public sector has been able to get a hold of private sector property rights and use them to specifically target disadvantaged groups. Another would be technology subsidies where the public, public sector funds are given to the private sector to produce a technology that can be specifically targeted towards specific groups. Technology embodiment in which you embody the technology in a product that only appeals to certain disadvantaged groups. And then finally, market segmentation where you're able to build marketing strategies that are explicitly able to target specific groups.

And these are just a few examples of how each of these different strategies have been used in the past.

So our particular study is interested in a particular type of abiotic stress tolerance. We're particularly interested in drought tolerance. So this - I just want to take a few seconds to describe the problem of droughts in rice production in Bihar. Droughts are a significant constraint to rice production. Rice is very heavily dependent upon water and India in particular has a lot of areas that are particularly sensitive to low, low water environments.

India has 22.3 million hectares of what might be classified as unfavorable areas. This includes 6.3 million hectares of upland rice and 16 million hectares of rain fed low land rice. And these rain fed low land rice areas are really, really particularly sensitive to droughts and are an area in which a drought tolerant technology could essentially be transformative.

Twenty percent of India's total rice area is drought prone. And then the evidence suggests that droughts have significant effects, or evidence suggests that droughts have been occurring with greater frequency in India and around the world, and so if this trend is going to continue, it's possible that droughts will occur with even greater frequency, even greater severity going forward, which just highlights the scope for a technology of this sort.

So this figure shows periods of drought and total rice production in India dating back to the early 1960s. So since the early 1960s there have been a total of 15, 15 times where rice production on a year over year basis has failed to exceed that from the previous year. And as you can see from these graphs, the majority of these occurrences have happened to coincide with serious droughts in several key rice growing regions of India. These gray bars representing different drought periods.

So we can see that a lot of times where we have these downward drops they coincide with drought occurrences.

Now there are a couple reasons why droughts can affect total rice production. One is that there is generally a decline in area cultivated under rice. So as we can see here dating back to 1999/2000, in several of these years in which there have been droughts, there have been significant declines in the area devoted to rice production.

It's also the case that when ___ droughts occur there is a decline in rice yields. Again we see a similar trend whenever there is, whenever there is a drought there is usually decline in yields from one year to the next.

So there are definitely implications of droughts for rice production. There are also secondary social consequences of droughts. Droughts often result in lower farm incomes since farmers generally have lower marketable surpluses that they

can sell to the market. There are also prices for consumers. Lower supply in the market means a higher price at the market.

Farmers are also forced to increase indebtedness or deplete their productive asset base as they try to smooth consumption due to their lower farm incomes. This can result in higher incidences of poverty and malnutrition. And there's increasing evidence that shows that even when droughts do not occur, the risk of a drought, the background risk of a drought can force farmers, or compel farmers to take less than optimal investments or use lower than optimal inputs which then sort of traps them into a low productivity environment.

Now in this low productivity environment or in this context where droughts pose these significant risks, a product like DT rice could potentially provide a means for reducing the risk, avoiding the increasing threats of droughts.

One thing we can note about DT rice is that we considered a productivity enhancing technology rather than necessarily a productivity increasing technology. And the distinction is the productivity enhancing implies that the variability of yields is reduced rather than simply increasing the expected value.

Now in many cases, and in the particular case of Sabaghi Dahn, it actually is able to perform quite well under normal conditions, so there's not a yield penalty, while maintaining its yield under conditions of drought.

So this Sabaghi Dahn was developed by the International Rice Research Institute. In India it's marketed as Sabaghi Dahn. In Bangladesh it's marketed as Birridahn-56. It has a different name in Nepal where it is marketed. It was released in India in 2009, and the first two states were Jharkhand and Odisha.

Sabaghi Dahn is tolerant under drought stress, so it's able to maintain advantages over check varieties in rain fed, drought affected conditions. So the check varieties that it's compared to here are IR36 and IR64, and it maintains a yield advantage of 29 percent and 19 percent over these check varieties under drought stress conditions.

And as I mentioned, there's no yield penalty under normal conditions. In fact, Sabaghi Dahn actually performs better than these check varieties under normal conditions.

So this all sounds great, right. You've got a DT variety that outperforms the check varieties under normal conditions, but also performs better under drought stressed conditions. There are a couple of challenges to DT adoption. One of which is that some researchers have argued that it may not necessarily perform better than other varieties under normal conditions. I've mentioned that this

particular variety outperforms IR64 and IR36 under normal conditions, but those are just two varieties. And there's a lot of other varieties in the area, and this particular variety might not outperform those under normal conditions.

So in that case farmers might not observe the benefits of this variety relative to other varieties that they may grow.

The same thing can be said under extreme stress levels. If the drought is severe enough, then the benefits of the drought tolerant variety basically comes to zero, and it performs just as poorly as the non DT variety.

