

THE CASE FOR CONSERVATION AGRICULTURE

Panel Moderator: Sir Gordon Conway

October 16, 2015 -9:00 a.m.

Introduction:

Ambassador Kenneth M. Quinn

President - World Food Prize Foundation

So welcome to the final day of Borlaug 101, crash course in the Fundamentals of Global Food Security. Remember, 11 a.m. today the final exam, so you'll want to take notes carefully on this session. And what's going to be a focus of it is this wonderful report that everybody received in their pack when you picked it up when you registered, "Africa's Potential for Agriculture." And you don't have a pulse if you weren't all week reading the incredible articles and spreads in *The Des Moines Register* that Howard Buffett has put in.

So I want to invite the panelists to come up on the stage now, and I'll do a quick introduction. Howard G. Buffett is a tremendous friend to the World Food Prize, to me personally. He rushed here from the Coca-Cola board meeting where he's a member of the board. And he said he heard some rumors that somebody from PepsiCo spoke this morning, but I assured him nobody from PepsiCo spoke in this room. You know, I said we have Republicans and Democrats, we had Monsanto and DuPont Pioneer, Coke, PepsiCo – you know, we try to be even... But Howard G. Buffet, family foundation – he wants to be known as a farmer who's from Nebraska but farms in Decatur, Illinois, and Nebraska and Arizona and South Africa and several other places. When you come to our Hall of Laureates and go through and see the incredible photos that are at the heart of his 40 Chances philosophy, his *40 Chances* book in there, you know he is one of the poignant photographers and great humanitarian leaders of our age. So we're so thrilled that he is here today.

Sir Gordon Conway, a member of our Council of Advisors, the Montpellier group, is the moderator, coming here for over ten years. And we have Kofi Boa, who is here from the Center of No-Till Agriculture in Ghana, an agronomist, farmer, director of the Center for No-Till Agriculture. And I was telling him before that Dr. Borlaug was a great admirer of the no-till approach and always wanted it to be highlighted at the World Food Prize. And Alejandro López Moriena, the Chief Sustainability Officer at Adecoagro and who's worked there since its inception and overlooks sustainability and evaluating and transferring the most efficient, profitable and sustainable technologies to be applied in each business line, region and country.

So with that, over to you.

Panel Moderator:

Sir Gordon Conway

Professor of International Development, Imperial College London

Panel Members:

Howard G. Buffett Chairman & CEO, The Howard G. Buffett Foundation

Kofi Boa Director, Center for No-Till Agriculture, Ghana

Alejandro López Moriena Chief Sustainability Officer Adecoagro

Sir Gordon Conway

Thank you, Ken. Thank you for the introduction and thank you for last night. Last night was great. I know we're all slightly muzzy-headed this morning, but we promise that we're going to liven you up with this discussion.

Just to start off, we all know what the big challenge is. We've got a growing population to feed, a population with changing diets, a big shift towards livestock products in diets across the emerging world. We also face the problem of climate change and the challenge that presents to us. We've got to produce more food, and we've got to do it in a sustainable fashion – that's the problem in a nutshell.

But added to that, we have a massive problem of soil degradation. The best estimates come from the University of Bonn, which is an organization called ZEF there, run by Joachim von Braun, which many of you in this audience will know. And his team have used satellite imagery, ground-true satellite imagery in many respects, to produce a world assessment of soil degradation. And the severe hotspots of soil degradation in the world come to nearly 30% of the land area of the globe. And it's about the same for Sub-Saharan Africa. That's not just any soil degradation, it's severe soil degradation.

So rising population, changing diets, climate change, soil degradation – put those all together, and they're formidable challenges.

So I'm going to turn first of all to Howard. Howard allowed me to ride his combine last week.

Howard G. Buffett

But not drive it.

Gordon Conway

But not drive it. He was quite adamant about that, and he said that I was a theoretician, which is true. And I used to be a practical person when I was very young and I worked on farms and did farming. But I'm now pretty well known as being more of theoretician, and he thought theoreticians shouldn't drive his combine. But he let my deputy, Emily, who's sitting over there – he let her drive the combine. He was a bit nervous. You know, this kind of thing, because these are hundreds of thousands of dollars, these combines, and you think they're all automatic and they are, but you've got to get them lined up. You know, that's the thing about

life—you can go auto queue, but you've got to be lined up in the first instance. And so that's what we're going to try to do now.

So, Howard, say something about your views about soil health and then what you're trying to do in terms of conservation farming. And then we'll turn to the other members of the group.

Howard Buffett

The greatest asset that farmers have is under their feet, which is their soil. And we like to think we do a good job of thinking about it, but we really don't for the most part. You know, you can take every list... here I go—I usually get somebody mad when I'm here at the World Food Prize—but you can take every list of every farm organization in the United States, and you can look at what are their top ten items they're working on. Soil conservation won't show up. You might see the word "conservation," but a lot of times that means something else. So it's not a priority. It's not a priority for our government either, although USDA has put a lot more effort into this. They have some really great young guys, men and women, working on it; but it hasn't been a priority.

So all you have to do is look at history. You know, there's this great book called *Dirt*, which tells you the history about soil. And the truth is, you can do a lot of things right, but if you get it wrong there, in the long run we're in a lot of trouble. So I feel like it's the one thing as a farmer and as an advocate for agriculture that our foundation needs to really focus on, which is soil. And the truth is, I'm getting old—I'm running out of time—so I get a little more cranky about it. But I just think the story needs to be told. And maybe I'm not right all the time, but I will tell you one thing—I'm going to try to get people to talk about it.

