



ANNEX B: Interview Transcripts

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Interview with Dr. Kofi Boa

Interviewer: Adam Stepan

Adam: Okay. I'll start off just by saying your complete name and your current role here at the center.

Kofi Boa: My name is Kofi Boa. I'm the Director of the Center for No-tillage Agriculture.

Adam: Doctor, tell us a little bit about the history of your own personal history. I know you had a University of Nebraska connection. You grew up in Ghana. You ended up in the States. Tell me how did this all come about?

Kofi Boa: It all started when I was a little boy, about 12 years old. I came back from school one day ...

Adam: [crosstalk 00:01:37] Hold on. We'll just wait for this big tractor to drive down the street.

Kofi Boa: Yes. It's gone now.

Adam: Okay, so sitting up, all right.

Adam: Okay, silence everybody. Okay, great. All right, so tell me a little bit about growing up. I know you had a Nebraska connection. How did this all come about?

Kofi Boa: Now I was a little boy here growing up, about 12 years and I came from school one day, my mother wasn't home. Nobody could tell me where my mother was so about 7pm an old man was [inaudible 00:02:11] that my mother was still on the farm and that was very surprising. Then I got to know that my mother's only cocoa farm was on fire and so I stayed and about 9pm, I heard my mother coming home crying in the darkness of the village. For sure, the only cocoa farm that was keeping us was on fire and from there, life became very difficult for us especially for me, the very young one of four.

At that time, I promised my mother I was going to spend the rest of my life fighting the use of fire on the farmland. Slash and burn had been the only means of preparing land in the area and so if I needed to have an alternative, then I needed to find something that could replace slash and burn. I went to school and I decided to do agriculture but even at that time I would come to the farm of my mother and I would just get a small portion of her land. Once she was doing the slash and burn, I would be planting directly in a mulch.

Adam: Okay. One second. I want you to zoom in a bit at him.

Speaker 2: It's way too much.

Adam: Way too much?

Speaker 2: Right there is fine.

Adam: Okay, that's good. Great. Tell me about that, you would be planting in the mulch?

Kofi Boa: Yes, so my mother would still be doing the slash and burn but I would just get a small portion of the land to do my no-till, that is planting through the mulch. I could see that my crops were doing better than my mother's big farm, so I decided that at school I would do agriculture and I went to college, I did agriculture. I went to the university and I did agriculture right here at the University in Kumasi. Then I had to work for the Ashanti Cocoa Project. Establishing cocoa farm, they needed to clear the land, burn it but plant and I tried getting people off burning and it wasn't easy to do that.

Surprisingly in 1983, there was a bush fire that swept across the sub-region and it destroyed several cocoa farms. Then we had the opportunity to rehabilitate the cocoa farms, plan again. Even then people were still doing the slash and burn, so my frustration grew and I decided to quit. I quit and I joined the Ghana Green Development Project where I started doing some...

Adam: [crosstalk 00:05:16] Hold on for one second. This bird 's chime is too loud. Do we yell at it? Would it go away if we yell? It's really strong, right? You don't think...

Kofi Boa: It's just a tiny little one.

Adam: It's just a tiny one but if you throw it ... Okay. Could someone walk over there where it is, please?

Kofi Boa: It's just on the plantain and...

Adam: Just go walk over there and so, rolling? Tell me the story. You were studying at University of Kumasi?

Kofi Boa: Yes. When I left the University of Kumasi, I had to work for the cocoa project and cocoa establishment was such that we needed to clear the land, but the tricky part is, that was where the no-till started. In those days, farmers would clear the land, would now burn it and plant through but by the time I was up growing and when I got to know farming, that had been replaced with the slash and burn. On these cocoa farms, they were slashing and burning. I tried to get people off but it wasn't easy. Fortunately or unfortunately, we had a bush fire which spread across the sub- region.

Adam: Sorry. Wait up. I'm sorry.

Speaker 2: Okay, speeding.

Adam: You were telling a story. There was a big fire.

Kofi Boa: Yes. There was a big fire that destroyed all the cocoa farms and working from the cocoa project, we had the responsibility to re-establish the cocoa farms and so I was thinking that with the fire that came, people would be more interested in planting without the use of fire but still they were using fire to burn to establish the farms. Then, like I said, my frustration grew because people were not going my way

and I quit working for the Ashanti Cocoa Project and I joined the Ghana Green Development Project at the Crop Research Institute.

There I had the opportunity to do some research in mulch; planting through the mulch across several ecologies in the country. From that time I had friends calling me Mr. Mulch. That was so interesting. Working from there, then I had the chance to do advance agriculture wherever I wanted to go and so I looked through and saw that there was a lot of no-till being done in Nebraska and I decided to go to the University of Nebraska in Lincoln. When I went there, I got very good exposure to the no-till systems.

When I was here, it was all about the small holder one, using manual implements and other things, but then I came back from Nebraska very much enriched. In a sense that I had been exposed to the very advanced no-tillage system just as well as the small holder system that I knew here. When I came back to the Crop Research Institute, I continued working in the no-till systems. Then we had a project that ended. It had a little bit of no-till, but when the project ended, there wasn't much no-till activity, and so I was doing everything all by myself, moving around and supporting NGOs, both local and international that were into the promotion of no- tillage.

Then working from the institute and doing everything on my own, I decided that I had to go on my own to push for what I believed in. I got more motivated to move away because at that time, we had a director who called me one day to tell me, "Kofi Boa, sit down. You are a research scientist. You are not an extension officer." At that time I was spending a lot of time on the farmers' fields, moving around with the NGOs, looking at what they were doing and helping them to get farmers to understand no-tillage farming.

When all these things happened, I decided to go away, go on my own to push for what I believe in and so I pulled myself away. Throughout all this, I was farming and when I used to work for the government and was staying in the city, I never spent the holidays or weekends in towns. Every weekend I was back to the village, farming. At the time when I was leaving, friends were very skeptical about my future and several of them were asking what I would be doing the next day. Of course I didn't know the least of what I was going to do the next day. I had friends coming to tell my wife to sit me down because they thought I was getting crazy.

At the prime age of my research career, I was quitting and nobody understood that, but before my wife got to know, I had already tendered in my resignation and I had had a reply so it was too late for her to sit me down. I came home and I said to my wife that if I never had anybody to work for, I was going to work on my farm because I was still working on the farms even though they were small farms. Shortly after I resigned, there were so many people looking for me to work for. I was contracted by Monsanto to ... Monsanto had this small holder conservation tillage development.

Adam: Just because I'm worried about the weather on stuff, I'm going to focus ... I think I want a bit of the background. Tell me a bit about the center, so what is the motivation behind the and when was it founded?

Kofi Boa: Yes. I'm coming to that.

Adam: Okay.

Kofi Boa: Throughout my life, I had been using my farms to teach and I have parts of reference around this area and I've been using all those farms to teach. Unfortunately during those days I was doing the rotations so a farmer would come and see just one crop at a time and the next time it will be another crop, but I realized that farmers were looking to see several crops because a farmer would come that is planting plantain and then you have cassava.

That would not be so much of an interest to that farmer so I decided to set up by the roadside where I can have a permanent place and I would have several crops in several systems running all the time so I could have the opportunity to address the needs of all farmers at any time and so in 2012, I set up here. I spoke to a lady in town, an old lady who agreed that if I was going to do this to teach, then I could have the land. We set up here in 2012 and since that time we've been working, but then sometime in 2013, we had a team and I had known Buffet prior to establishing this.

I had been looking at some of the conservation projects across Africa that he was funding. There was a team from the Buffet Foundation that came here and when they saw this, they got interested. They reported to Buffet what I had started here and he got interested and came in to support what I was doing and since 2013, we have had the support from the Buffet Foundation to do whatever we're doing here.

Adam: Tell me a little bit about the day to day we saw last time. What sort of work do you do? You can say here at the we receive farmers from across Ghana and internationally. We work a lot with young people like we saw today, young future farmers but we take the round to show them. What do you here at this center?

Kofi Boa: Yeah, at the Center for No-tillage Agriculture, there's a lot that we do. We do lots and lots of training where we have farmer groups coming in here, NGOs putting their technical staff and farmers together and then the Ministry of Food and Agriculture, this is where they train their technical staff on sustainable farming systems. Then we also have what we call the Sunday school. The Sunday school is every Sunday and then its cycle runs for five weeks. Every Sunday afternoon about 2pm to 5pm, we have a group that comes here.

Then we take them through the principles of conservation agriculture and we'll run them through five modules that go up for five weeks. Then we also have what we call the Fellowship Program. In fact, we are so tight here. Now everybody is talking about what there is to do in the face of climate change on agriculture and we are working under pressure because a lot of people come to us. A lot of people call us and all that, so we decided that to increase the number of experts in the country, we will establish what we call the Fellowship Program.

In there, we bring in students that have completed the first degree in agriculture and have done their one year mandatory service to the government. Then we keep them here for one year and give them training. We borrow their knowledge and skills in no-tillage farming so that through that processes we'll be able to increase the number of no-till experts within the country to reach out to everybody and we have that going. We have also been running trainings for people coming from outside.

Right now as I'm speaking, today is Saturday, tomorrow, Sunday we have a group coming from Botswana and they're going to stay for one week to go through no-till training. We also have been training partners for [CIT 00:15:44] in Africa, organized by [AGRA 00:15:46] and they come from all of

Africa. One thing that we have also done is, looking at scaling up, we have also brought in mechanized CA systems and within the sub-region, this is the only place where you can have expert training in mechanized conservation agriculture.

Adam: Okay. I'm going to now go back and talk some more general really big questions. In terms of Ghana, we're in the Ashanti region. Tell me a bit about the Ashanti Kingdom, how long have people been farming here, how is farming practiced? Tell me a bit the history.

Kofi Boa: Now Ashanti region is in the humid part of the country and then it used to be really forest land and that is where I said that in the very olden days, they were doing this type of no-tillage but the difference is that they will clear the forest, cut down the big trees this year and leave it untouched, so by the time they come next year, the whole trash would have settled, the mulch would have settled and decomposed and the [bed locks 00:16:49] come down so that they can just prune the trees and plant their cocoa in there.

This is what they were doing to maintain the fertility of the soil to be able to support crop growth but you know as population grew and then also the fact that most of them exhausted the land and planted those cocoa, they needed to come back to clear the shrubs and at that time weed pressure then grew, and so it was like they needed to slash and burn to be able to plant crops just around their houses. Of course in the Ashanti region, it has been farming especially the plantation farms, cocoa, that has supported the region, especially when you go to Kumasi where we have the king residing.

All the old big houses there were bought by cocoa farmers, so farming is traditionally enshrined here in Ashanti region both for plantation crop and for the food crop. Food crop has a very good market because the Kumasi market is very big. It attracts people from all over the country and from outside and so if one is farming in Ashanti region which has good conditions for farming and the market avenue is there, then it means that there is good prospect for farming and that is why farming became very popular and very important in this region.

Adam: Maybe just talk a little bit about ... Explain to me that we're in the ...

Kofi Boa: Yes, so you know the Kingdom of Ashanti is one of the oldest in Africa and it is one of the kingdoms still thriving, getting stronger and stronger all the day and because of farming tradition, what has happened is that population has also grown and there is so much pressure on arable land against the background of development. Now Ashanti also has a lot of gold deposits.

Gold mining and more especially these days that we have gone into surface mining popularized by the Chinese and other people, entrenched so much into the arable land against the fact that people had been farming for a very long time and our slash and burn farming practices [supposedly 00:19:19] caused so much degradation. Now there is pressure on food crop production.

The arable land is not able to support good crop growth like we used to do. Therefore, in Ashanti region, one would expect that those of us in conservation agriculture which holds the future for sustaining the productivity of a given piece of land should have rather settled in other areas rather than Ashanti region.

I tell you, we have the pressure and it's mounting, it's growing and so here we have an opportunity to show people what we can do to improve the degraded land as well as what we can do to support the sustainability of the already good lands and those are the two things that we have here which makes this region very unique in the sort of thing that we do.

Adam: In terms of after when Ghana became a British colony, the Gold Coast, cocoa was ...

Kofi Boa: No it was during the time that ... You see, when we had cocoa, shortly after, when the British was here we had cocoa and then after that cocoa was still coming up. Cocoa came up and one thing that has happened is, when the whole place went back into cocoa, I mean, and cocoa is a seasonal crop. Those days the varieties that we had in the country were seasonal crops, and so food crop availability became a problem.

Now we have taken very good note of that and so these days what we are even getting to people is showing them what we call transitioning from the food crop farm to the plantation farm because when the whole land went into cocoa, then knowing that cocoa is not easily eaten by anybody here in the country and I tell you, people have grown cocoa for 50 years, they have never tasted chocolate. Yes, and so getting their food crops like plantain, cassava and other things that you see around became a problem and I told you about the 1983 fire.

A lot of people have said that that was also a blessing because at that time there was so much hunger because the lands were filled with cocoa plants, cocoa plantation and people could not have land available to grow food, but when the fire came and destroyed all the cocoa farms and burned it up, people had the opportunity to grow food.

What has happened is that, a lot and lot more people are now thinking of reserving part of their fields so that when the cocoa farm is there they will still have places that they can grow food which is very much different from the initial stages just around the colonial days when people went in so much to grow cocoa.

Adam: In terms of, I know right now for the government, the fact that ... Tell me a bit about land holding in Ghana, is it a lot of small ag holders generally? Is that a challenge for expanding production?