So it seems as though moderate drought stress levels is the optimum level by which we can observe the benefits of the DT relative to the other varieties. Now the thing is, you don't observe a moderate drought stress level every year. And so this complicates the learning about the benefits or the technology relative to the non-drought tolerant variety.

And the way technologies are primarily disseminated, at least in the way we talk about it in economics literature, is you either learn from doing yourself or you learn from others. And with the situation where you don't observe the benefits on a year in, year out basis, it's difficult to learn from your own experiences, and also difficult to learn from the experiences of others.

So these challenges may affect the dissemination of drought tolerant technologies. It can also constrain the demand for drought tolerant technologies.

To estimate the demand for drought tolerant technologies we use a methodology known as Discreet Choice Experiments. They are hypothetical choice scenarios in which respondents are forced to choose among a series of hypothetical alternatives. These are designed to ascertain how farmers evaluate different choice alternatives. We're able to decompose their preferences for alternatives into how they value each of the characteristics that are embodied in a particular alternative.

We can use, because these are hypothetical we can use these to evaluate preferences for goods that are not yet on the market or that do not have functioning markets. These are used a lot of times for things like environmental amenities, things that are difficult to value in a market setting. But the nice thing about this is that it closely simulates real world purchasing decisions, so you can force people to behave as though they were engaging in an actual market.

All right, so this is an example of a choice task that is used in a discreet choice experiment. For those in the audience you'll find one of these on your seats this

morning, and for those that are participating over the web, this should be available on the Event page.

So this is in English, but the actual choice, choice test that we use during our survey were translated into Hindi so that the respondents could actually look at it and read it for themselves. But what this does is it describes a series of hypothetical bundles of randomly varying seed characteristics. And the characteristics that we included were the duration, and this is the length of time from seed bed cultivation to harvest; the yield, and this is in maunds per acre. And a maund is a local unit of mass equivalent to 40 kilograms. We included an attribute for whether the grain can be stored and reused as seed next season. This is a characteristic that captures economic value of hybrids.

We included the seed price, because this allows us to have a monetary measure for willingness to pay. And then an attribute known as the seeding rate, and this is the amount of seed that is required per acre of land in order to attain a full, a full plot.

So each one of these characteristics is then broken into three different alternatives. We have Seed Option A, Seed Option B, Seed Option C, plus a status quo option farmers could simply revert back to the seed that they used during the previous season.

Now by having these different options with these different combinations of attributes and different levels of these attributes, it forces the consumer to evaluate, just looking at these different options, which one of these four alternatives they would prefer the most.

So for example, Option A is a long duration variety. Farmers might say, oh I don't really want a long duration variety, so they might just block out all of Option A and focus on Option B, C, or their current seed, Option D. Maybe they'll look at Option C and say, oh it's a short duration variety. I like short duration variety. It allows me to escape perhaps an early monsoon withdrawal, but this only, this only yields 50 maunds per acre under normal or irrigated conditions, and yields only 16 maunds per acre under a severe drought condition. Plus, I can't save my seed and reuse it for next season.

So maybe I don't like Option C, even though it is only 25 rupees. Maybe I like Option B, which is a medium duration variety, high yielding under normal conditions, maintains its yield advantage under hot, severe stress conditions. I can, I can save it and reuse it next season, even if it does cost me 140 rupees per kilo.

So this just helps farmers to think through what their decision making process is. We collect information on their particular choice, as well as secondary information about what was their thought process, what factors went into them making a particular decision. Were there any factors that they ignored while making their decision, which just helps us to understand more comprehensively the actual decision making process.

At the same time we also conducted some experiments meant to measure farmers' preferences towards risk and potential losses. The handouts that were on your seat this morning, if you flip over to the backside, these contain a couple of these experiments that can be used to measure risk and loss aversion.

Now the way these work is they are a series of hypothetical lotteries. In each case farmers were able to choose Option A, which in some cases is a certain payment, or Option B, which is a lottery that has a potentially high payment and a potentially low payment.

In the second experiment towards the bottom of that page both Option A and Option B are lotteries. Option A is a winning payment which has a positive sum in both cases, and Option B is a losing payment, which has a negative sum. Based on farmers' responses to each of these two options, we were able to gauge quantitatively a measure for their degree of risk aversion and loss aversion. This is really important because it allows us to characterize different farmers and see whether or not their preferences for drought tolerance is driven by their underlying behavioral characteristics such as risk aversion and loss aversion.

As I mentioned, this study was conducted in Bihar, India. As David as alluding to before, CSISA operates in much of the Indo-Gangetic Plain, which starts up here in Punjab and Haryana, moves down across Uttar Pradesh into Bihar, and then into Bangladesh. Also covers the Torai belt of Nepal.