Conway Okay, but you're also doing something.

Buffett Well, we have...

Conway Just say a bit about what you're doing.

Buffett Yeah. Well, so roughly we have about 20,000 acres on two continents, three states here, where we do a number of research experiments. Our smallest research plot, with the exception of one little thing we're doing, is usually 80 acres; sometimes it's 320 acres. We believe in doing it so we can sell it to a farmer. So we've done a lot of things that I don't have time to talk about here today, but we've had special equipment that John Deere has helped us build. We've had the opportunity to take and try many different things that a farmer wouldn't take the time or really wouldn't want to take the risk to try to do. But we've learned things.

I mean, we just got off harvest in Arizona and Illinois, and we had 245 bushel of corn in Arizona with 180 units of N. We had 225 bushels of corn in Illinois with a hundred units of N. We had a hundred-day corn where we got 211 bushel. I mean, we're doing all these things that are different, and they're real results. And we do support Penn State and Purdue and Texas A&M, some other universities in different places, and some are down in Arizona. And they do what I call

traditional university research, which we've gained huge amounts from that over time. I mean, our productivity has doubled because of that, maybe tripled.

But I believe that one of the things we have to do is be realistic and practical about what we can get to the field and what does it mean in productivity. And there's a huge disconnect between that, a huge amount of the time; and so we're trying to address that with our research farms.

Conway We'll come back to you about how you actually do the conservation farming. I've got to turn to Alejandro in a moment. We worked it out just now. You have about half a million acres, right? That's big, B-I-G-right? It's big.

Moriena Yes, yes, indeed. Thank you.

Buffet Capital B.

Conway Yeah, capital B. Talk a bit about what you're doing there.

Moriena Okay, thank you, Gordon, and thank you to the World Food Prize for this opportunity to share our experience. We have this same view as Howard — the soil is our main asset for us as a commercial farming company. And we are planting more than a half million acres under no-till, because we believe that this conservation that we culture, it's good for us, for the short term. We are making profit out of this today but tomorrow as well. We can think, we must think in the long-term view. That's why we are doing this no-till and other best practices as well. But the gold center is the soil. We try to maintain all the properties of the soils for our cause.

Conway You've got a variety of soils?

Moriena Yes, we are mostly located in Argentina but also in Uruguay and Brazil with different types of soils. You have to adopt some specific techniques or rotations or balance fertilization for each type of soil and weather combination. It's always weather and soil, what gives you the agroecological environment. But after doing this small tailoring for each crop in each region, we are doing fully no-till in our farms.

Conway Okay. Now, Kofi, you've got a smaller farm, right?

Boa Sure.

Conway How much have you got on your small farm? And it's near Kumasi in Ghana, right?

Boa Yes, it's close to Kumasi in Ghana.

Conway And how much land have you got there?

- Boa Actually, I have a lot of small fields all put together. It should come up to about 30 acres, but they are just smaller field. And for the center we work on a 4.5 hectare training field.
- Conway It's experimental, or is it...?
- Boa This is not experimental. It's just at the center we do a bit of experiment, but we show the evidence of no tillage. And all the other fields that I'm talking about are smaller fields, production fields, and they're different crops and showing people that conservation agriculture shows has the potential for whatever crop we grow in the areas that we work.
- But you see, coming to this idea of soil health – you know, I have lived my life by recognizing from the beginning that the soil comes first. And anytime we talk about soil health, I liken it to a factory that produces a pill that saves lives, the lifesaving pill. And in front of this factory, every morning you get people line up to receive the pill, otherwise they die. So if it happens that they get in there and because of factory something happens and that day the factory doesn't operate; in other words, the factory gets sick, all the people out there behind the building will die. And it's just like soil – when the soil dies, if we don't take care and the soil gets sick, it loses its productivity. And when the soil loses its productivity, all of us depending on the soil will die. And that is why it is very important for us and more especially for all the small-scale farmers to ensure that we do whatever it takes to keep the soil healthy, because the small-scale farmer is always in touch with the soil.
- Conway Yeah.
- Boa The small-scale farmer has little opportunities beyond working on the field. And so in our own unique, small ways, all of us have to ensure that we do whatever it takes to keep the soil healthy, because it is only a healthy soil that can support the production of healthy crops to feed healthy people like all of us living in this... sitting in this room today.
- Buffet Kofi you have like the best experiment I've ever seen in my life. It's so simple. Tell us about your little concrete pad and your conventional strip till and no-till. Sorry, Gordon – I high-jacked it!
- Gordon No, no, no. You're...
- Boa Really, what happens is that, and this is a case of trying to influence what a small farmer does. The small farmer really, most of them, excuse me for or the word, are illiterate or not well educated. And so people cannot articulate very well from print media and in most cases to television and other things, you cannot talk about them as far as their homesteads are concerned. And so we went with a vision that you can never sound convincing enough if you have nothing to show. And so whatever we do, we make sure that it is there right there on the ground, because what we're doing there is to ensure that we are able to illustrate the benefits and

evidence of no tillage for people to see, more especially these small-scales farmers. For that matter, we have on the ground permanent plots showing different practices where we have the traditional slash and burn; we have the no-till, and we have it on the little slope, so therefore we reinforce sudden water retention by using vegetative barriers and inert barriers. And on this plot, as soon as you go there, unless you're blind, nobody talks – you really see. And in one year, 2013, where normally we should have 1,200 milometers of rain, we fell short and we had about 973. That year when we open it up on that plot, we lost about 17,870 tons of soil, over 7 kilos of soil – that is about 17 tons. Whereas, on the no-till plot, just leaving the trash and planting through, we lost 77 kilos, and the no-till burial plot we lost just 33 kilos.