Kofi Boa: Here in Ghana, land holdings are very small especially in the southern regions. It's only when you go to the northern regions where you have sparse population and therefore there are vast areas of land but then looking at productivity, in terms of inherent fertility, soil status and other things down here especially in the mid Ashanti, [Brahavor 00:23:10], Eastern, parts of central and western, are the places where we have the good lands and where one would surely think that we need to do a lot more in terms of food production.

What is happening now is that on and on, a lot more people will prefer to move into the cities especially even the youth. I mean, just after school, after the primary or the middle school, the junior high school, they will want to settle in the city because now people think that farming is too much labor intensive, it's not rewarding and more importantly, farming is relegated to people that when there isn't ... To tell you honestly, there is not so much respect for farmers because everybody thinks that the farmer is somebody who could not go to school.

A farmer is somebody who could not learn any trade and therefore had to stay in the village to farm, to produce food as a way of life. This is very bad and it is having very bad consequences on our development, especially in trying to ensure food security. Now the middle class, because people would not want to be associated with farming and be taken as people who are with the lower class, they would want to stay out of farming and that is very, very bad. That is why for some of us, we are motivating the youth.

We are getting the youth, advising them to get back to the land and this has been the cry of the government, the youth to go back to the land, but then you just cannot sit on TV, you just cannot sit anywhere and tell the youth to go back to the land. Go back to the land with what? They need technology, technology that works and apart from the technology, they need a bit of support because whatever happens in there, you need at least a bit of money to own the land or rent the land.

I mean, in the preparatory stages, you also need something to live on, and so the way things are going now, the youth are hurrying themselves up to the mines, the youth leaving the villages, the rural areas to go sell dog chains in the cities. Then the middle class, the technocrats, not wanting to get back into farming, it becomes very disturbing. The only thing that we see happening is that in this country when people have outlived their working age and they are going on pension, that is where they come back to us.

They come back to the land, but they come back to the land when they are weak. They come back to the land when they have a little bit of money to invest, and once they come with that little money to invest and you know in farming especially the plantation crop farming, the incubation period is long. You can go as far as three, four, five years and for most of them before it gets to start bearing, their resources are finished.

Adam: Got you, so let's just do a quick ... Do we get some water? Are you okay?

Speaker 2: Speeding.

Adam: Doctor, in terms of the expansion, the work you do in the villages, last time we saw you go to a local village, what do you do? Why do you go out to villages, do a slide show at night? Is it important to take this teaching to the village, to show people who wouldn't necessarily come here, you present in the local language? What do you guys do when you go to the local villages?

Kofi Boa: At the center what we do is, we try to reach out to everybody, especially the village folks because they form the bulk of food producers.

Adam: Sit up again, just a little bit straight up. That's great. Yes. Right, Adam? Okay, [inaudible 00:27:02]?

Kofi Boa: Is it okay?

Adam: Yeah. Okay.

Kofi Boa: At the center we try to reach out to a lot of people, especially people in the rural communities because they form the bulk of the food producers in this country. Now several times, people get to hear about us and try to look for us but we also carry ourselves to people and mostly what we do is that we have some videos and these videos are, they are mostly, it's drama around no-till farming.

Just to get people to be hungry for our training, for our services, what we do is we ... Like starting in a village, we get in there to show a video about our way of farming and then we get the opportunity to enter into discussion with the farmers. From there, they become so much interested, wanting to know more and they arrange to come to us for training. The videos have been a way of just getting people to see what we do, creating the opportunity for discussion and then also getting them to ask for more of interventions.

Last night what we did in that village, right now it's like every Tuesday for the next 5 weeks, that village is going to be here and just this morning when we were here, they sent somebody from the village to come to us. We were sitting here and just to let us know that they are prepared for that.

Adam: That's good. In terms of, is that an advantage that Ghana has?

Kofi Boa: Okay, you know at the Center for No-till Agriculture, we have a unique definition for no-tillage and that is where we have had a lot of problems with people when we begin to talk about no-tillage. Now no-tillage just on its own is that no tilling the land but our definition of no-tillage coming from this center is planting on an untilled farm covered with mulch. We took it from our forefathers because the no-tillage that they were doing, they call it [proka00:29:31] in the local Akan language, and it's like cut the vegetation, leave it there to rot, and bring back and then plant through.

For what to rot? For the vegetation that you have cut to rot, the organic matter to rot and plant directly through. When you talk of no-tillage in other areas, it's just like it can be a bed round where you don't till and traditionally our slash and burn could be described as no-tillage because they just slash and burn and plant without tilling just like we do in no-tillage. The difference is that we will always have mulch cover on the ground, and so our no-tillage is like planting directly in an untilled field covered with mulch. Normally the slash and burn would be planting directly on a field without tilling but without mulch.

Adam: Tell me when ... Describe a bit, carbon on the ground but it would only last for two or three years and then traditional people would ... Maybe sit up a bit just ... Great.

Kofi Boa: Earlier on, the slash and burn was very sustainable because we had just quite a few people living on vast areas of land, so what was happening is that, they would cut the field today, they would cut the vegetation, slash and burn and crop it for about two years. In that case, they did not have any problem because the organic matter that was in the soil was able to sustain crop production for that short period, but then they would move on.

In several cases it would take about 10, 15, 20, 25 years before they came back, by which time the land would have rejuvenated itself, but thus population grew and the land area became smaller and smaller. The opportunity to leave the land in fallow has been eroded and now that people are staying on the same piece of land and cropping that land season after season, year after year, the organic matter doesn't get to burn up and so the soil loses its productivity easily.

This has been one of the motivational factors that have pushed people into our type of no-tillage. That is planting directly on untilled field covered with mulch because the mulch this time now is able to retain moisture, is able to reduce the speed of run up so that you can have the soil stay, so soil and moisture conservation is there. The soil organisms in there also have this rotting material to work on as opposed to where there is nothing for them to feed on.

As these organisms in the soil keep coming up and down, they burrow up and down and they increase air and water movement in the soil. Now the soil doesn't get to cake like we see, and so in all the demonstrations and now it's been testified by the farmers that the way to go to sustain their lands is no-tillage. The casing point is 2015, we had very bad weather for farming especially in the second season and several fields were lost but in and around the Center for No-till Agriculture, farmers harvested so much.

Right now people come into the area to buy grain, why? We had the same amount of rainfall but it's because of the system that has helped us build resilience in the soil, in terms of moisture conservation, in terms of preserving the top soil. That is what has made a difference.

Adam: That's good. Describe a bit ... I think your demonstration was very ...

Kofi Boa: At the Center for No-till Agriculture, what we stress on is the soil comes first. We always get the farmer to appreciate that you need to take care of the soil and the soil will take care of the plants. A very typical example and a very funny thing we do is get the farmers to appreciate that if you want to give water to your plant, what do you do? You put the water in the soil. If you want to give fertilizer to the plant, it goes into the soil so through these two things, these two examples, get them to appreciate the fact that the soil is so important for crop production.

Now we have always been relating what is happening on their fields to the forest. Every farmer in this country would want to farm a forest, would want to clear the forest to farm. They would tell you, "Hey, that soil is good." Who is making it good? It's the system. Now they appreciate and everybody appreciates the fact that under the forest, there is active life. Under the forest, the moisture is there and then the soil is so moderated in a way that the soil organisms have food to eat and they are so vibrant.

They keep going up and down and in that case, they work the soil to make it ... They till the soil for us and so when we relate this to the forest, the farmers then get to appreciate that yes, it is rather down the soil that is more important. On our plot here, what we saw here is the mobile Soils Care but right on the soil that is on the ground, we have that soil profile pit and when the farmers are there, we get to show them the different layers. Then they get to appreciate the thickness of the top part, the most effective part.

Once they get to know that with the slash and burn, with the ploughing, that good layer gets thinner and thinner and thinner because of erosion, because the soil is washing up, then they become aware that this is what they have to do. In fact, several times we have had farmers coming here and at the end of the day they start crying. They cry because they tell us, "We have wasted our time."

That they have wasted their time for all the practices that they had gone through because they know, they get to see that these very simple practices are things that could have saved their lives, things that could have saved their farms, and so they cry that ... We had an old man, 72 year old man coming from over 50

kilometers away from here and when this old man came he said to me, "Kofi, I wish I had about 20 more active years." This is so gratifying and that is what is pushing a lot of people here.

Adam: Dr. Boa, in the US right now it's 33% no-till perhaps but there are lots and lots of farmers who already made huge investments in traditional plough tillage, huge combines, expensive equipment, half a million dollar combines, so for a lot of those people it's really hard for them to re-think of a new path. Here in Ghana, most farming has not been mechanized yet. It's only now making a transition to using tractors, to using mechanized equipment. In a lucky moment, could Ghana make the transition to mechanize farming the right way? Is it a good opportunity?

Kofi Boa: It is a very good opportunity for Ghana to mechanize farming. Already in the dry land areas, we have some level of mechanization going on because there are tractors with the ploughs and other things. In this country, if anybody talks about mechanization it's just equated to ploughing and so if one is not ploughing then he's not mechanizing. When we started talking about mechanized conservation agriculture, people were confused and were, "But you guys you don't use machines." "Not that we don't use machines, but we use different machines."

Now the point is that, Ghana has not gone so much in mechanized systems, and so right now as we have introduced mechanization, we think that it is a very unique opportunity for us to show the right way, right from the beginning, especially in the areas that have not been touched yet. Even in the dry land areas where there have been ploughs introduced long ago, the very moment we started showing people the way to go as far as mechanized CA is concerned, people have become so much interested.

We have brought a lot of farmers from the northern part of the country here. These days because of that, all the international NGOs that are operating in the northern part of the country bring their farmers here to experience the mechanized systems. We have been motivated to set up service centers in the north so that we can have our services hired out to the people over there and through this, we will be making mechanized conservation agriculture more popular.

Adam: Describe your mechanized conservation agriculture system. We filmed with John Deere. We saw the 1025 no-till planter, but describe the plan.

Kofi Boa: In our mechanized systems, we are very much aware that we are still very young as far as mechanization is concerned and most of our farmers, of course, majority of our farmers are in the small holder category, say about two hectares average and so we have started, like when you go to the roller crimper, you can have it to be very big, but we have just gone for a 6 feet one. Something that can just be rolled on smaller pieces of land. Then also the choice of the engine, the machine, the tractor itself, we were using the CT horsepower tractor which is not big enough and so it can easily be maneuvered around smaller fields.

With this narrow roller crimper, that can be moved around the fields. Also we have the two row planter, because we are not so big, the target immediately is for the small holder farmer progressing through the medium to the large scale farming system. We have the two row planter which can also be moved easily within the smaller fields. Now just after introducing the two row planter, we have had people that have come to us asking for six, eight row planters.

Currently we are told that there is a project in the north that accessed mechanized training from here that has started bringing in four row planters and they have indicated that they are going to bring in six and eight row planters. What is happening is that we have shown people the beauty of it, the value for it and then people have [bargained 00:41:18] on it but we'll continue to be progressing through so that we can continue to serve the needs of the small holder farmer just as we progress to the medium to large scale farming practices.

Adam: How does a roller crimper work? What does it do and what's the process? You grow a cover crop then you use a roller crimper to break it into a certain way? How does it work?

Kofi Boa: The roller crimper that we are using has come in neatly because you see what one has to do is to make sure that we plant on a field that does not have a living crop so that nothing will compete with our commercial food crop, and so the roller crimper is a way of killing a weed. There are several ways of killing a weed. Here we use a machete and a lot of people will also use the herbicide.

The herbicide have become very popular because we have the herbicide, the industry growing and so many of them coming in and everyone pushing for it, but the roller crimper takes away the drudgery of using the machete. Then also it takes away the dangers associated with the use of the herbicides, both for human and for the soil. What happens is that the roller crimper would be run through the bush attached to the tractor and then it will break the whatever, especially the cover crops.

The best condition will be establishing a cover crop and then at about the time when you have maximum biomass produced, you run the roller crimper on there and it will break the cover crop just at the soil level below the very last node so that that crop that we crimped cannot sprout.

Adam: Show me a little higher. No, down below. Right there. Describe it. Show it a little higher, so how does it work?

Kofi Boa: For instance, if this is the weed and then the very last node, the first node from the ground is here, then what we do is that the roller crimper will break it here and when it breaks it here, then it means that there is no node here to cause it to sprout and so it will die by itself. When it happens, the very moment we crimp then we come to plant, you see as vegetation is browning then the green thing starts coming out and that becomes so beautiful and that is why for our system, we call it the brown revolution. The brown giving rise to the green and it becomes so perfect that you have a nice carpet of mulch very well laid on the ground and then you have your crops right through the mulch.

Adam: Wonderful. Let's hear a little pat down. How does it work instead of ... Describe the various elements it has?

Kofi Boa: We normally use the no-till planter after we've used the roller crimper but you don't necessary have to use a roller crimper before you use the no-till planter. It can be used but the point is that it doesn't kill the weed and so once you plant through the thick bush, you have to come back to use a herbicide, but now, granted that we have used a roller crimper and then we have to plant, the no-till planter has very unique parts that help us to do this. The very first part you have is the [cutter 00:45:00].

That is the cutting blade and so that comes in front and what it does is when the roller crimper has just crimped and then the good thing is that the roller crimper will not detach the crimped vegetation from the soil and so the cutter will cut through a very thin line through the soil, through the mulch that is on the ground. Then it is followed by what we call the furrow opener, which will open it a little bit wide so that when the seed drops, it will drop in the hole because with that thin line created by the cutter, the seed cannot go through.