But this is the state of Bihar. As I mentioned before, it's one of the poorest and under, most under developed states in Bihar. We randomly sampled farmers from three rice produced, heavily dependent rice producing districts. Madhubani, which is the north, bordering Nepal, Bhojpur, which is kind of central west, right along the, right along the Ganga River, and Nawada, which is in the south.

So these three districts provide a great deal of geographic heterogeneity. There's also a great deal of economic heterogeneity. Bhojpur and, Bhojpur is one of the wealthiest districts in the state. Nawada is also rather wealthy. Bhojpur and Nawada have high rice productivity. Madhubani is one of the poorest districts and has ___ low rice productivity. But all three districts are considered drought prone.

Bhojpur was part of India's drought prone area program up until 2010, and Madhubani and Nawada are both part of the drought prone area program as of 2010 into the present.

This map shows rainfall deficiencies during the 2012 ____ season. That's the monsoon season in India, which starts from about the beginning of July and goes to about the end of September. And this shows rainfall deficiency deviations from long-term averages. And as we can see, these three districts both experience really significant rainfall deficiencies during 2012. Bhojpur - 32 percent below average; Madhubani - 48 percent below average; and Nawada - 49 percent below average.

So they are very familiar with experiencing droughts. They know the effect that droughts can have on their total production. And so this was going to be fresh on their mind and would hopefully be really informative into their decision making process.

So I know this figure is maybe a little bit confusing, so I'm going to take a little bit of time to explain what's going on here. This figure shows farmers' average ____ median willingness to pay for each of the different rice attributes. We included six types of yield attributes, varying combinations of yields under the different rain_____.

So these are listed across the bottom here, these six – Inbred 1, 2, 3, Hybrid 1, 2, 3. And then we consider things like the duration and then whether the seed can be reused. I realize that I mistakenly left off the valuation for the seeding rate, but I can, but I can discuss, discuss the results of that.

What these figures show are these dark lines represent the mean willingness to pay. The boxes show interquartile ranges. These kind of tails show the min and the max excluding outliers, and then the circles show the outliers. So what we can see from this is there is generally a really significant and positive willingness to pay for these higher drought tolerant yields.

There's a great deal of variation for the yields corresponding to the hybrid seeds. Much less variation for the yields corresponding to the inbred seeds. We also see that on average there is a negative willingness to pay for the process of having to buy new seeds every year. So I mean this is fairly consistent with what might expect. There's a tradeoff between having to buy new seeds every year, which is generally an attribute of hybrids with the higher yields that you, that you're able to attain through hybridization.

And then there's a positive but much smaller willingness to pay for short and medium duration relative to long duration. So we do find that farmers prefer

short duration more than, more than long duration, and they're willing to pay more for shorter duration than they are for something that is a medium duration.

We also see, kind of as I alluded to, there's wide variation in farmers' preferences for the different characteristics. These figures show how the distribution of valuations change when we incorporate things like risk preferences. And what we see is that when we control for risk and loss aversion these distributions all shift to the right, which means that as we incorporate things like risk aversion into studying the farmers' valuation, we actually see that it increases the way farmers perceive these different, these _____.

And these are just for the yield distributions. When we look at the other attributes we actually find that there is no, no effect of incorporating risk, risk aversion. So it's really interesting that when we, when we include risk aversion _____ analysis we see that that increases the valuation that farmers place for these drought tolerant yield distributions.

We can also – okay, maybe it's a little bit difficult to see this dash line here. Can everybody see that okay? Okay. We can also bundle the willingness to pay for each of the individual attributes, get what might be the willingness to pay for different hypothetical seeds.

So in this case we took characteristics for a drought tolerant hybrid and compared them with the willingness to pay for a drought cultivar very similar to IRRI Sabaghi Dahn. And we were able to trace out demand curves for these two hypothetical seed bundles, actually the one that's listed as inbred is actually a real seed bundle. Those are the characteristics of Sabaghi Dahn. But we were able to trace out the demand curves for a hypothetical DT hybrid and compare that with the demand curve for something like Sabaghi Dahn.

And we see there's a great deal, very, very different structure for demand between the two, the two products. Demand for the DT hybrid is much less sensitive to price. So if you adjust the price, even by a relatively large amount, you're not going to see a huge increase in either the area of land covered by the seed or the quantity of seed demanded. There's much greater sensitivity for something like a DT cultivar where particularly in this region here a small increase in price can lead to a significant increase in the area of land that's covered.

One thing that's interesting about this is that there is this group of, group of farmers here and group of farmers here who either really like the DT cultivar or really dislike the DT cultivar. These may correspond to the same farmers that really like the DT hybrid and really dislike the DT hybrid. But it's really quite interesting that there's just this huge like straight line on both ends of this curve.