Conway Okay, but, of course, it's not just... Your analogy of a pill only works so far. It's not just a pill. It's more complicated than that.

Boa Yes, it is.

Conway And it's not just no-till, right? Why don't you take us through a typical year on one of your plots, one of your farms?

Buffett I'll answer your question. I don't think there's a typical year. No, that's part of the problem.

Conway But we've got to get across, first of all, lots of people in theory know what conservation farming is and about no tillage; but let's get clear what it means in practice.

Buffett Yeah, so what we do is we never turn a bit of dirt other than where we'll run a row through where we plant the seed, because you have to put that into the dirt. So we look at three things, which is what FAO describes as conservation agriculture. We have minimal soil disturbance, we have continual cover, and we rotate. Now, what we have to start thinking about differently to get this right is – how do we farm in systems? We farm in pieces today, okay. And that's why we do a lot of the research we do. We have to start to figure out – what are the best symbiotic relationships and not just thinking about, oh, yeah, we can rotate corn and soybeans because soybeans create a little bit of nitrogen for corn – that's just the beginning.

So when I talk about our experiment that has 80, 90, 100, 110, 115-day corn, we're trying to do something there. We're trying to get the crop off sooner, get the cover crop in earlier so we can reduce our inputs. If you go to a university today, they'll tell you – for every bushel of corn... Some will say you need one unit of nitrogen, say you need 1.2 units of nitrogen, whatever it is. We just produced 220-bushel corn with a half a unit of nitrogen. And if you go to Rodale, which is a whole different story, which I don't want to get sidetracked on, they've found a way to do it, not with no-till – that's the issue – , with almost no nitrogen. You can do amazing things if you know how to use nature.

Conway Okay, but let's go back. You have a cob of corn, right, which is a [inaudible] longer. You harvest that corn, which is what I saw you do. You leave the stubbles about a foot high, right?

Buffett Yeah.

Conway ...in the corn. And then you sow a crop through the winter, and you've got three examples, right? You've got triticale, hairy vetch, which I don't really... I'm not sure I've ever encountered.

Buffett It's a terrible name, but it's a great cover crop.

Conway It sounds like something out of Monty Python. Anyway, hairy vetch...

Buffett Or worse.

Conway See, everybody knows about Monty Python. Or cow pea – right?

Buffett Yeah.

Conway And so you've grown those crops through winter. You harvest them when, roughly?

Buffett Well, we also do radishes, but we don't, we actually don't harvest them. We let them, some of them winter kill, and then some of them we kill with a roller crimper, which is another big thing we're doing at scale that...

Conway Say something about... I mean, you showed me a roller crimper, and I looked it up on Wikipedia, and it was all about what you did with your hair.

Buffett What hair, Gordon? Oh, sorry.

Conway I've still got hair, and it's not white.

Buffett Oh, wow, I think that was directed at me Kofi.

Conway But just explain what it is you're trying to do with that crimper.

Buffett Okay, so what you have... And actually Kofi even uses it to manage his residue.

Conway Okay, we'll let Kofi talk to himself in a minute.

Buffett Well, I'm going to let him talk about what he does with residue.

Conway Yeah, that's right.

Buffett Let me just explain what we did with a crimper, because we had a 24-row planter, 60 feet wide. If you went to a farmer today and he said, "Well, you can kill a cover crop without chemicals," they look at you like you've been to Mars. So we went to

John Deere, and we asked them to help us do this. It was a two-year process, and we had to send this piece of machinery back to Jake, who did it in Pennsylvania, the Amish guy, and all this stuff. But, anyway, after about two and a half years, we had this roller crimper that folds up to 12 feet, under 12 feet, folds out to 60 feet, and we run it with our 24-row planter. So we wanted to show that this could be done at any scale. Kofi will do it at 5 feet, and we do it at 5 feet in Arizona and South Africa. But the point is that this is a machine that mechanically crimps the weed or the cover crop, which means it can no longer take up water, which means then it dies.

Conway Ah...

Buffett So we have had huge success with running this on our farms with cover crops. So what we'll do in the spring... And we've had to learn how to do this. I mean, there's times that, if you do it at the wrong time you have trouble with emergence; if you do it at the wrong time, you have trouble with bugs and insects. I mean, this is not... This is closer to rocket science than anything else we do in agriculture, because it's hard to figure out. It's not easy, and you can't just open a book up and say, this is the way you do it. That's why so many farmers don't do it—it's not easy. But once you get it figured out, it is easy.

And I'm going to tell you one quick story. I used to get in an airplane... You don't have to do this anymore because of drones. I'm adjusting to technology but slowly. But I used to get up in an airplane, take the door off and go out. And a friend of mine in Illinois farms about 50,000 acres—he would line up like 7 planters for me or 12 combines, and I'd get these pictures of all this. So one day he calls up and he says, I've got my 7 or 8 planters in one field; here's where it's at. So we go out to take pictures, and they keep stopping, and one goes around the other, and the other one stops and the other one goes around. So I called Chris. I said, "Chris, what's going on?" I mean, you know, first of all, there aren't any good pictures because there's not enough... You know, but he said, "Well, you told me I could no-till corn into my soybean stubble." I said, "Yeah, I've been doing it 20 years. Of course you can do it." "Well, it didn't work." I said, "Well, what coulters did you have on your planter?" "What do you mean coulters?" Well, he'd taken a conventional planter and tried to use it somewhere. It's not made for that. So this is like trying to drive a car with no tires or something. I mean, it's like... You know, you have to have the right stuff. So this is just a case where it's a mindset, it's education, it's trying it, learning it, getting used to it, getting familiar with it, getting comfortable with it. But it can be done.