After the cutter, the furrow opener will come in and open a little bit. Then you have the metering device. Then the metering device will drop the seed. By which then we already know our seeding rate. When the metering device drops the seeds, then there is another thing that comes in there to farm the seed right in the soil for us to have this seed to soil contact.

Then once done, we have the closing wheels, that will come at the end to press the soil against the side of the seed so that you have the seed very well embedded in the soil but then on top of the seed is loose, so at the very moment it germinates, it's able to emerge. For our no-till planter, we have also brought in an attachment from the US that we call the residue manager because there are instances where we have to deal with very heavy residue.

The system that we're operating now, just after the cutter, we have the residue manager that will open up a little bit so that right on top of the planting line we don't have the residue. That allows more sunlight to hit the ground. The other good thing is that, which is very technicalized, most of the decomposing residue will release some chemicals. We call them [inaudible 00:47:30] chemicals.

They are the chemicals which work very well when they are right in contact with the seedling. They can kill it, but then the chemicals they are not so mobile and they do not last in the soil for long. When the seedling is not touching the mulch, then you have no problem with a little part and so we are able then to have perfect germination and emergence.

Adam: The group today for example, these were all young fellas. I thought they seemed very interested to see this mechanism.

Kofi Boa: Especially the youth, whenever we bring young people here, they get so much interested because you see what is keeping the youth out of farming is the labor that is in there. Everybody knows that our farming is so much labor intensive but then when they get to see that they can just manage vegetation with the roller crimper and be able to plant so easily with the machines, they get so much interested. The question that comes to us is how they can access these things.

Then all we are saying is that we are getting corporate buddies to be more interested in this because on their own they cannot access this, but our service centers are going to be stocked with the machines so that farmers in and around the service center can access our services. Then also it is going to be a way of getting people to invest in the CA mechanized systems because already we know that in the dry land areas there are places where we have people that have tractors and they are hiring them up to plant, and so instead of ploughing to destroy your land and we have an alternative that people have invested in then they can also have the benefit of the use of these machines.

In the first place, the whole idea is getting people to know that there is an alternative, a very viable alternative and also getting them to appreciate the fact that if they want to access the services we are setting up and also for people who want to have it by themselves, now AFGRI, the dealers for John Deere are here and through this system, they stock the equipment that people can easily access, people who have the means to do them can access.

Adam: In Ghana, we spoke and interviewed the person that John Deere represented for West Africa and we saw their dealership in Accra. On the one hand we have many small farmers, on the other hand need to buy a piece of equipment that could be used by a group. How do you manage that? How are you structuring to make that financially viable?

Kofi Boa: In Ghana as it is now, through some of these NGO projects, we have a lot of farmer groups especially in the northern part of the country and more so we have [Nicolas 00:50:37] farmers and Nicolas farmers have the capacity to access grant, loan from the bank. What we are doing is bringing their minds to the fact that this is also an area of investment such that they can access machinery, use that to service farmers to work for themselves and also to farmers that farm around them.

More importantly, we are also encouraging the farmer groups to try and own these machines so that they can use it for their own farms and then also for farmers who do not belong to the groups but also farming around, and in doing this they will be making money and at the same time helping to make farming more sustainable through sustainable practices.

Adam: One of the things that I was surprised and quite moved by in your presentation, is that part of what you try to share with people?

Kofi Boa: No-till farming, the immediate thing is the farmers own benefit, thinking that I have to improve myself to get more yield and then I become happy, but what we are telling everybody is that you are getting a good yield but you drink from downstream and then when the environment gets populated, you will not be spared. We go through all these processes to show them how the farming activities can impact negatively on the environment and then affect everybody.

The fact that when we go no-tillage, we'll be in a way reducing the negative impact of all these practices so that all of us will live in harmony with nature, especially like our farmers who still burn. I mean, when they burn their plot and then it gets offhand, what happens? It destroys other people's property and then also when they burn, they make the land so bare and then the run up goes to affect people downstream, but now everybody is getting to realize that it's not just about me.

It's about the whole community and that is part of our teaching. We do not just get people to appreciate the fact that improving their soils will just give them personal benefits but in addition, it is for the good of society.

Adam: Dr. Boa, what's your vision of Ghana and agriculture in Ghana in 20 years and 30 years? What would you like to see when people come here and visit?

Kofi Boa: Looking in the faces of people that come here and watching them go back and the commitment and more especially the feedback that I get from people, I get so motivated. I say that I will surely see Ghana becoming a no-till country fostering through west Africa and Africa before I die and it's going to happen because the way it has started here, now this village where we are, if nobody is doing no-till it's like the person has done something that is abnormal and that is how we want it to be because if one is not doing no-till, people go to see that it's like he's no part of everything.

That is how it is going and it's spreading. See, the point is that I want this to be institutionalized within the Ministry of Food and Agriculture, within all our research institutes, within all the agricultural colleges and universities. We have started making inroads. It's not easy. We need to break barriers. We need to go round administrative processes but we have started from the grassroots, the practitioners, the farmers themselves are seeing the value and so it's a matter of time. It will come like your revolution, I tell you.

Adam: Dr. Boa just to go back and change, just to cover one other thing. We've got it really, really well, what is the new type of mining that's happened and why has it happened here and how is it affecting the environment?

Kofi Boa: Anytime I get the opportunity to talk about mining in this country, I start by saying that I take responsibility, sole responsibility for whatever I say and I get so sad with myself and several times I cry. Now we are here in this country, especially in Ashanti region here where we had a very big and international gold mine, the Ashanti Goldfields and when I was young, people were going deep down to mine gold and we have coexisted with farming for years.

There has not been any complaints but recently there is the proliferation of surface mining and what is happening is that the top part of the soil which is good for crop growth is what is being destroyed and more especially in the water sheds, in the valleys and everybody here now coming to this center gets to understand that the valleys are even more productive than the uplands because when there is run off, the top part of the soil washes down into the valley, and so the valleys have the best part of the field. These valleys are the target and the top soil is being scraped.

We have given concessions to our own selves and to the Chinese to destroy our lands all in the name of investment. What investment? I mean, the point is that you might not have realized that African governments pride themselves, "At the end of the year, we have attracted so much investment." We do not care about the type of investment that we are attracting. This type of mining to me is nonsense. It's something that we shouldn't go in for.

Now what I fear which a lot of my colleagues I've not seen and I brought my colleagues working in a rice project at the research institute to understand is that the debts of Ghanaians are changing. Now early in the morning, every little boy, little girl going to the primary school will ask the mother for money to buy rice. If you go to the schools [regardless 00:57:39], if there are 20 people selling prepared food, about 18 of them will be selling different preparations of rice but then it is in the valleys that people grow the most rice.

Upland rice is not so much popular. We do it but it's not so much popular, but these valleys that we would use to grow rice are the valleys that have been given out to the people for strip mining and ...

Adam: You want to plug in the light?

Speaker 2: Well, okay, speeding.

Adam: Just to go back a little bit to the mining ... Okay, sit a little bit centered. There. Okay. Maybe turn your ...

Speaker 2: Turn your body this way a little bit more.

Adam: A little bit more?

Speaker 2: Yeah, great. Thank you.

Adam: Big industrialized groups, often Chinese foreign groups come through and use big tractors and then what happens is local people often go and do in a very small scale to re-work dirt that's been turned over digging deeper and sometimes, does the land collapse on them? Is it dangerous in terms of mercury? What are the risks that people working in those areas?

Kofi Boa: The strip mining that is operating in the country, now apart from destroying the lands, also pose a big threat to human life. In there they wash the gold and all these heavy metal get into the soil and who knows what is happening? These and the crops whatever is there, will not discriminate and so these heavy metals when they are taken up by whatever is there, it's all over the place going in and out of the rivers and whenever the river overflows and there's flooding, it takes it to wherever there is.

We have a big threat from soil and water contamination with these heavy metals that can adversely affect our lives. Apart from that, when the heavy machines have worked and the people have relocated or as they go, you get the locals coming behind, getting into the holes, getting into the bottom, sitting in that dirty water, trying to wash, look for gold if they even find it at all. Then there is a possibility of these things collapsing on them. In fact just recently, two villages from here, we had some little boys going in there, the mother had let them in the house, they went and played around. One got inside and died.

Then there was a young man in town in the afternoon, when he heard that, he also went trying to rescue that kid, he also got drowned. There have been several reported cases from around the mines, so people are losing their lives. Then in the abundant areas, you have stagnant waters and they become rich sources for the breeding of all sorts of pathogens, mosquitoes and other things. There is a very active area of mining in this country just here on our left side and we have ... Already because of the stale waters, they have really [bilharzia. 01:01:27]. Now the bilharzia is threatening human life seriously because there are so many standing waters.

The other danger in there is that when the mines have been abandoned and these big gulleys are there and it happens that the weeds take over, I mean, you would not know what is there and so as we grow, as the years go by, we are going to have more problems with people getting trapped in these valleys, and so the contamination from the heavy metals is there to deal with. The locals also going behind, going after the Chinese have left all the big mines, the machines have left to mine, they also risk their life.

I have seen in some of these, women carrying their babies on their back sitting in that dirty water looking for gold, whereas these fields could have been preserved, protected and managed to produce food for everyone. We have been questioning the value of gold. If looking for gold is degrading our soils, if looking for gold is killing our people, if looking for gold is bringing about this hostile engagement between the Chinese and the locals, then what is that value?

Last, about four days ago, I was here when we heard big sound and then we smoke, massive, black soot of smoke from way down there and what we got to know was that a fuel tanker had brought fuel to the Chinese camp, unfortunately people were cooking. They cook at the camp and for whatever reason there was a spark and the whole thing caught fire. The whole place burned, all their machines burned and the amount of smoke that went from there to the atmosphere in just one day will be more than 5, 10 years of an industrial plant putting smoke into the atmosphere, so we have to deal, we have to condemn all this.

Adam: I think we've really had a wonderful interview. I think we've covered everything.

Kofi Boa: No-till has a lot of benefits and one of that is ensuring that we are able to reduce global warming. Now it's all about putting so much carbon into the atmosphere and reducing the ozone layer and we're having all these problems. With no-tillage in the first place, especially in our part of the world, if you are not burning to put a smoke there, then you ask yourself where is the carbon going. The carbon is going into the soil and the very moment carbon goes into the soil, it becomes a very useful asset.

The carbon content of the soil if it is high, this organic matter then is high, then we are improving the soil. Now when in no-tillage the idea is to keep the place green. The only time that you have a browning is when you have cut it down, but when you have cut it down, you will still have the carbon going into the soil. The point is that we have the plants to siphon the carbon dioxide, the carbon from the atmosphere and fix this carbon in the soil whereby it becomes a very useful product.

If we had a lot of people going no-till for which we are not going to be using all that machineries to be ploughing, you see, and to be harrowing, going back to plant and going back to do all those things, and then when the machine is down, you need so much power to move it on the ground to plough. It's not like using the roller crimper. The roller crimper is just running on the ground. The no-till planter is just a very light thing that is in the ground but with the plough, with the harrow, there is so much of whatever is in the ground to be pulled.

In that case, there is so much carbon into the atmosphere. If we do away with all those practices then we are reducing the amount of carbon we are putting in the atmosphere. We are putting so much carbon down and by that processes, we'll be ensuring that they are so much sequestered and we clean the environment.

If we are fortunate enough to live strong, and then continue to push for the adoption of no-tillage and we get every farmer to understand, adapt and adopt no-tillage practices, we surely would be living in a very nice environment because on and on we'll be reducing the amount of carbon we put into the atmosphere. Therefore, this global warming would be able to reduce. Otherwise, we fear. The two degree centigrade that everybody is talking about, we are just getting closer.

Adam: Wonderful Dr. Boa. Thank you so much. Cut. Thanks.

[END]

Interview with Edwin Price

Interviewer: Adam Stepan

Edwin Price: Edwin Chappell Price. I'm the Director of the Center on Conflict and Development and the Howard G. Buffet Foundation Chair on Conflict and Development.

Speaker 1: Going back some history about how technology has worked together with agriculture. What was the role that John Deere, iron plow and the 1830's. What was the big breakthrough there?

Edwin Price: The turning plow was able to turn the soil and to provide for greater aeration to a greater depth in the soil. It would help to warm the soil early in the season because we'd be turned up to the sunlight and would add a couple of weeks to the growing season especially if you're in a more gnarly area where temperature became a concern or a constraint on the production. It also provided for at least conceptually in providing a good bed for root growth of the crops. There was a convention that good seed bed or where there was good contact between the soil and the seed provided for quick germination because of the contact between the soil would provide for quick moisture absorption by the seed.

Speaker 1: Okay. To go back for people who don't know, what was happening in the 1830's? Was America expanding West? Was it coming to huge plains that were natural grass prairies? What was happening at that point in the USA?

Edwin Price: At that time ...

Speaker 1: My question will go, in the 1830's US was an Ag culture nation. What was going on in the 1830's?

Edwin Price: In the 1830's, the US was an agricultural nation. The population was moving Westward in rocky pine lands that had not been farmed before. They were covered by prairie grasses. There was a need to turn the soil and to be able to plant crops early because families needed a sustenance from the very time that they arrived on the plains. There was a very strong, Westward movement, homesteading and agriculture was taking hold in the Midwest.