So some general observations that we can take away from this. As I alluded to, the demand for the DT hybrid far less sensitive to price. So a reduction of the DT hybrid is not likely to have a large effect on DT hybrid demand. There are significant differences in the demand structure for these two. Demand for the DT hybrid reveals a much greater degree of variation in preferences among the different farmers.

The DT hybrid, or DT inbred does ____ vary a great deal. For a large portion of this figure, the willingness to pay varies within a very narrow band.

The fact that there are these differences, different demand structures suggests that there is potential natural market segmentation. You have a group of farmers that really like the DT hybrid and are willing to pay significant premium for that, which suggests that there is a potential market for private sector to take advantage of. And yet, there's a large portion of the population that would not be willing to pay a premium for the DT hybrid, which suggests a potential market for a DT cultivar like Sabaghi Dahn.

So as we say here, there is a role for both public and private sector involvement in the delivery and development, discovery, delivery and development of DT seeds.

So overall takeaways, we definitely found that farmers in our sample really liked the reduction in yield variability that were conferred by these hypothetical DT seeds. They were willing to pay significantly more than what they are generally paying for seeds. As we can see from this figure here, I mean the willingness to pay for some farmers ____ all the way up to almost 700 rupees. This is significantly more than farmers are currently paying for many, for many of their seeds.

But they're willing to pay the most for seed that not only offer reduced yield variability during times of drought, but also performed better during normal conditions as well. Not completely surprising farmers are risk averse, but they also like to have yields under normal conditions.

There were a significant segment of the market that values the yields and lower seeding rates for the DT hybrid. Yeah, which suggests that as I alluded to before that ____ a DT hybrid and a DT ____ could definitely coexist. This also suggests there is the role for potentially public/private partnerships that could develop these DT hybrids and DT cultivars simultaneously to reach more resource poor small holder farmers in Bihar.

Thank you. *[Applause]*

QUESTIONS AND ANSWERS

Julie MacCartee: Thank you so much. We are now open to questions. So we'll take some from both the in person audience and online, and we'll start over here. Please state your name and organization when asking a questions. Oh yes, and our two speakers will drag their chairs up to the front to make it easier to see you all. I'll pass it back here first.

Thank you, _____, a _____ Climate Change Advisor. That was an interesting presentation. I was kind of intrigued by the graph for the quantity of seeds. You know the DT hybrid, despite being lower priced, is only, you can only acquire what three times less than, or four times less than the inbred? Is that correct? So what was the cost for, what was the reason for a lower - is it lowered option rates or I'm still kind of curious that price is not a big driver there.

And the other thing was if you can unpack a little bit more the impact of socioeconomic diversity across the three districts that you looked at. Thank you.

Patrick Ward: By the fact that hybrids generally have lower seeding rates fewer seeds are required. Because of the hybrid vigor that results from heterosis, the hybridization process, fewer seeds are required to cultivate a particular area of land.

Male: [Inaudible]

Patrick Ward: Yeah, so we have the same, the same farmers are represented by each of these demand curves. So we have, we have the willingness to pay for the DT hybrid and the DT cultivar for the second set of farmers. So I mean the total area is the –

Male: [Inaudible]

Patrick Ward: Yeah. Yeah. Yeah. Socioeconomic characteristics, differences between the three districts. Okay, so let me just – so Bhojpur and Nawada are both relatively wealthy, relatively developed. The capital, the capital of Bihar is Patna, which is in this district right here, so Bhojpur is in close proximity to Patna. A lot of people from Bhojpur migrate to Patna for labor. So it's generally relatively wealthy farmers generally own moderately larger tracts of land. They have access to _____ irrigation.

They are also, a lot of the farmers here are rapidly adopting SRI. I think there was a farmer in Bhojpur who claimed to have yielded 22 tons per hector using SRI, which is about four times the national average.

Madhubani is a very poor, poor district, very underdeveloped. Any other like specifics that you –

Male: [Inaudible] is there a difference in - how does that socioeconomic difference between these sites impact their risk aversions, or how willing are they to adopt a new technology. Because I might have missed it, but clearly the socioeconomic issue is a big deal.

Patrick Ward: Yeah. Yeah. So what we found is that largely driven by difference in wealth, we believe, farmers in Bhojpur and Nawada were willing to pay more for the DT seeds, both the DT hybrid and the inbred. Farmers in Madhubani were willing to pay less, but we think that's largely due ____ income rather than necessarily geographic heterogeneity or anything like that. Does that address your question or?

Male: [Inaudible] they might be more willing to try out something new that doesn't put them in the same situation. So they might be less, you know they might be more, they could probably take a larger risk because they've already lost something so there's nothing to lose if I go with something new that has a promise of giving me something better.

Female: [Inaudible] less ____.