Conway If you grow cow pea or hairy vetch, you get some nitrogen into the soil?

Buffett Absolutely. I mean, the whole point of the field I'm talking about where we used about a half a unit of nitrogen to get 220 bushel of corn was because we've had hairy vetch in there and probably because we've rotated for the last four years.

Conway But with triticale you're not getting any nitrogen. Why are you growing that?

Buffett Yeah, you get... No, you get some, but we're growing that... I mean, like for instance, Doug's a big fan of triticale. I'm not. Doug runs our farm in Arizona.

Conway Triticale, for those who don't know, it's a cross between rye and wheat. Okay, go on.

Buffett Yeah, but I like annual rye, because you can get roots that go five feet deep. I like radishes, because you can get roots that go three or four feet, five feet deep sometimes. So I like going after compaction and radishes and cereal. Their root systems will hold nutrients. So I have a different opinion about what I like to use, but we use all of them to learn.

Conway Okay, and then after the cover crop, you always go to soybean, or will you go back to corn at some point?

Buffett We use different cover crops. That's part of the reason why we're using different cover crops.

Conway But after the cover crop.

Buffett So after soybeans...

Conway No. After the cover crop.

Buffett Well, after the cover crop, we'll go to either soybeans or corn, depending on the rotation. We rotate. We only rotate between corn and soybeans. Now we do some things corn on corn so we can learn about corn on corn, but our primary farming activity is a rotation.

Conway Okay. Alejandro, now you do things similarly or different?

Moriena Yes, I think the whole idea is similar to the cover crops to protect the soils and make all these healthier soil working year around between one crop on the other crop in the next row. But we don't do 100% of the area with cover crops, because we are a profit-driven company, and sometimes you have to balance what you are getting from one harvest or what you are getting for the long term. So it depends on the region, on the crop, obviously, and the prices of commodities. We do more cover crops or less cover crops. But what is really important is that all these techniques should be applied in a tailoring way, because there are some farms, some soils that they are more resilient and you can have more deviation from the natural system or the best practices more. But there are other farms that the soil is more fragile, and so you can involve that way, and so on those farms we keep on doing the cover crops, because it's really important for the systems.

Conway What kind of cover crops are you growing?

Moriena We are using grasses legumes, different types, mostly, sometimes it's wheat, oats, barley, triticale as well, differences, VCI—I don't know exactly the name, but some

legumes that we have there. But they are pretty common crops in the region. In Brazil we use other – crotalaria, brachiaria, other grasses.

- Conway And you cut them or you crimp them at the end?
- Moriena No. Most of them we spray with chemicals. We do in the large-scale commercial farm system. We do some mechanical killing of the cover crops, as Howard will say, in the rice operations.
- Buffett In a half-million acres, you need a lot of roller crimpers.
- Conway Well, you've got one.
- Buffett Well, no, no. We have four or five, actually.
- Conway Oh, I saw one. And then you always grow soya, or you grow...?
- Moriena No. We have different crop rotations for different regions. The most relevant region, which is the Humid Pampas. We are planting wheat and soybean in the same growing season, then corn and then soybean. And in between the corn and soybean we may have some cover crops there. So all we do is trying to kind of emulate what nature was doing in those environments and trying to do similar biological models, I mean, the crop rotation, the cover crops, and all the other best practices, have in mind what nature is doing there. And the Humid Pampas used to be full of grasses, so we try to emulate that system.
- Conway Okay. Now, Kofi, you grow corn.
- Boa We do.
- Conway Maize, you would call it, right?
- Boa Yes.
- Conway I would call it maize. It's just these guys call it corn.
- Boa Yeah, maize is right.
- Conway Corn is the old English word. That's why you've got it here in the United States, because you're all... Well, never mind. But, Kofi, you grow maize.
- Boa Yes.
- Conway And then what?
- Boa And a whole lot of... We grow cow pea just like you're talking about. And you know Africa we have a variety of food crops, and so in addition to maize we have a wide array of crops – plantain, cassava, cocoyam, maize. We do rice and vegetables too. And this is another describing. It's not any different from what we

do. In fact, the principles are the same, but the specific practices are different, depending on the scale and also where you are. Certain, the system like they're talking about. In the manual system, whether a farmer is doing a slash and burn or whatever, it requires slashing. So in an initial stage one, we have slashed vegetation and we leave it there to cover the ground so it might protect the soil surface. And then we plant through. In the very early stages, from the very first where one is transitioning to these conservation agric system, that is where it becomes necessary to have a preplant herbicide to just control the root growth and then plant through. But after that, when we incorporate, we integrate cover crops, then the value of the preplant herbicide comes out. And we do... So when we have done this and planted, the very good thing is that we take advantage of this mulch to give the crop a head start. So by the time the weeds show up, the crop will have built it's competitive ability. And that is why now farmers spend less time and labor and effort in controlling weeds in the no-till farms.

But like we have farmers doing the rotations, and we have farmers doing the maize test. And so if it is about rotation, the maize goes and then the legume crop comes in its place. But we are mostly rainfed in Africa, and so towards the end of a growing season, as we enter into the dry period, we put in a cover crop. And most of the cover crops that we have, once they get established, are able to stand the drought to some extent. So when we have taken the cassava food crop, then this cover crop stays to protect the soil surface. Then in most cases by the time we come to plant, this cover crop would have completed its lifecycle, would have died and formed the carpet. And right from there it becomes so easy going in there to plant.