Speaker 1: What was the challenge of the plains? Could it have been farmed without ... Was the iron plow important to opening up the plains and allowing that to become farmland?

Edwin Price: The plains had been for centuries growing grasslands and trees and was arranged for wildlife, for buffalo. The soils were not at that time suited to perennial, agricultural production or annual agricultural production. As a result, it was necessary to break the soils, to break that sod in order to plant the seed of the new crops that were coming into the region. The farms, the homesteads needed to get a quick and early start to plant their crops and to have food for their families.

Speaker 1: What did they discover? Did it turn out that actually, those soils were incredibly deep, incredibly rich once they broke through that sod? Was that a huge global pay dirt in terms of finding really rich soils?

Edwin Price: The plains were blessed by centuries of having been able to accumulate carbon to have stored nutrients. There were very deep soils that have been left by the glacial movements in the US.

Speaker 1: Sorry. We'll pick up that. We should let him put a little note.

Adam: It's okay. Yeah.

Speaker 1: I'm sorry. We'll pick up.

Edwin Price: Right.

Speaker 1: The plains were blessed with certain conditions?

Edwin Price: Yeah. The plains of the US were blessed by very rich soils, very deep soils that have stored carbon for centuries. They were untapped in terms of high productive agriculture so that when the farmers came there and trying to get an early start for their families, moving from the East Coast, across the rivers into the plains, they were able to break the soils and tap into this rich resource that was a treasure for that generation.

Speaker 1: What did that open up? Did that open up almost 100 years of just incredibly productive crops that fed the expansion of the US? Was it also in some ways, was it sustainable? In some ways, were they mining the carbon into the soil? Was there a point where that bounty started to end?

Edwin Price: As these soils were opened, they were able to sustain families for generations. They were rich soils. They seem to be endlessly fertile for continued cropping. What gradually began to happen was not only depletion of the nutrients. What began to happen was that without cover, without cover year round on these crops and the blowing winds and the rains, during the rainy seasons would take these top soils and fill the rivers with tons and tons of soil. Over time, this depleted the soils. It became what was famous as the dust bowl because these soils have been depleted and diminished by the elements over a period of time.

Speaker 1: One big step forward in terms of technology and mechanization of agriculture was creating ... I guess it was iron. Was it steel or iron, the original John Deere plow?

Edwin Price: I think it started with iron and then later, steel. I haven't [crosstalk 00:06:38].

Speaker 1: Okay. I'm sorry. Again, another big thing was the creation of the general combustion engine and the creation of the first tractor. Maybe you can describe what were the 2 big technology jumps in terms of farming in the USA? The plow and the tractor.

Edwin Price: What we need to recognize about those early days was that it was just a few people trying to cultivate large areas of land. That was not possible. They couldn't use the older techniques of hand implements, hose and hand implements. It was necessary to use plows pulled by draft power. Of course, they had horses and mules. Even that became insufficient for cultivating the Western lands. It became possible through the combustion engine and with the use of a tractor to cultivate more lands and to use

less labor, which is very, very critical in the opening of the West. Those labor constraints were key to bringing in the mechanization of agriculture for the West and for pretty much the entire US.

Speaker 1: Let's talk over to life in a farm in the 20's and before up until the depression in [inaudible 00:07:56]. What had happened? Was it really a transformative new type of life? You're there in Iowa and Nebraska. You're on the plain. You're far away maybe from your neighbors but you have the Sears catalog that comes. You become a business person. You want expensive tractor grabs. Was there a transformation of economic life in the American Midwest in this period?

Edwin Price: As it became important for farmers to have mechanization on their farms, in consultation with their bankers, I'm sure that the banking industry was very much a big part of those early days. They were able then to finance the mechanization of their farms and to bring in tractor for mechanization. That began to put farmers on a fairly intensive treadmill that as they invested more and more in machinery, they needed to cultivate more and more land. They needed to pay for the machinery. As a result, the farming became more and more extensive through the application of mechanical means. It was not a bad thing. It was very productive. In fact, it was key to the rise of the industrial civilization as well because it was important that the industries, the factories that were producing goods for the US in the cities that they have a supply of food.

They needed a supply of workers. There was a trade off. The farms became land extensive using mechanization providing food in large quantities. Reducing the number of farmers that it took to produce the food and increasing the land area that was able to produce the food needed by the cities in that period of time. There was a complete transformation of the US civilization at that time is we began to specialize in agriculture and specialize in the cities in industrial production. This tight connection between the development of cities with providing the machines needed on the farms and the farms providing the food for the cities. Very important relationship over that period of time.

Speaker 1: In the 1930's, I guess we're starting. That relationship broke down. There was a great depression, huge crash on Wall Street. I think that probably had impact on the finances of a lot of farmers or a lot of banks probably called them on loans. I never really studied that very much but might be a connection there. Also, the land for the first time suddenly said, "Wait. We can't do it this way." What happened? Was it a perfect storm from the stock market crash into the dust bowl? What happened to that period?

Edwin Price: In some ways, this period of time became the perfect storm.

Speaker 1: My question to you is ... We'll cut off. Maybe the great depression in 19 ... Stop [right across 00:11:03] in the great depression. Sorry.

Edwin Price: Yes. What we had an effect was the development of what was looked to be a very good relationship between the cities and the farms in that period of time. Then several things happened. Number 1. The land began to give out. The dust bowl occurred. The winds began. The agricultural seeds to produce that circles that was needed by the cities but also on the other side, we had the great depression. The crash of the markets in the 1929, 1930's, in that period of time created credit constraints on the farmers. Farmers could no longer pay for their land. They lost their farms. In this productive

system that had been developed began to come unraveled. It was a tragedy. It was a tragic period of time when farmers lost their land and the land also lost its productivity at the same period of time.

Speaker 1: What happened in terms of where was the dust bowl most dramatically visible? Was it in areas that were maybe slightly marginal land in Oklahoma? Maybe certain areas in North Dakota? Where did this happen? You need a second there?

Adam: I'm just going to take this up. 2 seconds.

Speaker 1: 1 second. I don't think we're actually seeing it because you're worried it might pop out?

Adam: It just sometimes pops out.

Speaker 1: Okay. I guess describe the dynamics of what was the dust bowl? Where did it happen most? What happened to the farmers? Did they go to California? What happened?

Edwin Price: During the period of the dust bowl, farmers had to pick up stakes and move as conveniently as they could often to the West Coast looking for livelihoods and other trades and other professions in the West. There was a dream of wealth in California. That left these lands barren for a period of time. It was a tragedy for Kansas, for Nebraska, for the plains area. What had become very interesting about this period of time was that because of the level fields, because of the homogeneous structure of the soils, the homogeneous fertility of the soils, that enabled these farms to go to some size. It meant that there were just very few people farming large areas of land. As a result, when a few people leave, it was devastating for land productivity because there was not the management and the manpower to cultivate these expanses of land in the great plains of the West.

Speaker 2: We'll go without you?

Speaker 1: Yeah.

Adam: Yeah. I'm wondering if we just ask him real quick. Does this sound like it's ...

Speaker 1: Cool because I'll have you come in this point. Let me make a couple connections. We have no voice over, too. It's a mix of voice over, some bits of what you say will be classic. It will be good stuff. What was the beginning of movement against traditional agriculture? I know there's a famous book, 1943, *Plowman's Folly*. What was that book? What was the beginnings of this movement? Was it building on what happened in the dust bowl? Did Congress suddenly step up and say, "We have to think about the soils. We have to get involved." What happened following the dust bowl?

Edwin Price: Following the dust bowl, there was a combination of factors. Number 1 was that the US economy was in depression. There was a need to employ people, to give jobs to people. There was a growing concern of how the natural resources of the US have been abused. Through a combination of public programs, the Soil Conservation Service was formed. The WPA, many different programs came into play to conserve land, to provide jobs and incomes for farmers living off the land and to try to rebuild that productive agricultural sector in the plains that had blown away during the dust bowl.

Speaker 1: What was the book Plowman's Folly? What was that book? What did it argue? What impact did it have?

Edwin Price: The Plowman's Folly helped us to recognize that the original precepts of deep plowing, turning the soil to its exposure to the wind, to the rain was perhaps not the best approach that could be taken. That there was a need to look at more conservative techniques in soil management.

Speaker 1: Was it controversial? I think it even argued that there was no scientific basis for plowing. Did people think this was a heresy? Was it ignored? What happened when it came out?

Edwin Price: Actually ...

Speaker 1: You're okay. How did the no-till movement come about? Specifically, let's talk a little bit about Western Kentucky. Why would it be Western Kentucky, an area with grown hills that people started maybe having the first people to experiment with some of these techniques. How did that come about?

Edwin Price: Western Kentucky was at that time a producer typically of corn and later soybeans and has become today, one of the major producers in that area. What was being recognized then was that perhaps in order to conserve moisture in the soil, in order to have ... Even though they have rains periodically that in order to spread the moisture through the season, it would be useful to keep the soil intact and not to turn it to hold the moisture in the soil. Also it is recognized that after many decades of plowing the soil, the weeds that normally grow in the soil had been actually depleted over a long period of time. Plowing no longer became as necessary for weed management in those Western Plains. The additional feature was what we've mentioned earlier was labor.

That deep plowing or power became clear that it really wasn't necessary to use all of that horsepower and to use all of that fuel and energy in order to open the soil. It might be just as efficient to leave the soil intact and to drill seeds in through the surface.

Speaker 1: That introduced me to Western Kentucky but what kind of area is it? Does Kentucky go from rolling hills into the beginning of the plains? Does a rolling area lead more likely to ... For erosion, for top soil. What's Kentucky like?

Edwin Price: Kentucky bears a lot of similarities with the Western plains. It's the beginning of Western plains. While there are rolling hills, it also has its flat areas. It's also an area that is well watered. Near rivers, near major stream beds as well as has adequate rainfall through much of the growing season. Because of those rolling hills, when the rains did come, there were deep gullies were cut into the land. This was taking off tons and tons of soil as well. The water erosion was a very serious problem on these rolling hills.

Speaker 1: How did the no-till movement come about that we're going to visit later this week a farm that was in 1962. Did people initially think this is crazy? This is never going to work? What do you think the reaction was in the wider farming community to the first attempts to try this technique?

Edwin Price: When the idea of no-till came along, traditional farmers were unenthusiastic to say the least. It was heresy not to consider that the soil had to be opened to breathe, to receive the sunlight, to receive

the water in the sea. It seemed quite foreign to farmers at the time that you could leave the surface intact and plant into that surface. Part of it was the real need to early open the soil so that the heat get into the soil and warm it, which would extend the growing season. It was also important to open it up in order to have a good seed bed. The farmers really felt like that pulverizing the soil, plowing deeply, pulverizing the soil would make a good seed bed and give good contact with the seed. As it turns out, this was not necessarily the case.

The heresy was it took a long time to put down this notion that no-till was an unhealthy way to farm. There was a belief that it would lead to destructive practices, that it would lead to a decline in fertility. When in fact, just the opposite turns to have happened.

Speaker 1: How did this idea spread? I know that people from Brazil and Argentina, the Southern part of especially Brazil. There was a group of people there. Sometimes, it takes a few people. I know there was really a couple of people who were German immigrants who settled in Southern Brazil rolling hills who also had very dramatic issues with top soil depletion. Did they come to Kentucky? Did they look out for examples? Why did suddenly Brazil get into the story? How did Brazil and Argentina get into the story?

Edwin Price: It's often the case with new ideas. It's a heresy where it was born but it finds fertile ground elsewhere. In this case, in the case of no-till agriculture, Brazilian farmers visited Kentucky, saw this technology and felt that it was especially of great use in Brazil where also new land areas were being opened up. There was a deficit again of manpower and a deficit of mechanical power, a deficit of energy to till these lands. Therefore, this idea that you could till the land and plant a crop without use of large scale machinery for plowing was a tremendous revolution in their thinking. Since they had few other choices in Brazil because of the large areas being opened, and the lack of skilled manpower to operate those lands, this technology found extremely high applicability in Brazil.

They were able to open large areas of land for sugar cane and for other types of agricultural production.

Speaker 1: Yeah. Go ahead. I think the rolling hills was a big connection. I think actually, there's an article that follows a lot of it. They would actually also did some early work in creating no to tractors, no to planters. There was a back and forth between innovation.

Edwin Price: That's right.

Speaker 1: Maybe just to follow up with an idea. There was also development of an understanding that actually tractors could be used, mechanization could be used. It required different sorts of equipment. What was the technological equipment side of creating tools to plant in this new way?

Edwin Price: To plant this new way, farmers recognized that they wanted to leave the soil surface intact. They needed to find a way to get rid of or somehow incorporate or otherwise deal with what had been left on the soil from the previous crop season or from whatever growth had occurred in the soil. They had to deal first with the residues and the growth on top of the soil. If you're not going to plow it, how are you going to get rid of the weeds? How are you going to get rid of the crop residue from the previous crop season? Another problem is how are you going to get the seed into the ground and get the soil contact with the seed? There are at least 2 major issues was how to get the seed in the soil, how to get the

fertilizer into the soil, how to get nutrients to the crop as well as how to deal with the crop residue from previous seasons.