Male: Or it could go by the other way too. So the socioeconomic status of the farmer has a huge impact on how it plays out, and I was trying to see how that, this aggregates between the three districts your whole results. So if you were to plot the results for individual districts how would it play out? What would be the dynamics that emerge?

Patrick Ward: Individual districts or individual households really. I'm good.

Julie MacCartee: Do we have a question from our online audience?

Female: The first question is of course related to that. It comes from _____. Regarding the feminization of agriculture, how does that impact ____ and improved variety of ____? Are different features demanded? Does it impact willingness or ability to pay?

Patrick Ward: You want to take that one or should I?

David Spielman: It's a fantastic question and it's something that I don't think we have much insight into. We are working on some sort of gen – sorry I'm having an echo here – we are working on some sort of the gender dynamics of this particular choice experiment. It's a separate paper we're working on.

The feminization of agriculture has huge implications for many different things. If you're talking about some of the work CSISA has been doing on resource conserving and labor saving machinery and equipment, I think there's a strong case to be made, or at least there's an empirical question as to whether women will own or custom hire, or rent, or use labor saving machinery, particularly for farm production.

I think there's a lot of heterogeneity in how households manage female labor and labor more generally. They use their own household labor. They also hire labor depending on their relative wealth from other communities.

So understanding those dynamics is really important. In this particular case I mean you had some, first you have female heads of households, but you also interviewed women – we interviewed women and men in different situations. And what were your observations? Do you remember?

Patrick Ward:

Yeah. This analysis is still ongoing. One of the things that we observed was that on average women were generally more risk averse and were willing to, had a higher marginal valuation for the types of seeds that didn't necessarily produce better yields under normal conditions, but had less variable yields under moderate drought stress.

We're continuing to try to unpack that more and see the relationship between, see to a greater degree the relationship between women's role within the household and their role in decision making coupled with their risk preferences and their preferences for the different seed characteristics.

But to touch on something else that I think the question was addressing, there's a lot of problems of asymmetric information when it comes to women and the feminization of agriculture and their access to these new technologies. For one, it seems largely that women don't know where to go to get information about new seeds, new technologies. On the other hand, extension agents and private sector custom hire dealer, customer hire service providers or seed dealers don't exactly view women as a potential market.

So some of the work that we're doing in CSISA, in Odisha in particular, is utilizing a system of nongovernmental organizations that have women self-help groups, and we're trying to bring these two parties together and create opportunities for sharing of information and human capital building so that women know where they can go to access information. The service providers and seed dealers can view women as potential markets, which may be increasingly important as this feminization of labor increases as more and more men move, migrate to the city, or as more and more men take up nonfarm employment as a result of the – so India has a program called the Mhatma

Gandhi National Rural Employment Guarantee Scheme which offers rural laborers up to 100 days of nonfarm work at a market wage.

So as more and more men take advantage of this, this may result in more and more women being the primary farm decision makers. So as we're able to facilitate this information sharing, it may be beneficial for the women that are left behind.

Julie MacCartee: Okay, next.

Female: Thanks for your talk. I appreciate any study that looks or tries to tease out risk averse behavior. Not easy. This is a study design question. When you, you have the three choices of potential seed and then the one that people use currently. Were you aware of what their current seed was, because of course the status quo would affect their choices.

Patrick Ward: Absolutely.

Female: So if you did know what the seed choices were, did you aggregate the data based on what their current perspective was?

Patrick Ward: So we collected information on what their current seed was as well as the characteristics of that seed, or at least their perceptions of those characteristics, and then used that when we were doing our statistical modeling to see how the hypothetical seeds compared with their status quo.

Female: [Inaudible] Did you see a big impact [Inaudible]

Patrick Ward: We weren't able to parse anything out like that. What we were able to see was that only 11 percent of farmers, only 11 percent of total choice scenarios. Each farmer was presented with nine of those choice scenarios; different ones. Not the same one nine times. But only in 11 percent of those total number of choice scenarios did farmers actually prefer their status quo rather than the hypothetical ones that we were, that we were including.

Female: [Inaudible]

Patrick Ward: Yes, we, we had, yeah. Yeah.

Male: Tom Timberg, consultant. There were a number of just background clarifications. You do know what kind – what – who is selling seed or distributing seed at the moment in these three areas. I gather from what you were saying of the _____ seed would be distributed through some public sector channel whereas there are some, to what are extent are competitive private sector channels actually available in any of the three areas?

The other thing which – the tray study indicates that the Mhatma Gandhi scheme is basically not working in Bihar. Other things are working, _____ etcetera. Now to that, to the extent that that's the case - on the other hand people are moving out of Bihar, migrating and large, at rapid, rapid rates. Are either of those facts at all noticeable in for example a lower level of a feminization in the labor forces, differential level of feminization in the two prosperous areas, and the Nepali border area.