Conway So the rains start when? What month do the rains start?

Moriena Yeah, it depends on where you are within the...

Conway Where you are.

Moriena Where I am, we have two seasons, and so with the two rainy seasons, starting season sometime in April. And then by August when the first crop is growing, the first is cleared and the second food crop comes in its place. And just towards the end when, about the middle of the growth of the food crop, then a cover crop is seeded in between. What is making it good now is that very early on, when these systems started, we had a very narrow range of cover crops; and therefore we had restrictions. But now right there at the center we have about 12 different cover crops. And, depending on what the farmer, the cropping system that the farmer is operating, we are able to identify a particular cover crop that fits in there without having any adverse effect on the food or cash crop.

So, like the system I'm describing now, there are cover crops that we put in. For instance, in maize we have a cover crop, the bush mucuna, which is not aggressive at all and fit at different levels with the maize. Within the first week of planting maize, we put it in. And so the farmer doesn't have to do anything at all in terms of weed control, because the cover crop covers the ground, smothers the weeds, and by the time we harvest the maize, the cover crop itself is dead.

Conway That's really important. These two guys grow GM corn and soybeans, and they use herbicides, right? You both use herbicide. You're not using GM.

Boa No.

Conway But are you using herbicides?

Boa Yes, especially at the beginning, because when one is transitioning, then the very first time the wheat regrowth has to be controlled before the seed goes in there. But once it is stabilized, they input on the herbicide, comes on very low. And right now where we have the cover crop, they were integrated in the systems, we don't talk about herbicide.

Buffett One think Kofi kind of reminded me of – one is, we did something in Arizona a couple years ago almost by mistake, but that's overstating it, but now we've done it a few years, and we're going to really get more serious about it. We have a pivot where a portion of that pivot we went ahead and worked it, so it has no cover, and then the rest of it has a cover crop. I showed you a picture of this. We picked our corn. The picture is amazing, because the no cover is all tasseled out almost 15 days before the corn with the cover. So you could say, "So what?" Well, at the end of the day when we picked the corn, the corn with the cover has 20 bushels an acre more than without cover, and that would have to do with a number of different things. Kofi described some of it. So now that we've done that a couple years, we're saying we need to really get serious about trying to understand it. So we're going to get more serious about it. But I think those are the things we could learn.

The one other thing I wanted to just describe on Kofi's experiment that he was talking about is – so when you go look at his experiment... I'm a visual guy. My wife gets mad at me. She'll tell me it's... I'll say, "What time is it?" She says, "It's 10:15." I still get up and go look at the clock, so I've got to see it. She gets really mad at me. But anyway it's not the only reason.

Conway It's 9:35 now.

Buffett Is it? But here is the point. At the bottom of the conventional till, he'll have like seven or eight barrels full of soil, and strip till you'll have a couple of barrels, and at no-till you'll have this much soil in one barrel. So it's really visual, and so when you go see it, you can just get it.

Conway Yeah, yeah. Now, we've got the principles clear – right? – that you need to be no-till. Secondly, you need rotation, and you do need rotation with legumes if you can but or at any rate with crops that will improve the root depth. And then you also need to ensure that you've got cover of land – it's not open to the elements. Those are the three key principles, and you follow each of them.

I'm still intrigued as to whether... We've got a half a million acres, we've got whatever, and then we've got just a few acres. And I can't quite work out whether

it's easier or more difficult for you, Kofi, trying to do this, than what these guys are doing.

Boa Well, at our scale I think it's very easy to do it, and that is actually what has motivated a lot of the small-scale farmers to go into this. Because with this system, as I said earlier, the amount of labor and the effort that one puts in comes down low. And at the end of the day, I already said, we are mainly rainfed. And being able to hold that much water we get from nature in the soil for use by the crop is very, very important. And it is when we have this cover that we're able to reduce the speed of runoff and have the water get in there. And once it gets in there, because of the cover, evaporation is reduced to zero.

Buffett Think about it this way. All those roots are channels into the soil. And so if you run across... The disk is the greatest compaction machine ever invented.

Boa Yes.

Buffett You run a disk over and over and you dig a little down to where the bottom of where that disk blade was, it is packed, hard soil. Okay, so where's the water going to go? Where are the nutrients going to get to the roots? Okay, so if you have all these roots – there are thousands of channels – so when you leave the old corn roots and the old soybean roots and the old wheat roots and then you put cover crops in there and they start penetrating that, you have created a completely different ecosystem underneath that soil. And that ecosystem is what starts to build and maintain your soil health.

Conway But you think it's just as viable for smallholders? You've seen smallholders doing it? Is it just as viable for smallholders? Your view, Howard, on this.

Buffett Yeah, I mean, what you have to do is you have to say – Are they planting by hand? Are they planting with animal traction, or are they planting with mechanization? And there's a good answer to every one of those. I've visited hundreds and hundreds of farmers that plant by hand that do no-till. The Clinton guys, they have farms in Malawi and now in Rwanda where they're doing this with a number of farmers. So when people... I have this farmer next to me in Illinois who has had huge leadership roles in agriculture, great guy. And he says to me, "I tried no-till one year and it didn't work." I mean, to me that's like saying, "I tried marriage for a year and it didn't work."

Conway It happens.