Those went out with in different ways. It's a tandem development of dealing with crop residue and weeds and then the other issue of placement of the seed. 2 key areas where the development of the planter and the development of a combination of techniques to deal with the crop residues. One of those came along. They came along more or less at the same time. The use of the heavy roller and it's now called a roller crimper to roll over the plants of the previous season to incorporate plant stalks into the soil and to kill the weeds was important. Then use of a drill and a knife to open a slit in the soil was important. That's called a coulter. The use of a drill or a coulter to plant the seed became important following the use of a roller crimper to press down the previous crop residues.

Also, we'd have to say that herbicides came into play as well. The use of riversides to terminate the growth of weeds or any other plant that had been left growing was also important.

Speaker 1: What happened in Western Kentucky and parts of the US? Did people slowly overcome their initial doubts? We're going to film this. I'm going to have a field day there where people come. How do farmers learn things? Are they naturally conservative? Do they have to see it to believe it? How did it spread? Now, what movement do you have in terms of no-till in the States? I think it's 30% of US farms use no-till. How did the movement spread and how the farmers come around thinking that this might be a valid way of farming?

Edwin Price: To help this technology spread, there were a number of factors involved. One of them is that farmers learn from other farmers. What's most important to them is how does this new technique affect the pocketbook? How does it affect the yield of the crop? How does it affect profitability? There was an interplay of different factors. Farmers could not afford to give up much yield in order to use this new technique. The other side of it was the cost of production. They were saving on cost of production. You could have given up a little bit of yield if your cost dropped even more. It turns out, they were able. The farmers using the no-till agriculture were getting as good yields with no-till agriculture but also able to reduce their costs. In order for a farmer to want to adopt that, it was necessary for them to see that it worked on other farms.

It was also good to have scientists coming along in the form of extension agents who understood the technology, had worked with them in experimental basis and knew that the technologies worked and were able to inform farmers fully of all the techniques that are required to accompany a no-till agricultural system. The predominant factor in helping farmers to adopt a new technology is for them to see it on a farmer's field. For them to see that the yields are as good as if they had used conventional agricultural production practices.

Speaker 1: Great. By the way, I forgot to offer you any water. [crosstalk 00:28:42] Okay.

Edwin Price: I don't think of that stuff.

Speaker 1: Okay. Great. That's a good thing. Let's move now and talk a little bit about Ghana. Adam, I assume you're all good from your side?

Adam: Maybe we just take a second. I think it's worth estimating. I don't know if it's a class next door.

Speaker 1: Are you hearing it?

Speaker 3: Do you want to go grab a water for me?

Speaker 1: Why don't you hold the roll there?

Adam: Yeah.

Speaker 1: All set. Let's change a bit to our focus about looking for some Ghana.

Edwin Price: I'm going to say one more thing.

Speaker 1: Yes, please.

Edwin Price: About the adoption.

Speaker 1: Yeah.

Edwin Price: You may not want to use it.

Speaker 1: No. Perfect.

Edwin Price: One other unmistakable feature of no-till agriculture versus conventional tillage is the cosmetic effect. Farmers had a hard time giving up this notion of long, straight rows. It was something aesthetically pleasing. In fact, much of the photography today still shows us these curving hills, rolling hills with furrows, nice furrows, nice straight rows of plants. There was a feature of the conventional agriculture that was aesthetically pleasing to farmers to see and for the city person to see as well. It was hard to give up that notion. It was hard to give up the notion that you were not going to have this beautiful rows there for a period of time with the soil there and ready for the plants.

Speaker 1: No. It's true. It's really funny. As someone who's totally new to this, it took me a while to get your brain around those.

Edwin Price: Yes.

Speaker 1: It's funny. Basic Ghana, it has a very different history. Maybe you can just give me the intro to Ghana. Obviously, it's a place where in one hand, it's a very ancient land. People have been farming in Ghana for thousands of years, hundreds of years certainly. It was also a British colony for a long time where those huge focus on certain export crops, cacao. How does that very different history of Ghana affect lots of very small holdings? It doesn't have a lot of open, big farms right now. How does that very different set of factors affect the Ghana agriculture system?

Edwin Price: No-till agriculture is found in the West. Tropical agriculture was a different thing entirely. In the distant past and even until today, one of the ways that farmers plant in the Ghanaian agriculture is shifting cultivation. Their most earliest form of cultivation is to simply cut all the growing things on the land, let it dry. Burn it and then go through the field, making holes with a stick and flipping seed into it. This is a technique in shifting cultivation that was pervasive in Asia as well as in Africa and probably that time, in the US. One can imagine that the early planting conducting by Native Americans probably followed similar techniques. The new technology came in. What was new at that time was then to find power to plow these fields.

Because there were Western educators, Western colonial powers had moved into the area, the plowing technique was introduced and thought to be necessary for modern agriculture. I would say that even until today, the convention in Ghana would probably be that plowing is the appropriate technology to use for opening land and for maintaining crops. Ghana had made its name actually in cacao production, in coco production for the West, for Western markets. Of course, coco is a perennial crop. It didn't require a lot of land preparation or a lot of land maintenance after you get the crop planted but maize is also a very important crop for African agriculture. The Ghanaian tribal structures consists in one area a king, the Ashanti king.

Under the Ashanti king, there are many other sub kings that have large land holdings under their control often with other farmers working on their lands. On those lands, it's quite important for them to produce annual crops that pay their rents, that pay and provide them income for the farm household. Ghanaian agriculture for decades had depended upon opening the soil and plowing and producing crops in the conventional method that had probably been introduced by Western cultivators who came to the region. The interesting thing about tropical agriculture is that it is not subject to the same constraint of the heat that is in the cold weather. Unlike the Western plains, opening the soil to receive the heat and to heat the soil early in the season is not really a factor in tropical agriculture.

In some ways, no-till agriculture actually has a better fit in the tropics than it does in the Western plains because it's not necessary to heat the soil through plowing. Also the tropics do have more rains than the West. Therefore, the likelihood of soil erosion is greater on those soils because of the heavy rainfalls that are received pretty much year round or intensively in various rainy seasons. They're also subject to the wind, wind erosion and for the deepening of gullies on the soil. Ghana was a very receptive area for the introduction of no-till because of a couple of things. One was the environmental feature that it was really suited for no-till agriculture because it was not really necessary to warm the soils early in the year.

A second factor is that the Ghanaians also traditionally long in the past were used to using a primitive form of agriculture shifting cultivation where all they did was to cut the plants, burn the plants that were growing on the soil and then dibble the seed in. That you could say is the earliest form of no-till agriculture. When we began to introduce the idea of no-till to farmers, they understood it right off the bat because they knew that their grandfathers and others had used this technique. Even they themselves might have been familiar with it. What was really new for the Ghanaian farmers however, was the notion of intensive cropping, of using crop mixes in order to keep a solo cover on the soil at all times. The traditional shifting cultivation system could only survive if you could leave the soil vacant after 2 years.

You plant 2 years of shifting cultivation with a stick and with burning the crop or slash and burn is another term to choose for it. That can only be productive if the farmer can leave that soil idle for say 5 to 7 years between plantings such that it has the chance to restore nutrients to the soil. Shifting cultivation

while it had some of the elements of no-till agriculture, it didn't have the feature sustainability that more modern no-till agriculture has.

Speaker 1: Good. To give me a bit of a background on the center for no-till, sorry. The Center for the Conflict Development. What is your center? How did it come about? Why did you decide to focus on agriculture in developing world specifically in tropical Africa?

Edwin Price: One of the earliest engagements of Texas A&M University as well as many other land grant universities has been to help to spread modern agricultural technology to developing countries. Ghana is one of the countries where Texas A&M and other universities have worked. We for a long period of time believed and basically built our introductions upon the miracle of new varieties, of using modern wheat, modern rice, modern maize varieties that had many different attributes who are particularly well adapted to the tropics. The famous scientist, Dr. Norman Borlaug won a Nobel Piece prize in 1970 himself spent a lot of time in Ghana on maize production. In fact, to the end of his life, he felt that that remained one of his biggest challenges that he had not solved. That is how to produce maize in tropical agriculture.

The notion up until then had been let's use modern seed, modern seed varieties that are highly productive. Use fertilizer and other minerals. Add it to the soil. Use modern fertilizers. Use herbicides and pesticides as necessary to grow on your crop. As it occurred to all of us who are working in development agriculture, this technology wasn't everything. We began to recognize that there was a need for conservation of soil resources, of finding the very best techniques. In fact, Dr. Borlaug himself would often say, "We've got to use every tool in the box. We've got to use fertilizer. We need to use herbicides. We need to use GMOs even when we need to improve land productivity." He also agreed that conservation techniques are also very important for soil conservation.

We at Texas A&M for a long period of time worked broadly in agricultural development for all developing countries in agriculture. Then we began to recognize that there was a very sinister relationship between conflict and productivity and poverty and conflict. In fact, it's now become, we've come to understand that it's probably about 70 or 80% of the world's poorest countries are also the countries that are most prone to conflict. We began to see that agricultural technology may be a key player in the way to reduce conflict. To help prevent conflict from occurring in the beginning and to help families feed themselves during conflict and to recover quickly after conflict. We're getting to see this very close working relationship between agricultural technology, conflict prevention and conflict recovery.

For that reason, we have become very interested in the application of soil conservation techniques and no-till agriculture as a way of improving productivity in areas where land has become a constraint and a cause of conflict. Most places, many places that have conflict today will tell you that the conflict often emanates from competition for land. This is even the case in Iraq and especially in Congo, in Rwanda, in Central America. Everywhere we go, we'll often learn that conflict over land is a key issue for people. If we can increase land productivity however, that will reduce the need for farmers to continually find new land. We regard no-till technology as one of the pre- imminent ways of our helping to improve land productivity to reduce the competition for land, to take the edge off of those dire conflict over land and to reduce conflict in countries in general.

Speaker 1: Perfect. In terms of Texas A&M's work in Ghana specifically I also know that you guys have commissioned several big studies. In fact, we created in some ways a study. Maybe let's just talk a little

bit about tech new film and also lessee in field with different extension agencies. Talk a little bit about the studies that you guys have done at Texas A&M. One of the things that was seemingly important was to really look at the different zones to understand a country like Ghana. You have to understand the different zones, how their different coastal, the transition, the forest area and with the Northern area. What are the studies that you guys have done? What picture emerges of Ghana in terms of soils and eco to potential? Why do you do that work?

Edwin Price: We've been interested for some time in understanding the relationship between farm assets, technologies used on farms, hunger and conflict. We looked at 3 countries in West Africa. We looked at a country that we thought had the makings of a fairly prosperous economy and that was Ghana. We regarded in the sample of countries in West Africa that Ghana was one of the more promising countries. Meanwhile, we also looked at Liberia, which was at the other end of the scale. A country that has struggled not only through Ebola but civil wars that have been decimated their rural population and have decimated agriculture in the country. We looked at Liberia as well and then a country in between is Senegal. Senegal appeared to be that had some elements of the conflict, that had some elements of other issues that are inflicting agriculture and conflict.

It was not yet as prosperous as Ghana. It was moving in the right direction. We compared those 3 countries. Across the 3, we discovered that as a matter of fact, in Ghana we could find that improved land practices or soil management and crop management practices had a high pay off in Ghana because they had enough assets to absorb technology. By assets, I'm talking about farmers own a lot of their land. Farmers have implements to work their land. Farmers in some cases have some machinery to work their land. They may have animals also to work their land. Ghana had enough of a base of capital as well as a receptivity of technology to make use of modern technologies. At the same time, we learned that unfortunately in Liberia, the level of assets on farms is not sufficient yet to be highly absorptive of modern technologies.

We know that Liberia has a way to go. Sure enough, in Senegal, it falls in between. Interesting also is that even added labor, the addition of labor in Liberia doesn't help the farmer because they don't have the critical assets to farm with modern technologies. In Senegal, if you add more labor, you do get some push. In Ghana however, if you add labor, if you add assets, if you add technology, all of that has productivity. Ghana was a very promising country in the sense that it was at the early end of a technical stage in agriculture. It was ready to absorb modern technologies. It did have a labor constraint. You can find that farmers often complain in Ghana of not having enough labor. That the cost of labor is high for them. That's a sure sign that there's a need for mechanization.

Speaker 1: Describe the study that was done for Fred.

Edwin Price: Fred.

Speaker 1: To really look at the different ... What are the agricultural zones of Ghana? How did the study come about? Was it at Texas A&M? Maybe use the word Texas A&M Center working with the government of Ghana extension agent. What was the study? What are the zones? What have you learned about the different areas of Ghana?

Edwin Price: I may have trouble recalling all these. It's very important when looking at the adoption of modern technologies that you have a very good awareness of the different soil characteristics, the different weather patterns of different regions. Ghana has several major growing years.

Speaker 1: I'm just going to have you a little bit to the left. Okay. I was just seeing a bit of the vent behind him. Okay. Great. Sorry. We'll pick it up from the top.

Edwin Price: Okay. Great. When introducing a new technology to a region, it's very important to understand the different rainfall patterns, the different soil characteristics, the different sizes of farms even and the different native coverage of the soil. Is it timberland? Is it forest? Is it scrubbed plains? Is it bush? In Ghana, we understood that the adoption of no-till agriculture was probably going to depend somewhat on these innate growing conditions from one region to the other. We're able to identify even the Ghanaian government identifies 4 major growing zones. There's a forest zone, a transition zone, the coastal plains and the central zone. We've learned that no-till agriculture had different characteristics in each of these regions. That some are more receptive and it's more productive in some years than it is in others.