And of course there's the final area issue which is any Nepali border area also has a lot of smuggling going back and forth over the border and I guess you have a question of the reliability of responses in circumstances where a large amount of the market may be illegal.

David Spielman:

So I can, I can take a few of those questions. So in general, seed is retailed to farmers through, in India, rice seed, through private retail shops. Right. They source their seed from wholesalers who obtain it from state owned enterprises or from the private sector. And the difference between where they source it from is usually very observable.

So an openly pollinated, an inbred rice, and improved rice cultivar is typically sold in a large burlap bag of I think a maund or 50 kg, or sometimes smaller. Usually if it's certified it has a tag stabled on it from the certification, the seed certification agency.

Where as hybrid rice is packaged typically in poly____ bag, in a proper plastic bag with labeling, and marketing, and lots of pretty pictures, and things like that, and they are in much smaller quantities. So farmers may obtain, for the most part, their seed from the same places, but there's, it's fairly obviously what is coming from a parastatal or a state owned seed company and what is coming from a private sector. That is what is like a high quality hybrid.

There are also some private companies that are in the market producing inbred, these open pollinated varieties, so they get the, they get the germ plasm from the research system or from these parastatals, and they actually produce their own wheat and rice seed as well. And they label it slightly differently and whatnot, and they sell it usually alongside fertilizer. But farmers can see these things quite distinctly.

I think for the most part those are the channels that they're purchasing through, right?

Patrick Ward:

Yeah.

David Spielman:

And now I've forgotten the other questions.

Patrick Ward: One was about - so Norega is not successful in Bihar.

Male: [Inaudible]

Patrick Ward: Yeah.

Male: In 2014 they'll sell sapocary and we'll not what they actually bought. I mean so it's a moving target. But the report was it wasn't working.

Patrick Ward: Yeah. Could you remind my, remind me of the –

Male: Does that affect, for example, do you have a lower level of feminization than you would have expected in the market? Is the social, are the social compositions of the farmers you're dealing with different than, because of that? In other words, you are talking as if what is probably true elsewhere in India the Mhatma Gandhi scheme had some effect on farmers and, therefore, on their behavior, and I'm just wondering if it's the case.

Patrick Ward: Sure. Yeah, we didn't – so I apologize if I was misleading before. We weren't specifically looking at Norega or its impact on feminization of labor or anything like that. I was just trying to paint a picture of some of the work that we're doing in CSPSA overall outside of this particular, this particular study.

So we didn't, we didn't focus on that dimension of these changing labor or asset gender dynamics. We did have some female head of households in our sample. It's difficult to compare that to what one might expect from the national average because we used a semi purpose of semi random sampling scheme. We were primarily interested, because this is a rice technology we are interested in rice growing households, so it's difficult to parse down what the effect of Norega is on rice growing households versus other Pulsar or whatever.

Male: The question on Nepal –

Male: [Inaudible]

Patrick Ward: Yeah.

Male: - now there's all kinds of black market activity, but it doesn't really affect the rice economy. But I'm just asking –

Patrick Ward: So there's obviously a huge cross border trade between these two countries. As far as agricultural inputs go, the trade is generally northward bound. Fertilizer especially flows over the border to Nepal, and so do, so does Indian subsidies.

Male: Nicely subsidize.

Patrick Ward: Right. So there are lots of market distortions there. But in this particular study, and the sample of farmers that we were looking at, I mean we're very careful to gather information on their sources of income, their household expenditures as a proxy for income, and lots of other measures. So in a sense if there are any explainers that in theory or in practice would explain their behavior with respect to DT rice, we control for it and we account for it.

I can't see any reason, I can't see any sort of impact pathway between smuggling and preferences for DT rice or rice trades, but we could theorize about those. And this is a hypothetical situation, so there's no actual market situation, so there's no actual market transaction, so I'm with David, I don't quite see a pathway where –

Male: That may be the answer that is any distortions in the real market shouldn't have any effect on the responses.

Julie MacCartee: I think we have a question from our online audience.

Female: Yeah. I've got two actually. One is just a clarifying question from Dick Tinsley in Colorado State. What is the mechanism for drought tolerance? Is it an ability to withstand heat or better able to mine more water from the soil?

And the second one is from Loretta Burns, who is joining us from Seattle in BMGF. Does your research consider consumer preferences for certain grain types in addition to farmer preferences?

Patrick Ward: So to answer the second question first, we did not explicitly consider different grain types. In our set of instructions that were read to each of the respondents, they were, they were asked to consider the attributes that were not explicitly included to be identical across seed alternatives.

So grain type was assumed to be uniform across the different, the different alternatives.

David Spielman: Let me just jump in here. It's a good question to ask in the context, especially of hybrid rice because maybe the participant realizes this, but one of the constraints the hybrid rice adoption, especially in Bangladesh and India, recently has precisely been the cooking or taste qualities of the rice.