Buffett Well, it does happen. Okay, it does happen, but you've got to work at it, right? You've got to try. Okay, you've got to compromise a little bit, in my case a lot.

Conway There's a microphone on here.

Buffett But the truth is – what do you ever do in anything in agriculture and try it for a year and know that it works? Nothing, nothing. Okay, every farmer knows that. So

it's like my friend Chris who never put coulters on his planter, I mean, it's like this is an education. It's a mindset. I had one guy who taught me how to farm, actually, Francis Kleinschmidt, who came over. I wouldn't have been farming if he hadn't of helped me in early years. And he came over one time to Illinois. I was no tilling, and I hate to admit this in public, but we do have one little finishing machine that, if there's a place or two where we've had like heavy rain, we'll run in and fill it in – right? So out of a 40-acre field, he's in the tractor with me, and I probably don't till .001, one tenth of an acre, but I go in and hit these little spots. And he's just like – "You've got to finish the field."

- Conway What about smallholders in Argentina or Uruguay or Brazil? Are they using this approach, too?
- Moriena We don't have that smallholder scene.
- Conway No?
- Moriena Yes.
- Conway There's not a lot, right?
- Moriena I mean, there are no much cases there in South America, very little. There are some in Paraguay that they are doing conservation agriculture. I think smallholders, generally speaking, can do all this conservation agriculture easily.
- Conway Specifically, I want to ask you. When I first came across conservation agriculture, it seemed a bit like a religion, you know? There were all these people who were... And you tend to talk about it as though it's a bit of a religion. I mean, but, Alejandro, you're a really hard businessman, right?
- Buffett Yeah, was that an insult?
- Conway Yes.
- Moriena Sorry, sorry.
- Conway But you don't see it as some big, ethical thing. You see it as being what works, and you know it works. How long have you been doing it?
- Moriena Yes, well, we've been doing this since inception, since more than 13 years ago. And, yes, we are a profit-driven company. We are doing this because of the profit, and I think it's not... The detail is how we link both these environmental and sensitivity to the soil and to the agriculture and the profit. So I think the great point here is thinking on the long term, having this long-term view. So you can use all these efficient technologies to produce both profits to increase your productivity, to increase any size farm productivity but considering the long term as well. So it's not thinking only on one harvest and even more than 40 harvests, thinking on the next generations; because soil will be there for them. So that's why we are

implementing all these technologies and best practices. And I think that smallholders can do that as well but should be tailored.

Conway It's more difficult.

Moriena Yes.

Conway I mean, most of you can take the long term, but, Kofi, your farmers where you live, it's much more difficult for them to invest, isn't it, in this?

Boa No. In fact...

Buffett Say that louder. I like when he's wrong.

Boa No, no. I mean, you see, the point is that people who talk about the farmer of conservation agriculture is not feasible on a small scale farm are people who have only seen it at scale, people who have only experienced the big-time conservation agric as practiced by Alejandro and Howard. But, you see, you come back to Africa. The small-scale farmer has virtually come through this in some way. There have been very minimal disturbance. So it's getting to them where this is nothing new, not completely new. The point is that we're doing things just as they're doing but at a different scale. And you get to the small-scale farmer in there, working through the system like this and transitioning into it perfecting it. And a lot of things are coming from experience, but the one thing that has made it unique and what is moving it is the amount of labor reduction in there. And the other thing is that the resilience built in the soil to such extent that when there is drought, you see a huge difference in there. A lot of people talk about the waiting period, and people, when they talk about a waiting period and conservation agriculture is where they are looking for some big differences in changes in the soil. But I tell people that with conservation agriculture, within a day, two, you see a change, because it would have the mulch here, we'll have the bare land here, and it rains today. You come the next day or two, and there is more water retained under the mulch than on the bare ground, on the plowed ground. And therefore, knowing that our plants always pick water from the ground, whenever have an extended period of moisture retained, the crop does better. So in our case we say that conservation has immediate impact...

Conway That's good.

Boa ...in terms of ensuring temperature moderation, right here.

Conway Does a smallholder have to adopt all these parts of conservation?

Boa No.

Conway ... from the beginning. How do you start with smallholders?

Boa Yeah, they're very... Essentially it goes in stages. The very first thing is ensuring that the mulch cover is there, and that is what everybody is doing now. And then building into it the rotations, integrating the cover crops in there. So the very basic thing is that, have the soil covered, put a crop there, and you'll reap the benefit instantly.

Conway If it's all so great, why isn't the whole world doing conservation farming? I mean, what's the problem?

Buffett It's a combination. It's mindset, it's comfort level, it's knowledge, it's access to the right kind of equipment. It's a number of things. But, Gordon, you're not going to get away. You called me both religious and a bad businessman, so I'm going to answer that question. You're not going to get away with that. I love this guy. Don't you love this guy?

Conway You can insult me, too.

Buffett No, no, I'm not going to insult you. You could be right.

Conway I could be right, but I'm the moderator.

Buffett Let me answer this. This is an important answer.

Conway I'm listening, really listening.

Buffett And I don't want to be melodramatic, but you described how I advocate for no-till or conservation agriculture.

Conway Right.

Buffett I've been on every continent, every country in the continent of Africa. I've visited with thousands of farmers over the last 30 years. When you see children die because they can't be fed, you think there has to be a better way. As a farmer, I adamantly believe – Kofi is proving it, okay – that you can farm better in Africa. So you can't tell me that I tried it for a year – tell that to a mother who's lost children. You can't do that. So I am passionate about it, because I think that you have to wake up. You have to accept the fact that where we are today, the status quo is unacceptable – it is clearly unacceptable. How are you going to change them? Okay. How are you going to change it? So when people throw stones... Let me tell you, when people throw stones at conservation agriculture, give me a better answer.