Another feature to look at is tenure patterns as well. Is the land owned by the farmer that started growing the crop? Is the land being rented on a share crop basis? Is it being rented on a cash or long term lease spaces? All of these have influences over the suitability of no-till farming. In Ghana, we learned that the transition zone is particularly well adapted to the use of no-till agriculture. Over long term experiments, we're able to learn that through no-till agriculture, we were returning nutrients to the soil. The soil nutrient levels were maintained at a higher level under no-till agriculture than without it. It's different across zones. One always must be careful to look at how this mineral and fertility retention behaves across different zones. We did find that indeed, there are differences.

It's also important to look at the socioeconomic conditions. It's very remarkable to me that the capital of a crowd, the other large cities in Ghana are populated with extremely large numbers of youth who've left the farms. The landless youth who were selling things on the streets in Accra or a number around as much as 500,000 young people. We learned in talking to them that many of them had left the farms. Another aspect of this no-till agriculture is bringing in back to farms a kind of technology that is regarded as modern, highly productive. It requires good management. This provides a reward to the young farmer. If they want to stay on the farm or if they want to leave the city, return to the farm and become farmers again.

We hope that through this more technical approach, this more scientific approach to understanding the resources that you have available on the farm as well as combining the know how of modern agriculture using conservation, agriculture and no-till technologies, that these young farmers will see that there's hope in their moving back to the farms and finding a life for themselves there.

Speaker 1: Shift a bit to your left. That's great. We have about 10 more minutes.

Edwin Price: Okay.

Speaker 1: You've been wonderful. I've got about 3 or 4 more questions.

Edwin Price: Okay.

Speaker 1: To talk about ... Again, maybe you want to use the word Texas A&M in some of your answers. To talk about the work and the development, the work with John Deere, how did that deal come about? What were the elements of it? Was there realization that Ghana was really on the cusp of beginning to mechanize as agriculture? Is it a fork in the road? Do you either go down traditional till or perhaps a no-till trajectory but does it have to be appropriate technology so that no-tills directly will work. What was the thinking behind the deal and how did the deal come about?

Edwin Price: One of the mistakes that's often made in working in agriculture in Africa is for scientists to think that because farmers are poor, that labor is cheap. That therefore, family labor really doesn't matter too much. You don't have to worry how hard it is to do a job because they've got plenty of people to do the work. That's not really the case. Through our research at Texas A&M, we've come to understand that even poor households have to be careful about how they expand their labor and their energy. That it really matters. It certainly takes a lot more effort in order to produce a crop or produce a food or good for the household. That made us begin to look and understand that in Africa, mechanization is probably going to be one of the key steps in increasing agriculture productivity in Africa.

Not every area or not every region is at a point where it can utilize mechanized agriculture. Farm assets may be at a low level subset. They are just not at the point of adoption of the modern technologies. We begin to recognize that agricultural mechanization is probably going to be a key once that agricultural community has reached the takeoff point in agricultural production. That caused those of us working with Howard G. Buffet Foundation to join with him in looking at how can we approach agricultural mechanization in Africa. Mr. Buffet particularly as a farmer himself in the Midwest had become quite convinced of the value of no-till agriculture and began to discuss the idea with us of how might we build a program that could introduce no-till agriculture with appropriate implements for Africa.

We had to consider the possibility that these implements would be pulled by draft animals rather than by tractors or at least by small tractors. Ghana had even tried already to introduce large scale mechanization with large tractors. This had not been successful because these tractors had to cover too much area and too many farms in order to pay for themselves. We began to think, maybe a smaller size tractor, maybe smaller sized implements were the answer. We couldn't do this on our own. We really needed a commercial agricultural machinery scientist and development and technicians to help us think about this problem.

The Howard G. Buffet Foundation approached the John Deere Corporation about this proposition that we could develop implements and machines that are appropriate to African farms particularly to Ghanaian farms and to the use of no-till agriculture. Out of that there developed a partnership between the Howard G. Buffet Foundation, the John Deere Corporation, Texas A&M and others to implement a new and modern technology based on no-till agriculture and no-till implements.

Speaker 1: In terms of the Ghana in the moment that's in right now, I was very struck. I've talked to you before when I went to the North. I don't know how pronounce but Tamale.

Edwin Price: Yeah, Tamale.

Speaker 1: Tamale. To see that this was really was the Ghanaian agricultural frontier. It was really the place where that battle is playing out. Let's talk a little bit about the moment. Let's talk about the Northern frontier of Ghana. What's going on there? The big irrigation project, the consolidation of big farms. Is that really where the decision or future of Ghana is going to be decided in terms of is it going to go no-till? Is it going to go? Mechanization is going to happen. What's happening now in Northern Ghana? What does it mean for the future of Ghana?

Edwin Price: One of the fortunate associations that the Conflict and Development Center Texas A&M has is an association with Agri Corp. It's a group of young agriculturalists who has trained at US universities and spend the early part of their career a year or so in developing countries to assist them in adopting modern technologies and teaching modern agriculture and working with them in youth club organizations. Actually forage and FFA. In working with Agri Corp and introducing some of the ideas of no-till farming, we were able and quite amazed by the quick adoption by forage clubs and by the parents of forage clubs members of this modern technology of no-till agriculture. It appears to be at the point of possibly taking off. Unfortunately, in the region around Accra and in the central parts of Ghana, urbanization is increasing at a very rapid rate.

In our early research with farmers, we were very unfortunate and the farmers unfortunate that some of them lost their farms within the 2 or 3 years that we began the research because of spreading urban use of land. The no-till agriculture is probably going to need to move or agriculture broadly is probably going to need to move toward the North and to improve agriculture in the North. The interesting thing about the North is that there are many interesting things about Northern Ghana. Not only is there expanses of land that are under utilized at this time or lower levels of productivity. There's ample opportunity to bring that higher prosperity. There is another issue that's a foot in parts of Northern Ghana. That is areas have been used also for range management, for livestock raising, for basically pastoral herders.

Pastoral herders, some of them indigenous, some of them who have moved into Ghana over the past 50 years and even more recently within the last decade are largely herders. They're using this land presently in more extensive methods out of pastoral farming. Meanwhile, agriculture production is moving into the area. The same melody that affected the US in the Southwest 100 years ago where you had range wars between herders and cattlemen and farmers is now emerging in Ghana. The story in the years ahead will be how can these nomadic or more pastoral systems who have cultures dependent upon them, how can they survive while at the same time, no-till agriculture or other forms of agriculture are moving into the area. The balance hasn't been discovered yet.

We think the balance probably lies in assisting the herders to become more sedentary in their practices and to develop stationery livestock feeding systems through feed blocks. We've worked with that in Iraq and other places and found in Ethiopia and other areas of Africa, we've learned that we can develop stationery livestock production systems that are much more compatible with crop production. Northern Ghana is an area of promise. It has ample water resources. There are parts of it that have hydroelectric power in the Volta region, has a hydroelectric power and irrigation. It's going to be able to feed the area. We regard the advent of no-till technology. The dynamic receptiveness of young people through the forage clubs and as supported by Agri Corp to be really possibly an answer to the future of agricultural production and food production in Ghana.

Speaker 1: Is Ghana at a crossroads? The great effect is that Ghana's at a crossroads. Is Ghana at a crossroads to decide what path its mechanization will follow?

Edwin Price: Ghana is at a crossroads in many ways.

Speaker 1: Sorry.

Edwin Price: Ghana is at a crossroads in many ways. Not only is that a question about how agriculture is going to move. It's a question of how the young people of the country are going to respond to this opportunity. Ghana has a burgeoning urban population. Many of those youth have migrated from farms into the cities. They need to find jobs. They need to be reabsorbed into agriculture. Ghana is going to need to decide socio politically how does it want its youth to develop? How does it want its agricultural product to develop? Are those one and the same?

We believe that through the development of no-till agriculture, more intensive farming with intensive rotations of crops between nitrogen fixing crops and food crops that we can create a highly sustainable, highly productive agricultural sector that will be regarded by young people and old as well as the way of the future. We believe that if we make no-till agriculture technology a promising and attractive technology to attract the youth that we're providing not only a secure food supply but also a stability in a population that is at this time a little bit volatile because of its increasing size and because of the inability of the urban community to support all of the young people in urban enterprise.

Speaker 1: The last question because I know that Dan is waiting for us upstairs. This is a big one. It's about this question of the debate of the connection of the no-till and global warming. There's a couple part question I want you to explore a bit. Is there a traditionally have farmers and environmentalists see themselves as perhaps adversaries? Maybe environmentalists are also trying to maybe restrict the use of land and somehow, in the West there certainly was adversarial relationship at times. Has that changed? How do conventional farmers view the people who are coming to this issue to say, "Wait. No-till also sequesters carbon. No-till will save the world in terms of global warming." What are the camps on that discussion? How do those 2 sides connected different?

Edwin Price: For at least 50 years or even going back further to the Plowman's Folly, there is a notion that modern agriculture, what was modern then, what is modern today is different but it's always modern agriculture regardless of the era has been regarded often as somehow destructive to the natural environment and long term destructive to the sustainability of our planet and our livelihoods. No-till agriculture comes on the scene. It appeared when this debate is as important as ever and when it's as hot as ever. No-till agriculture has some of the attributes that should be attractive to those who are most concerned about the planet because it does use less energy to produce crops and to produce food.

For that reason, no-till agriculture can be regarded as an asset to those who want to remain in farming, who want to be assertive about how agriculture can be a productive force in sustaining the planet, in sustaining the resources of the planet.

Speaker 1: Have the traditional farmers and I guess the environmentalists, the people ... Do a lot of traditional farmers don't believe that global warming is taking place? Do a lot of traditional farmers, they have no-till for other reasons. Are there 2 groups that are coming at it from a different perspective?

Edwin Price: There are probably some farmers who still believe that there's not global warming. That there's no need to change their technologies. That community is probably declining, probably contracting

because of the weight of evidence from weather scientists today. It's likely that the no-till agriculture may be found not to be ... It's going to need agriculture always needs change. Always needs tweaking, always needs adaptation. Right now, you're really not sure. Scientists are not sure fully of what is going on in the soil. When you leave it intact, when you don't open it up to sunlight, to warmth and to rain and so on, what are the communities of the flora and fauna in the soil? How are they behaving in this new agriculture? We really don't know. For the most part, we think it's healthy.

For the most part, we think it's adding fertility and adding productivity to the soil but we're really not sure about what are these communities of biological entities in the soil. How are they behaving in this new agriculture? There's a lot yet to be learned about no-till agriculture. There's probably going to be improvements on that as well. In the balance, it's probably fairly clear that no-till agriculture is at the interface between the camps that believe that there's not global warming. That we don't really need to adapt to our technologies. Those who believe that we must continually change our agricultural technology to adapt, to evolve in conditions.

Speaker 1: Does it make for some interesting encounters between people who ... Traditional farmers and environmentalists. Is there starting a new debate that we couldn't imagine 15, 20 years ago?

Edwin Price: For the most part, no-till agriculture, conservation agriculture is probably bringing together camps that have been at odds and had no basis for communicating one with another. No-till agriculture has provided that thread of common interest because those who are interested in a productive agricultural sector are beginning to see the value of maintaining soil biota through no-till. Also, the environmentalists are also at a common ground as well maintaining intact soils, maybe the best way forward. I think that no-till agriculture is providing an opportunity for the first time for no-till, for environmental advocates as well as agriculture productivity advocates to find common ground in a technology, in a set of technological practices.

Speaker 1: That phrase. Thank you so much.

Edwin Price: Okay.

Speaker 1: Let's get some room tone.

Edwin Price: I could have done more. If I knew what your questions were, I probably should have done more homework.

Speaker 1: I should have sent you that. I'm sorry.

Edwin Price: Yeah.

Speaker 1: I'm sorry. I think we've got some great stuff.

Edwin Price: Okay. If you got a few sentences, that will be good.

Speaker 1: Good. All right. Just 30 seconds or 20 seconds to sound. Here we go.

Saved by the Soil _____ SIPA-17-0011.5

Adam: Room tone.

Speaker 1: Good. Great. Thank you.

Adam: Thank you.

Edwin Price: Okay.

[END]

Interview with Fifi Fiavi Kwetey

Interviewer: Adam Stepan

Fifi Fiavi: Sang, would you say a community close to Yindi.

Speaker 2: Okay.

Fifi Fiavi: In the northeast of my country.

Speaker 2: Northeast, yes. Interesting, we're looking forward to going there. I know it's also very different.

Speaker 3: Same thing, again, let's start.

Speaker 2: Perhaps you could talk about the traditional role of agriculture in Ghana. Ghana is a very ancient country. It has ancient kingdoms, like the Ashanti kingdom, and others. What role does agriculture traditionally played, and how has it traditionally been practiced?

Fifi Fiavi: Agriculture in Ghana has been the way of life of the people throughout history. Whether they were warriors, or royals, or ordinary people, agriculture has always been the common activity among all sections of society. The traditional roles have not changed that much. Specifically, to secure the food needs the basic food needs of the people. Where economies became formalized, to provide raw materials for factories, or industry that rely on agricultural raw materials for their processing. Then also, as a way of interacting with the global markets, and taking advantage of the global market to generate goods for exports to earn foreign exchange that can contribute to the development of the country.

Speaker 2: I know that traditionally for example, in the Ashanti region in the forest region, the traditional style was slash and burn where people would go to a certain area, clear new forest, cut it down, burn it and then be able to plant there for 2 or 3 years and then move. Could you describe the traditional cut and burn rural agriculture?