Now that's something that breeders will eventually address, I assume, over the next five to ten years, but it has been a constraint to adoption. But in this particular case we assumed constant attributes on tasting and cooking.

Patrick Ward: And then the first question, the mechanism for drought tolerance, that's also a really good question. There are, there are several potential avenues by which

drought tolerance can be introduced. Dehydration tolerance, deeper roots so that it can, it can extract water from lower levels of the soil, leaf curling so that it reduces exposure to sunlight. These are avenues that planned breeders have been exploring as a way of introducing drought tolerance.

We didn't explicitly indicate any, we're not, we're agnostic when it comes to the actual mechanism for drought tolerance. When you talk to the breeders from Eerie who have done work on Sabaghi Dahn, what they'll say is that it's just bred to be drought resistant. The parental lines that have come together for breeding have inherent drought tolerance, and they don't specify a particular pathway by which that's achieved.

Female: We have a question back here.

Male: Hi. Matthew Kraus from Partnering for Innovation. If you could go back to the yield curve with the drought overlay. The very beginning.

Patrick Ward: Very beginning.

Male: Yeah. It appears in any of these that the yields are already going down prior to the drought being identified. So I'm wondering is this just an effect of a lag where they're determining a drought is in a certain year and it's already happening, and there's already yield effects, or are farmers perhaps making some decision to get out of this crop. And if they are making a decision, might they, that be the time when you would want to bring in the drought tolerant seed varieties or market them at that point?

Patrick Ward: So I think, if I'm understanding it correctly, I think that's, I think what you're observing is just a function of what we're observing the yields and the droughts at discreet points in time. And so this is the average yield in 2001 and 2002, and then this is the average yield for the monsoon month, for 2002, 2003. There's no continuous curvature between those periods.

So the downward trend isn't so much a downward trend as it is this is what's observed at one point and this is what's observed at another, and what we observe by tracing it out like this is the downward slope.

Julie MacCartee: All right, we have time for a few more questions. Do we have any more from online, and then I'll grab John from over here.

Female: Yes. This one comes from Jim Tarrant from IRG/Engility who is joining us here from D.C. He recently came back from Indonesia where he was evaluating a climate service basically seasonal drought early warning systems for irrigated rice cropping systems vulnerable to ENSO drought and La Nina floods combined with a climate field school to help farmers to understand how to use climate

forecasts for their cropping calendars. Are the drought tolerant researchers looking at such adaptation measures in their research?

David Spielman: Well, in this particular study, no we weren't. There are early warning systems being developed and information systems being developed to convey that type of information to farmers, but no, that wasn't, that wasn't within the scope of this study.

Male: I have I guess three, three question questions. The first question is as far as the, so the spread of hybrid rice, forget drought tolerance, is like four or five percent across India. How is that, is Bihar an area where there is a good bit of hybrid rice already, and how, you know. And then leading from that there probably would be some information out there that you could draw on sort of willingness to pay for just hybrids. I mean you'd have some primary data rather than having to disentangle it from yours.

My second question is, it's kind of interesting with the cases, the four cases if there was any thought about – this is, I guess a retroactive suggestion, but there's something about using kind of farmer current method, but coupling with like a policy instrument, like an insurance instrument or something like that, if they're willing to – I don't know if that was considered. You're smiling, so maybe it was.

And my third question is kind of just a broader picture question, was so certainly this would be abusive if I'm a seed company. I'd want to know that farmers are willing to pay more for hybrids versus inbreds and how it changes based on their land holding. Are there, are there kind of audiences, like is this be, would this be something of utility to a state government on how they would shift a particular policy to encourage more adoption of drought tolerance? I'm just curious about the audiences for this kind of result.

Patrick Ward: I tell you what, I'll take the first two, you take the third.

David Spielman: What was the third?

Patrick Ward: Who is the audience?

Male: Who the audience is for this product?

David Spielman: Who is the audience? Good question.

Patrick Ward: So the first question was about hybrids in Bihar. Bihar is actually one of the states where hybrids has been very successful. Some of my colleagues at the New Delhi office have been studying the expansion of hybrid rice in Bihar, and

they've actually, using state agricultural statistics, they have found that 60 percent of farmers in Bihar are using hybrids. That seems a bit high to me but –

Male: [Inaudible]

Patrick Ward: Hybrid, yeah, hybrid rice, yeah.

David Spielman: And we have our data as well from CSISA.

Patrick Ward: Yeah, and the CSISA baseline data which we have shows high, high numbers as well in specif-, geographically concentrated areas, 40 percent or something like that. So hybrids are very successful in Bihar. They do have subsidies on hybrids, so that does help the overall dissemination.