Conway Okay, but how are we going to make it go big? I mean, I've seen lots of it in Africa, but how are you going to make it work on a bigger scale? I mean, you're already doing it on a bigger scale, but it's still not all the agriculture for Argentina and Uruguay. What's the barriers to other people adopting it?

- Moriena I agree with Howard that the main aspect is educational. Sometimes it's cultural as well. You know, farmers want to do what they've doing for many, many years – it's traditional way of doing things sometimes. We have that in Brazil very, very strong – opposite to Argentina where no-till was easily adopted. In Brazil was more slowly, more cultural education by readers. So I think that depends on the region that we are talking about. In other places like here in the United States, here in the corn world, maybe you cannot do full no-till because weather conditions, weather constraints. So it should be analyzed depending on region and cases.
- Conway Okay, but Kofi...
- Buffett There's another answer.
- Conway But Kofi, and then I'll come back to you. What's the barriers in adoption, say, in Ghana or in West Africa more generally?
- Boa Well, it has a lot to do with knowledge, and knowledge diffusion, and then having the right people passionate enough to kick the dirt the farmers right there. We have a lot of people talking, the academics talking about the non-feasibility of conservation agriculture, but these are people who really do not have what it takes to implement that on the ground. In the first place, there isn't much support coming from the government in terms of pushing conservation agriculture. It's just now that, because of the noise being made on climate change, climate smart and all that, that we see efforts being made in that direction. But like he said, one of the biggest barriers is breaking tradition. People are used to clean fields, planting. And here it's like, when the field is very clean, that is where the farmer is a good one. And this is the time when we're getting people to appreciate that, keep the mess on the ground – and it breaks normal tradition. But at that point, what is more important than is showing people right on the field, physically, people seeing the difference. Like Howard said, coming to an institution where constantly people come to see side-by-side demonstrations and seeing the difference in crop performance.
- Conway Are you getting any help from the research institutes in Ghana or from the extension services?
- Boa No.
- Conway Is that a barrier or...
- Boa That is... I quit working for the research because I wasn't having that much support. Fortunately, we had a small project. I used to work at the Crops Research Institute back home in Ghana, and we had a little link with CIMMYT at a time where conservation agriculture was picking up. And so I had the opportunity to get in there, but just immediately after that support, after that initiative, there wasn't anything conservation. And so I was just one single person out there doing it not as a program in an institute but as an individual. And that is why I quit working for the Crops Research Institute, because I needed to preach for what I

believed in. And so I pulled myself and decided to go. So at that very time when I was pulling myself away, people came to talk to my wife to talk to me because they thought I was getting mad. "Where are you going to get the next month's salary?" But I said that my wife knows that even when I'm working at an institute, we are working on the farm. So I said, "I'll work on the farm if I don't get to work for anybody." So it was through this that I have come this far. And now everybody points to me as the one moving conservation agriculture. And so the research institute now come to me, my colleagues in there, come to me to learn, and I am influencing the rest, the extension system. The unfortunate thing is that extension system has broken down. But otherwise, I'm pushing research and extension.

Buffett ... Kofi, don't let your wife meet my wife, okay.

Boa Oh, no, no.

Conway We haven't got a lot of time, but I just want to come to this issue of climate change in the role of conservation agriculture. By the way, this is not an advertisement, that Montpellier panel just published a report on climate change of African farmers, and it's outside on the table. I hope you... There's people waving them — that's great. It's a religious meeting again.

Buffett 1-800-Sir-Gordon, right? Is that how you get it?

Conway No. Give me a while, really.

Buffett I know.

Conway But the point is this — we're going to have to reduce greenhouse gas emissions. At the moment, we're on track for a 3-degree above preindustrial world, not 2 degree, 3 degree. If we get to that, it's disaster time. We've got to cut down on emissions. Agriculture has a role to play here. Now with conservation agriculture, you can get carbon sequestration, not a lot, and you can get something like half a ton per hectare, right, as I understand it.

Buffett It's more than without it.

Conway Yeah, it's more. That's right, more than without it. But you have got... You've been looking at rotations that will reduce your use of nitrogen, and that in turn will reduce greenhouse gas emissions. Can you just describe this briefly?

Buffett The big thing is that cover crops and also some of the rotations, but rotations don't mean... I don't want people to walk away thinking it has to be corn and soybeans. One of the most effective rotations in no-till is corn-corn-wheat-soybeans and then corn-corn. So, I mean, it can be different combinations. There's not a magic formula to it, and it's going to depend on your soils where you are.

But I think what we're trying to do is prove two things: One is, you can reduce synthetic inputs, and when you do that, you can talk about the carbon stored in the

soil; but you also have to think, okay, if we don't need a hundred pounds or a 120 pounds of nitrogen in that field, what's that do to the overall footprint? It's huge. You don't have to produce it, you don't have to transport it, you don't have to store it—you don't have to do all these things, right? You don't have to use fuel to apply it.

Conway And you reduce nitrous oxide.

Buffett Yeah, absolutely. So you have to kind of look at the whole picture. But when this big story comes out, you know—no-till doesn't hold as much carbon as we think. And it's like, so what? It does all these other things, so it's not...

Conway But how do you get to reduce the nitrogen input there?

Buffett You have to use cover crops, and you have to get the symbiotic relationship...

Conway How much can you get? You can reduce by half.