Fifi Fiavi: The traditional land preparation method for seeding throughout the country has been what has often been described as slash and burn type of agriculture. People have to interact with nature. There is a lot of confusion in nature so to speak without all these mixture of trees, shrubs and vegetation. Even in the culture the community of plants that are economically useful to the farmer and therefore, they go into clean up. They heap the rubble and then burn so as to clear up for the season of planting of their crops. That has been the traditional system. It has remained that rudimentary for a very long time.

That is beginning to change somewhat as farm has become more permanent or semi-permanent in outlook. Land is no more that available so that can you keep shifting because there is [inaudible 00:03:06] who came with shifting cultivation as we were taught in schools. In other words, after using a piece of land for a couple of years the fertility gets exhausted so you move to the next but our numbers against the [inaudible 00:03:21] supply of land will no more permit that. Therefore, as land are getting more permanent the slash and burn method and also shifting cultivation are also getting lower in throughout the practice.

Speaker 2: What are currently the principle zones? When you look at Ghana, it's a vertical country that goes from the coast to almost the desert. Describing as the different zones what kind of crops can you grow, what are the challenges, what are the opportunities?

Fifi Fiavi: You can divide the country broadly into 2 sections. You have the southern section which is a forest and reforested areas and then the northern zones which is more Savannah, but you can still have a transition zone in between the 2 extremes. Now, in the northern part of the country rainfall is monomodal or there's just one rainfall season that lasts about 5 months in a year and therefore, all agriculture activities what we call crop production has got to be boxed into the 5 months of production. Then you have the transition zone which is if you like which has 2 seasons. A major season and a minor seasons and therefore, depending on the duration or maturity of a crop you can have production in the 2 rainy seasons.

Then you have the forest area which is more there is a lot of rainfall in there. In terms of quantities you have 2,000 plus millimeters of rain per annum in the southern sector forest area, and then you have less than 2,000 to around 1,400 in the middle zone and just about 1,000 millimeters of rainfall in the northern parts of the country. In the far north, which shares borders with the naughty neighbors that would be Burkina Faso. The rainfall is slightly less than 1,000 millimeters per annum, and in these days of biting climate change issues, the rainfall is beginning to even get smaller in terms of volume. Now, the current rainfall pattern you have dictates the crops and the crop cycles that will definitely will be growing.

In the northern part of Ghana, you have mostly the greens, the dry greens and the dry legumes that are most popular. That is maize sorghum, millet, groundnuts or peanuts so to speak and then the beans group. Then in the middle belts, you have some permanent tree crop culture particularly cocoa coming in cashew as permanent cultures in addition to all the other arable crops that are growing by the farmers. In the forest area, you have the more permanent tree crop culture being, the more if you like common agricultural practice. You have the oil palms, the rubber, cocoa. Name them coconut, and the rest of it being the order of agriculture in the area.

Where lands have been cleared, have gone on the coastal zone which area also coastal savanna [inaudible 00:07:07]. You have the pineapples and then the fruit trees, mango, citrus and so on now becoming the other so you can have the 2 very permanent. In the northern section, there are some tree crop production cultures; mango is one which is also now just beginning to happen cashew nuts and then you have wild nuts that are harvested for the economic benefits such as shea nuts which is extremely important in the economy of the north.

Speaker 2: In terms of the traditional back during the times of the Ashanti Kingdom how was agriculture organized under Ashanti Kingdom, was there a certain amount of organization about who would go where in terms movement of people? For how many years are we talking about agriculture? In the US, for example, we filmed that there is in Nebraska big ag schools but the land there is not even firm for 150 years so there a lot more nutrients in it so could you tell me about how long has this land been farmed in Ghana? Is it been farmed for more than a thousand years and has there been various kingdoms that have been organizing this farming but at different times? Can you tell me about the length of the time of the farming here?

Fifi Fiavi: As I said, agriculture and fruit production in our part of the world has been the main economic activity running for centuries so in those times were organizing to traps to overpower each other and take

lands. I'm talking about issues that date back 500 to 600 years ago. My own area in Damongo our civilization has been running for, our [inaudible 00:09:19] have been running for over 5 centuries now, and that has always been as we told agriculture as well. The same with the southern sector except for the fact that those were forest based. Anytime around the 20th century onwards agriculture has been the main activity in addition to royalty.

You had society organized into different levels, so you had the royals and then there were the commoners and in many instances, one had power over the other. We saw the common people engaged in agriculture productivity to feed the economy, and then those who were in royals were more business people who did traded either with the local business people or with foreigners that came from our colonial masters. If I can use that for word of expression.

Speaker 2: To talk about that during Kono times, Ghana was called the Gold coast. It was a British colony, what happened to agriculture at that point, was there a real focus on exports crops, and coca production? How did the colonial period with the defeat of the Ashanti Kingdom, how did that change agriculture in Ghana?

Fifi Fiavi: With the defeat of the Ashanti Kingdom and many other royal organizations that are I know that the Germans also did their best in the east of the county right towards the northern tip of Ghana, and therefore, our own kingdom was also disrupted, with the Damongo Kingdom was also disrupted. Once that the Ashanti Kingdom was captured or overpowered, so to speak they disrupted agricultural activities a little bit. Because the priority of the British colonialism wasn't agriculture but really to take advantage of the minerals particularly gold that was available in the belly of the earth to spread for international trade. Now, if even they showed any interest in agriculture at all, there was no agriculture that had to do with plantations that needed to export raw material to feed the industry that were out there.

Therefore, oil palm, cocoa, rubber became the key agricultural commodities that focus was on. It was also the case that the country was sharply divided into 2. The northern part was seemed to be the pull of labor to they brought in to work in the mines and also these cocoa plantations, oil plant plantations to suffer. That's why if you come into Ghana and maybe until recently, and also you can [inaudible 00:12:32] between the north and the south mainly because the colonial decision or policy was that well the northern part of the country was not economically worthwhile. There was nothing to service the colonial economy and therefore it was only the human resource that was available and therefore, it should be brought down south to supply labor to the plantation agriculture and the much.

Speaker 2: Even if it's true you look in the map of Ghana the main place where they have rails; trains are all in the south that go as about to Kumasi, so the production is very labor intensive. It's unusual. During colonial times was it organized as big plantations and then after now it's more smallholders, could you describe how the structure of coca production under colonial times and how it evolved with independence?

Fifi Fiavi: Indeed, cocoa production has always been done by small scale plantation owners. The average cocoa farm is not more than it's just a few hectares in size. It's the marketing that is well organized and therefore there are well-organized institutions to led the entire value chain be serviced without any challenges, and that's how colonial masters wanted it. You found farmers organizing small small, just small small cocoa farms but the institutions to organize the market or so was so tight that it is possible

move their beans to various warehouses within reach to be mopped up, later on, to be taken to the coast for export to the foreign markets. The pattern of production hasn't changed that much except that there are now cocoa farms that are beginning to be enlarged mainly on account of other buying out smaller farms to put them together as a big ones under management but has always remained small cocoa farms being out together.

Speaker 2: Describe the role of the cocoa board? I know the cocoa board still is a big important entity here. It was set up during colonial times, what is the cocoa board? Where does it sit? What is its role? How does it connect to the market?

Fifi Fiavi: The cocoa board in itself has gone through some changes from colonial times it was the institution that they know everything about cocoa. From research through extension, to production, to purchase of the beans and then for exports into the foreign markets. It was the mainstay of the Ghanaian economy. You got a company that particularly the one that came to foreign exchange earning to service the economy. Since the 1990s it underwent some changes in order to give it a better a decentralized outlook and therefore you had all the different department becoming semi-independent companies. You have the cocoa production link, marketing link, you have the research link and then services.

Speaker 2: Sorry, we had a problem here. I want you to go and fix the comp hold on. Done with the AC?

Speaker 3: Yeah, I'm going to turn off in a second. I think that it is [inaudible 00:16:14].

Speaker 2: Cool down for a second here.

Speaker 3: Let's just frame that piece.

Speaker 2: This is wonderful because you are covering one area that we want to do. Let's just go back and talk a little bit about the cocoa board, maybe just tell me; you can give me a bit on the history when it was set up? Where is it? It's still in the same place. What's the history of the cocoa board?

Fifi Fiavi: Cocoa has existed soon after independence to direct affairs of cocoa marketing so that it could really be useful to the economy. Since independence, it has been a semi-independent government body backed by act of parliament or a role to operate freely and without any interference from the rest of the country. It has a board with a CEO who directs the affairs and then as I said earlier on the different divisions were later on made fairly independent. You have this who were federated into independent companies, in charge of marketing, in charge of research production, services and then movement of the purchase of the beans and so on into the ports for export. That has been the structure as of now.

One may ask why was that necessarily. It was necessarily because the general economy itself has moved from the publicly dominated economy into a mix of privatization and public regulation economy. Therefore, there was the need to change public institutions or allow for some private participation into the cocoa industry and so if you watch most of the beans are transported to the port by private transport owners and then the provision of services others inputs as a job or publicly published and bided for so that who can supply various inputs for the industry. It was mainly like opening up the cocoa board for private participation in the 1990's and rather been the institution as of today.

Speaker 2: Did the focus known colonial times as focus on cocoa for exportation a lot of people felt that it meant that traditional agriculture creation of food crops was perhaps ignored and even after independence a new nation needed export earnings? Was there a lack of attention to growing food for Ghanaian consumption, is there a historic problem with that? Now, that Ghanaian economy is growing is there a real demand for more food, it is going to have to import food? How does this focus on cocoa connect to agriculture regularly?

Fifi Fiavi: The focus on cocoa the managers of the economy at the time if like be a transition from the colonial mentality. There was feeling that we're fine. We could use our earnings from cocoa to import key foods to feed the population and therefore, there was always a certain disconnect between investment in cocoa and investment in food crops. Most of the studies have indicated that whenever you had a massive injection of public funding into cocoa, you had the other the food crop of agriculture economy suffering a little bit, but I think up to the 1990's that changed. When the cocoa board was opened up for public participation, there was also an absolute need to begin to look inwards to meet the food demands of the population and simply put the challenges of the economy was simply not being able to support public dominance of the food sector.

Then using foreign exchange earning to import the food to feed the population when the country had all the climatic and resources. Human and land resources that produces food. That also changed the dynamics to some extent and now you can have both as subsectors move and indeed even when you look at the agriculture statistics in Ghana cocoa is always isolated to provide its own statistics and all the other crops boxed together, so they always say growth in the crops subsector excluding cocoa and then the cocoa is made to go its own figures or assess its cocoa independently. That is meant to express the public interest in the cocoa sector, and the public funding of the cocoa sector and therefore, they absolutely need to give it an isolated assessment from year to year.

Speaker 2: In terms of move now there is I know that one of the things we're looking at the move to no-till we were filming yesterday was John Deere they had the 1025 no- till planter. What stage is Ghanaian agriculture economy is it trying to choose a path to go down?

Fifi Fiavi: I would say that our agriculture is in the transition. We're in a transition. In other words, whether we like it or not our agriculture is becoming an integral part of the global agricultural economy, and that is beginning to set standards that we must meet as a country. Secondly, we have a booming and expanding middle class who are well informed and have their choice as to what it is that they want to eat. Thirdly, we have democratized them to a level where we have to accompany on daily basis to the people including accountability based on what it is that we're providing for people's kitchens. Now, it's also a transition because we're moving from basic rudimentary subsistence agriculture to service other farm families to agriculture that is aiming at the market both internal and external markets.

We cannot use the same tools of yesteryear's to deliver the change that we want as of today, and therefore, government is prioritizing a complete change in the tools that we want to use. Now, in this while the basic tools which is the hoe and the cutlers as of yesterday and then we also have the sophistication of a tractor like the John Deere that you were mentioning which is also mechanizing at the highest order. While in between the 2 extremes is where the bulk of our farmers are caught so we have to mechanize as appropriate. We have to mechanize taking the mix of the different farmers that we have in our pool and ensure that everybody has the tool that will satisfy his or her needs.

Mechanization is very key because things have got to be done faster. Secondly, technology is also similarly important because if you mechanize and your level of technology application is still rudimentary, I'm afraid that you will soon not get the desired results. Thirdly, value addition and packaging of food for the population is also extremely important. In particular, that agriculture is no more wonders to provide just food or raw materials, but it is also to give an opportunity for job creation for the teen who live in Africa who needs something to do after qualifying from college or from university of whatever level of education that is high.

Our population, our youth cannot be holding on to digital telephones that are at the high end of technology, and we'll soon give them a hoe and a cutlers to go to the farm. It certainly cannot work and therefore it will be mismatch. A total mismatch and therefore we need [inaudible 00:25:22] is mechanized. We need abandon look for new products in agriculture that will attract the youth into agriculture.

Speaker 2: I think that one of the thing that we're seeing in a farm ... What is the challenge having to do with soil quality in Ghana?

Fifi Fiavi: I don't know where to start this from, but you will notice that the attitude of agriculture in Africa [inaudible 00:25:59] of all was really to exploit the soil to meet our food needs. That was basic idea, so the issue of even feeding the soil to feed the crop so as you can get our food needs was frowned upon but the moment came to the use of mineral fertilizer, and so you will find that of all the globally Africa is lacking behind seriously in terms of consumption of fertilizer to use crops. That explains why African soils do have terribly been exhausted until today, and they absolutely need now to consume fertilizer in order to catch up with our yield needs and the volume of food that we need for our citizens. It's almost like having to go back one step to manage the soils so that they can give you our plants can react to get the necessary output from the farms.