In terms of willingness to pay for hybrids, the novelty of this particular methodology is it allows you to capture willingness to pay in a hypothetical situation. When you actually have the good on the market you can observe willingness to pay by varying prices within the market, and those are probably a real indicator of what people are willing to pay.

And I forgot your second question.

Male: What was my second question? I forgot my – it was about the insurance instrument that –

Patrick Ward: Oh. So it's funny that you mention that, because we are actually preparing to launch a similar type study in Bangladesh where we are actually bundling a drought tolerant cultivar with a weather based index insurance.

Male: Is that hypothetical.

Patrick Ward: Hypothetical.

David Spielman: We are.

Patrick Ward: We are.

David Spielman: And then third question was, what's the audience, the policy audience for this type of work? That's a great question, and when you're dealing with policy in India, like I said, it's an incredibly complex landscape.

I think one of the communities, if you will, that we're focusing on here is the private sector. I think that while USAID and the CGIR, of which we're a part, and many others, are still very closely aligned with the Indian public research and extension systems, and we believe that they're an important means of reaching

small holders with new technologies, I think we all recognize that the private sector has an important role to play in developing and delivering new crops, or new, new seeds, new trades let's say.

So, so reaching out to the private sector and saying look, your decision makers have to think about well what are you going to invest in things like hybrid rice? What are you going to invest in markets like Bihar or _____, or _____, very marginal areas? And how are you going to work with the public sector to get the traits you might want, whether it's the Indian Council on Agricultural Research or the Land Grant university system in the U.S., like UC Davis.

So really the policy discussion starts for us in some cases with the private sector, and then we bring in their counterparts in the Indian research system and in other communities to figure out how, how best to go about investing in solutions ideally together.

Julie MacCartee: All right, well we are actually running up on the end of our time. You are all right with one more?

Patrick Ward: We are.

Julie MacCartee: All right. This will be our final question and then we'll get wrapped up. And while this question is going on, if you wouldn't mind filling out the surveys that are on your seats, those are always helpful for us, even if you've attended multiple times. You can either leave them on your seats or drop them off at a table, or with one of our staff.

Male: Larry Paulson, retired US Ag officer with lots of experience in that region. Question about farmers' perception. Apart from the hypotheticals and thought experiments about risk taking or risk aversion, it's generally considered that 20 percent to 40 percent is, or maybe 40 percent improvement in a yield is sort of a minimum to be actually identifiable by a farmer; maybe down to 20 percent compared to for example green revolution technologies that quadrupled yields.

So I'm wondering how do farmers perceive this actual variety that has 20 or 30 percent improvement under certain conditions. Is it worth investing a lot in or does it need to improve before it's worth spending a lot on marketing?

Patrick Ward: I think that's an excellent question and, unfortunately, it's not something - these technologies are so new that we don't really have a good sense of whether farmers can actually perceive these yield advantages. The yield advantages that I referred to before were based on agronomical field trials. And so we don't really have a good sense for how it performs in farmers fields and whether farmers can actually detect those differences.

But that's definitely something that is a very keen policy relevance.

David Spielman:

I would also say that post green revolution we're in an era where farmers are considering more than just yield. Yield is always important, but even with hybrids, which have a significant yield bump, you're only talking 15 to 30 percent.

So that maybe observable given the adoption patterns we're seeing. It may not be observable. That's a good question. And the circumstances under which it's observable and comparable across different plots, different years, are complicated.

But I think a lot of farmers that we work with in CSISA and our work are really thinking about more than just yield. Obviously, like I said, yield is important, but duration and the ability to put in a ____ winter crop, especially a horticulture crop, not necessarily wheat, but anything else is increasingly I think something that farmers are recognizing as profitable, because market infrastructure is improving in some areas. Horticulture crops, vegetables, fruit, whatever it may be can make a real big difference to household welfare and income. So duration is a big one.

And then some of my colleagues in Bangladesh have actually done some work on this where they've actually looked, again at referring back to the earlier question, on grain quality, taste and cooking quality. A lot of the markets for rice in Bangladesh, for instance, are diversified such that there are no a higher premium being paid for finer rices, you know the aromatic, slender, bold, whatever are.

And I think farmers are becoming more conscious of those quality traits. We were in Haryana once and I should have realized this, but Basmati, which many of us eat here in the states, right, the fine slender aromatic long grain rice that everybody eats and loves has a yield of what, 1.5 tons per hectore. That's a quarter of what other farmers are able to get on the hectore with other less fine varieties, yet they grow it because it commands a higher price in the market, so.

Julie MacCartee:

All right, well on behalf of Agrilinks I'd like to thank David and Patrick for your very detailed and clear presentation and your great responses to the questions. And thank you to our audience, both in person and online for supporting Ag Sector Council, and we'll be in touch with the post event products from this event and with details on our March event.

So thank you all very much.

[Applause]