Buffett Well, here's the challenge, okay. At Rodale, they've got it down to a science where they are using basically no synthetic inputs, and they can grow 220-bushel corn, but they can't no-till it that way. Okay, so you have to find a balance between that. And we've had this great guy, Tim LaSalle, working for five years—he's not there now—in South Africa, and he's done some amazing things. What we have to figure out is how to get some of this stuff included and out there, which we've not done a good job of.

But let me throw one other thing in here, because it relates to climate change. There is something I call the fertility belt, okay. And that can be misinterpreted. But if you look at it, it's 30 degrees north and 45 degrees north. It's this little strip that goes around the world—65% of the cotton, 55% of the corn, 45% of the wheat, 45% of soybeans the world is growing in this little strip. Now that should tell you a whole bunch of things, okay. And if you look at Africa, it crosses, I think halfway down between Algeria, Libya and Egypt. You're not getting very far with this fertility strip. Okay, now think about that for a minute. If you look back at history, where has the money gone? And this is one of my... I always say something that gets misinterpreted. This is not a criticism, it's not an insult; it's not anything like that. It's just the fact. Where does the money go? The money goes in that fertility belt, except for maybe rice, okay. Only 20% of the rice is grown in that fertility belt, and there's probably a few other things. But in potatoes, and Gates has done a great job on potatoes and cassava. I mean, there's other stuff now getting attention. But the point is—if that's where the research is, then you're missing the rest of the world. Okay, and you're missing some of those important crops and the diversity that African farmers need. You're also missing the opportunity to understand how do you fight climate change outside the fertility belt, okay. It's a big deal. It's a big deal.

Conway Okay. Alejandro, you're able to reduce nitrogen inputs and increase profits using no-till or using conservation farming rather?

Moriena Yes, we are using nitrogen use on sometimes phosphorus use, due to no-till, crop rotations and cover crops. It works. Maybe for the commercial, large-scale farming it works more slowly than a research, concentrated, intensive station, but it works. In the real world it works.

Conway Do you use microdosing at all?

Boa Not at all, no. What is happening is we just came through using cover crop mixtures, and that is making a lot of difference. Different species of cover crop bumped together on the same field. And we have just started that one. We have gone through a crop of maize without any extra external input in terms of soil ammendments. And this, the yield that we had, normally on our fields, we have had been having about five tons per hector of maize. On this plot without any external input, we have had 5.5 tons of maize, just putting a bunch of cover crops in there. Each of these bringing its different attributes, killing it and planting some more.

Conway You know, the average for Africa has gone up, roughly to about 1.2.

Moriena Yes.

Conway 1.2 tons per hectare...

Boa Yeah, 1.5.

Conway So getting 5 tons is terrific.

Boa Yes.

Conway If all smallholders in Africa could get five tons, you'd transform all of Africa like that.

Moriena And this is a fact, and that is why the no-till village now is a net exporter of food. And that is what we want to see across the country.

Conway Okay, okay. Now then, we've got 4.-something minutes, and I'm just going to ask... Howard wrote a book called *40 Chances*, which I'm summarizing it but at least to say all of us have got about 40 years of working life. Some of us have exceeded that – that's why I'm up here. But what I want to ask each of them is, for the new two chances in the next two years – you've got a chance next year and a chance the year after that – what do you want to do with that chance? I'm going to start with Alejandro first and come back to Howard.

Moriena Okay. I think one of our main challenges, and I will build up the asset, the chance for me is having all these sustainable ways of producing food, being differentiated on the market, maybe premium, maybe a label, maybe it's access to differentiated market, but I think it's good for people, for customer, and customer can differentiate if your food was grown in a sustainable farming, conservation

agriculture or not. So I don't know the models, and I am not talking about a specific scheme; I'm just talking about the idea, trying to reach that idea will be...

- Conway Okay, Kofi, what do you think next year or the year after, what is it you want to really achieve.
- Boa I really want to focus on helping to reduce land degradation coming from surface mining, which is now all over west Africa. And the way I want to do this is – the youth form the biggest labor force in there... So what I want to do is build role models out of the youth, and in doing this I will target the leaders, both men and women, the youth in there, spend time with them and give them real technical education on the ground and build them up as smarter farmers, and use them to wean off the youth from the mines.
- Conway That's good, that's a great use of your chance. That's terrific. Howard, you've got...
- Buffett Thanks, Kofi – now I've got to follow you.
- Conway That's why I did it this way. Come on, you've got a chance next year, something...
- Buffett I think.
- Conway No, no, you have. I've looked it up – you've got one.
- Buffett I would hope that... We're starting two really big things in DRC, Congo and Rwanda. They carry a lot of risk in terms of whether we can succeed – that's what makes them big. They're different. And so my hope is that in the next few years we can succeed at that, because if we succeed at that, I think we are in a position where we can show people what can be done differently and some of the things that can actually count and change their productivity where a lot of people will benefit if it increases. So I'm just hoping we can have success with those.
- Conway Great. Well, we're going to end now. I think all of you will agree it's been a fascinating discussion. I think all of us will have learned something more about conservation agriculture. Conservation farming is probably a better word than conservation agriculture. And I think the three of them are real witnesses to the way in which it's not just the practice but having the understanding of the principles behind it at the same time. It's principles and practice coming together. There's a wonderful phrase in the Roman literature which says that agriculture is not only a science, it's also an art. And that really does describe the kind of things that these three guys have been doing. It's about science, but it's also about art – and by the word "art," they mean skills, and it's having those principles underneath it. Please join me in thanking our three panelists.