That also poses another problem because the gene pool of African crop varieties are not active to fertilizer application mainly because the cycles of production over many centuries have put most of these crop varieties into a dormant attitude towards fertilizer consumption. That's why there is a need to look for also new crop variety that can deal with the tellings that we have as of today. Yes, feeding the soil or managing of soils so that the organic matter content can even be lifted up in order to make the mineral fertilizer useful to our crop production endeavors. It's extremely important and being looked after.

Speaker 2: We will be filming with I don't know if you know Mr. Kofi Boa at the Center for No-Till Agriculture.

Fifi Fiavi: I know Kofi Boa.

Speaker 2: Okay, not so hard maybe you could talk about no-till in Ghana is it building on culture traditions, do people say that's not different from what I know?

Fifi Fiavi: No-till agriculture has been in practice for a very long time. Particularly in the southern half of the country and this is where the soils are relatively deeper where probably it's fairly deep, and you don't have grasses overtaking the lands too much. Because the average approach was to cut back the vegetation. Leave the [inaudible 00:29:04] on the ground, and sometimes it got too much, and that's why they needed to put them together, and band but they never disturbed the soil itself. They just planted

onto the soil the way it was and tons and tons and tons of papers have indicated that yields from an undisturbed soil will always be better than yields of soil that have been turned in out several times. Either by machine or by using some kind of mechanical device.

We got soil of course, it's an equal system that really needs to be maintained and that has always been the better but it's a kind of a shall I say a graduation from as you go up higher off the land the [inaudible 00:29:57] and therefore does it need even some time to gather the soil together in order to have adequate root room for to concentrate nutrients or concentrate moisture for the plants to trap. If you want to want to sum up agricultural production in Ghana, you will say that land preparation has been more of no-till than serious mechanical tilling of the soil and the production season has been more organic than inorganic.

Speaker 2: We're looking forward to visiting the scenes.

Speaker 4: I'm ready.

Speaker 2: Okay ready.

Speaker 3: Camera speeds.

Speaker 2: We got to turn off the AC right?

Speaker 3: Yeah, go ahead.

Speaker 2: Sorry.

Speaker 4: Move.

Speaker 2: I'm very sorry. Okay. We're rolling? Okay so gold is always been an important product in Ghana, and it's still is. I know for a long time under colonial period and for a long time afterwards independence small-scale gold mining was illegal, and then it was authorized again, but it still remains unregulated. There is some that are legal there are others that aren't. What is the effect of small-scale gold mining, legal gold mining in rural Ghana, is it something that's affecting the environment? Is it something that's attracting youth? What is the effect of rural gold mining?

Fifi Fiavi: I must state without any hesitation that the small-scale gold mining particularly the illegal one which is most of it.

Speaker 2: Could you repeat that again so I can hear, it's small scale gold mining?

Fifi Fiavi: The small-scale gold mining, particularly the illegal forms of it, which is most of it is really having a terrible impact on our environment, particularly for agriculture. A lot of their chemicals are used are regulated particularly mercury that is washing onto our water bodies and creating a lot of pollution for water bodies that are meant for provision of bottle water or illegal water for our farms. That is really a fight that the government is taken on to liberate our environmental sources from this type of disease if I

want to put it that way. It's not helping at all particularly in our agricultural front. There are many excuses that people give for engaging in illegal small-scale mining with an emphasis on illegal small-scale mining.

There is a law that regulates small-scale mining. That law does not allow foreigners or non-Ghanaians to be in that sector, and unfortunately, you have foreigners who somehow come into the country under the cover of other businesses eventually fund themselves in the mining areas and causing this type of problem. The other excuse is youth unemployment that people are unemployed, and therefore they become pawns for such foreigners to take on the advantage of their idleness so to speak to get it on. Livelihood systems are being worked out for such environments so that they have alternatives for the youth their engagements.

In particular, that it is also a very serious life-threatening exercise. They have all manner of barrow that they dig with ground shackle structures to support the weight of the earth, and many [inaudible 00:34:14] collapse on them and then they lose their lives. Several times that has happened. It is not a good thing to lose your own life or to bargain with your own life just to secure employment, and if you're not [inaudible 00:34:30] employment, I don't think it is good enough to engage in an illegality. Public education for us all to understand that it is not a good exercise. It is really something that we must all do as a government institutions, in particular, its impact on the culture. It certainly it's extremely bad. I've been to the field myself and seen some of these things personally happening, and it is not good.

Speaker 2: Can you describe how it works? I believe they come along to a part of often virgin forest. Cut down sometimes either manually or with excavators and then describe the process how they do it and how does the land left afterwards?

Fifi Fiavi: Most of our good resources particularly those that are closer to the surface are found in the forest areas as well or areas of high vegetative cover. In certain instances, because these are illegal people who are using rudimentary tools to do the mining they don't have the infrastructure to draw water because mining requires a lot of washing of earth to get to the minerals. They require the resources and logistics to draw water from river sources to the allocation, and therefore, they'll go and do the exploitation either in the riverbed or just on the banks and then wash everything that is happening in.

In situations where the mine is regulated, there are usually waste dumps where most of the waste water is washed into process further. In other words to make harmful metal run into our water system and eventually our food chain. Unfortunately, that is not the situation, so that's how it works. They use very rudimentary tools. They take undue advantage of young people. Locate the mines close to concessions this is basically that what they do. Once they know that there is a concession covering a certain area of square kilometers of land. Then once the concessionee begins to exploit in one corner, then they also run the other corner of the land. Because once the concession is giving news that there is gold that's available.

They'll work on informants who also let them know of these areas, and then they settle to get this. It's a combination of their own local intelligence, the fact that they want to engage in making money quickly and then they will do so at the peril of their lives because they don't have the resources, the logistics to do so. In doing so, they really pollutes our water bodies and in certain cases our agricultural lands.

Speaker 2: Come over here. Try and not always look to me if you administer. If you look at just at the line yeah. In terms of what is the current big priorities for the minister, what are the things that the ministry is currently working on in terms of initiatives for extension or taxes or investing, attracting? What is the strategic plan for the minister of agriculture for Ghana?

Fifi Fiavi: Our strategic plan for as a ministry really is one to undergo a certain institutional renewal. To decentralize heavily so that our potential staff and officers can account directly to the people at the lower levels and to strengthen them so to deliver their mandate. Number 2 is to build the necessarily infrastructure to give us a leap into the future and that infrastructure will come in the form of weather neutral. Weather neutral production systems because use we know the totality of agricultural productivity in Ghana production in Ghana is totally dependent on seasonal rainfall. We need to get out of that in view of the [failure 00:39:11] rates of the seasons as we are currently experiencing. There is enough rainfall but its simply the harvest of the water, the infrastructure to harvest the water so we can produce all year round that is the problem, so irrigation development is a huge priority.

Irrigation development is as I said earlier on to ensure that the infrastructure is supporting all categories of farmers, so it's going to be from tube wells to boreholes to small reservoirs to managing the lands, bundling lands to prolong the season, to dig irrigation schemes that can be supported by huge capital. The other priority really is also about value addition. We think that the economies must sophisticate to keep the jobs in the country because the post farm activities is what really brings the engages more hands, and that is why we have to do a lot of post- harvest management of our own agriculture produce in the country to provide the needed jobs.

In other words, our agriculture must tie into our industrial development so to speak so that the necessarily movement can be done in that direction. The key priority is to arrest the imports of agriculture commodities for direct consumption using very expensive foreign exchange that we earn for exports into encouraging local production so that we can overwhelm the volume that are coming from foreign markets and save the foreign exchange that we ought to be using. Some vision if import substitution so that we don't have to import what it is that we can produce in the country.

Speaker 2: Is it fair to say that the Ghanaian economy has embraced private development, private sector in many sectors, services, oil, and gas, is it now a time where the Ghanaian agriculture system is becoming before professional, is becoming more of a business? Is that part of what you need to do as to create entrepreneurial business environment for people to think about agriculture as a business, as a money making scheme?

Fifi Fiavi: Absolutely, not necessarily on we're behind the transition. Trying to move production for the farm family table, to production for the markets and that includes the farm family table so the drive is to try the best we can to get investments into the agricultural sector. The economy has been opened up since the 1980s, and getting the public dominance of the economy to retreat, to give way for private sector to come in because in many case we already have the resources to invest. Now, the key issue that confront the agricultural sector as of today really is to have investment come into it. We've tried it with the transport sector. Some time ago it was the state transport company that dominated a long distance transport system in Ghana. It is no more the case. There have been adequately completed, and private sector is providing quality service to the Ghanaian population.

Mining, most of the mines were owned by government were diversified introduce private capital there, and the mines are working well and providing government with the needed income either from taxes or royalties et cetera which is working well. Air transport has seen some capital. Electricity, power generation, the gas petroleum sector et cetera. All these examples are indicating that where you open up for private investment to come into your sector, the results are often very good, and that is what must happen to the agricultural sector. All the issues of building infrastructure, the issues of value addition et cetera must really be done by the private sector.

Note also that even though the production base is dominated by small scale farming. These are private small scale farmers. They are private people and therefore, what is needed is the resources for them to lift up their game so that the necessarily economic gains can be made. The government so to speak must collapse more into a regulator setting standards, settling disputes, doing arbitration and organizing and investing in the big things. Whether it is road infrastructure, transport infrastructure, irrigation infrastructure so that private sector can take advantage of these piece of infrastructure today to do the proper thing itself.

Speaker 2: In some ways, the fact that Ghana hasn't mechanized yet is to be able to at the same time commercialize make it's agriculture more commercial, more mechanized but perhaps in a more sustainable path?

Fifi Fiavi: Absolutely, that you have just described the situation that is-

Speaker 2: My question will be cut out so if you could try to repeat?

Fifi Fiavi: Ghana will definitely mechanize it's agriculture because that is just the modern way to go but as I said earlier on it has to be a mix. Mechanization that will service the already existing system of production that we have. In other words, between the hoe and tractor, a lot can be done to help the average smallholder today. The emphasis is to commercialize not necessarily to go large scale. We want the production units can still be small, but it must have a commercial objective and that commercial objective means that they must adopt their product technology. Adopt the appropriate tools for working the soil and adopt tools that will keep the soil productivity high and the only way to do so is to have no-till and other associated technologies that will keep the environment production intact.

Speaker 2: Maybe could you say is Ghana lucky perhaps that it's big move into motorized or mechanized is happening now and not 20 years ago? Do we know more now? Is it a time when people understand better the value of things like no-till than they did before? Is perhaps Ghana lucky to be doing this now?

Fifi Fiavi: Yes, I think we're extremely lucky that other experiences have run the whole distance and then found disadvantages in there and now advising to come back to where Ghana is if I can put it that way. That is a huge resource and experience that we can tap into to ensure that we are not going down the wrong path again only to come back the next time. We will not have a huge agricultural estates thousands of hectares of land. Even the land tenure system will hardly permit that type of ownership within country. Therefore, mechanization, commercialization must all be done in the context of the current organizational state which is that the small- scale producer has dominated the system for a very long time, and I see them sustaining the agriculture economy of Ghana flying into the future. Therefore,

all organization of appropriate logistics and mechanization must be tailor measured to fit it the kind of system that we currently have.

Speaker 2: Then one last question. The fact that many of this are small holders and have say cooperatives that also changes? For example, we talked to various people from the business sector they are also having to structure to sell to often not a one farmer but perhaps a cooperative. You and the government what sort of things need to be done to make ... How do you organize groups of small farmers to get scale? How do you do that?

Fifi Fiavi: There is a lot of institutional changes taking place within the ministry that's managing the sector and also the private sector that the ministry is partnering to get the system to run. What the private sector will have to live with is the fact that the farmers are in regards scattered. That doesn't help the market much, and so the ministry is shifting emphasis from dealing with the farmer as a person or as an individual to dealing with farmers as viable economic gains and in groups. We have farmer-based organizations facilitation of the creation or the information of farmer-based organizations that can even specialize either as production units, as marketing units or as off-takers or as aggregators et cetera.

The common denominator in the entire institutional organization is that there are being organized to be into to play our role in a commodity value chain approach rather than just the ministry emphasizing on production all the time. If it is a value chain, that means that every person must play his role along the chain before the chain can be adequately serviced and made profitable for all to benefit. You have farmers organized into units. You have off-takers organized to deal with the growth of farmers. You have that taken them industry.

If I take the example of cassava for instance. You have cassava farmers small scale scattered across the country. There are people who organize them into cooperatives so that at the end of the season or jointly harvest they sell the cassava to an aggregator who will also process the cassava in the fields. Package them well and deliver the same cassava to produce to the breweries who need that to do their brewing of alcoholic and nonalcoholic beverages. It could have been too much for the breweries to go to the farmer to buy the cassava from each individual from it simply would work, and that's why the commodity value approach is the best way to be able to organize our production and post-production activities.

Speaker 2: Great, minister this was wonderful. Thank you so much, sir. We're just going to record some silence ... Okay.

Speaker 4: I'm through with my mic okay.

Speaker 2: Yeah, we're going to get room tone.

Speaker 3: Just record room tone or anything?

Speaker 2: Room tone. Good thank you. Cut. Wonderful ...

[END]