War of the Weeds Presentation Transcript

(Slide 1) When I saw the movie, War of the Worlds, about machines that have been buried beneath the surface, waiting for the right moment to come up and destroy the planet…and when I saw these machines cracking the soil, as they're emerging, I realized that it's not science fiction, that we have an unseen menace in our fields right now, waiting for the moment to destroy our crops. They are weeds and weed seeds.

(Slide 2) So we put together this talk called *War of the Weeds*, and I hope to convince you that indeed, America farmers are in a war. The weeds are out there, and they're buried in the soil and they would compete with our crops for resources and our crop yields would go down. So it's a war between crops and weeds for resources and the crops need our help.

(Slide 3) Let me give you the plot outline right up front, the plot outline is pretty simple: without chemical weed killers, weeds would destroy our crops and the only hope for America would be its teenagers. So I will return to this plot toward the end of the talk to bring it around.

(Slide 4) Scene 1, weeds are everywhere. There are 400 major species of weeds in the United States and they come in all different shapes and sizes. There are pigweed plants; they get to be 8 foot tall. There are plants like nightshade that hug the soil. There are grass plants like foxtail, and perennials, like Canadian thistle. They come in all different shapes and sizes. They emerge at all different times of the year. Different species are more prominent in one region or another.

(Slide 5) To give an idea of how ubiquitous they are, these are estimates of weed infestations in Virginia corn. To point out that a farmer doesn't face just one weed species every year, but probably five or six major weed species. Lambsquarters infest 65% of the acres, pigweeds on 70%, foxtail on 75%, and then lesser amounts of cocklebur, crabgrass, horsenettle, johnsongrass, and velvetleaf. The average field's going to have five or six major weed species in it and they are all different. And again, some of them are grasses, some of them are broadleaf, some of them emerge in the winter, some of them emerge in the summer.

(Slide 6) Weeds are survivors, to borrow from another popular TV show. This is a photo of a single lambsquarters plant. Each one of these plants can produce 72,000 seeds. So let 10 lambsquarters plants go to seed, you get 720,000 seeds put back in the soil, waiting for a chance to come up. And each one of those seeds will be alive in the ground for 40 years, so just a few lambsquarters plants can put millions and millions of seeds back into the soil.

(Slide 7) To show you some numbers on other weeds, a pigweed plant, has 117, 000 seeds per plant. Each one of those seeds can survive in the soil for 10 years. 19,000 seeds per smartweed plant, can survive in the soil for 30 years. So again, they are

different, they are weeds because they have excellent survival mechanisms. An enormous number of seeds, a long period of survival in the soil.

(Slide 8) So when you look at an idyllic picture like this, cornfield, blue sky across America, we just point out and say that there is a buried menace here. Those seeds are down in the soil. Each acre of cropland in the United States probably contains somewhere between 50 and 300 million buried weed seeds per acre. They can live down there for decades, waiting for a chance to come up.

(Slide 9) Weeds do emerge every year. Not all the weeds will emerge every year. Something like 5 to 10% of those weed seeds will get a signal. Perhaps it's a little light, perhaps it's a little water, the temperature. Something makes that weed seed grow and push up towards the soil. So 5 to 10% of the weed seeds emerge every year, but there are so many seeds in the soil that on average, you get about 2.5 million weeds coming up on a single acre. They take over, they will fill the empty space, so in this picture of a field, you've got some broadleaf weeds in there, tall weeds, short weeds, foxtails in there, there are 5 or 6 different types of weeds in every field. 2.5 million weeds will emerge per acre, and again that's 5 to 10% of that 50 to 300 million buried weed seeds will come up.

(Slide 10) And so we have war of the weeds at its most basic. This is a photo of what's supposed to be a citrus orchard. There are trees in there, but you can't see the trees because of the 8 and 10 foot weeds that have come up. And what weeds do is that they compete for water, nutrients, and sunlight because they are weeds with excellent mechanisms to compete for those resources. They muscle out the crops.

(Slide 11) War of the Weeds at its most basic, looking at this corn field. On the left, excellent weed control. You don't see any weeds, you see nice tall corn plants. On the right, you see what 2.5 million weeds per acre look like. Look how dense they are. And you see that the corn plants are shorter. You can see that the weeds are competing with corn for resources. So you're trying to grow 25,000 corn plants per acre, against 2.5 million weeds per acre. It's not fair. At the end of the day, that means 50-90 % of yield loss for your corn if you don't control the weeds.

(Slide 12) Here's what it looks like for carrots. Something we're all familiar with. Zero weed competition on the left. The carrots getting all the resources, the carrot's got all the sunlight and the space to grow. So you have nice large carrots. On the right, those are carrots that had to compete with weeds the whole year, and so we say a 70% yield loss. You literally can see it. You can see how the weeds got so much of the resources that the carrot yield…is 70% lower.

(Slide 13) Scene two…The Constant Gardener. Again, another popular movie. We have to remember that the use of herbicides or chemicals to kill weeds is relatively new. We've had this technology for only the last 50 years. So before that, for centuries, human beings used their labor with hoes to get the weeds out of fields. It was the primary way of killing weeds for hundreds of years.

(Slide 14) This was the primary job of children in the summer. When I talk to schools, I point out why do you have a summer vacation? It was because your grandparents were needed out in the field in the summer to pull weeds. So kids were given the summer off, like these kids in a sugarbeet field, up in North Dakota, pulling weeds by hand and on their knees.

(Slide 15) Scenes like this in the South, millions of people spending their lives hoeing cotton. That was a major part of people's lives up into the 1950s in southern states.

(Slide 16) In California, the tool that was used was called "El Cortito." That's Spanish for the short handled hoe. This hoe is 15 inches long and the reason they cut the handle off of this tool was to give it to migrant workers. In order to use the hoe, they had to bend over and by bending over, it brought their eyes close to the ground where they could kill the weed with the hoe and avoid killing the crop. If you have a long handled hoe, sometimes you'll miss the weed and you'll kill the crop. And so this was the main tool used in California for weed control for the first 50 years in the 1900s.

(Slide 17) So the problem with humans as weed killers in the 1940s through the 1960s, child labor protection laws. You're not going to have children out in the fields for 12-14 hours, 6 days a week. Increases in agricultural wages from 10 cents an hour to 1-2 dollars an hour. There were no minimum wage laws for agricultural workers, so up until 1945, the average wage for agricultural workers in this country was 10 cents an hour. Following World War Two, there were opportunities for workers in factories, mass exodus from the farm. The labor rate was bid up, and all of a sudden, the farmers had to pay 1 or 2 dollars an hour. They demanded a less expensive way of killing weeds. And then the short handled hoe was banned in California.

(Slide 18) I do recommend this book by one of the civil rights workers who was involved with the Hispanic laborers to get the short handled hoe banned. This was a civil rights issue, a human rights issue. You look at this picture of this worker, bent over at the waist, doing this for hours and weeks at a time. Permanent back problems were the result. If you read the autobiography of Cesar Chavez, he did this as a young man. Permanent back problems for the rest of his life. So the government of California banned the short handled hoe in the 1960s because it was an unsafe tool that caused permanent back damage to workers.

(Slide 19) Scene 3, another way of killing weeds, gasoline powered weed killing machines. You have a machine like this, these whirling blades behind it going in the fields, uprooting small weeds.

(Slide 20) This is the way it looks up close. You can see the weed killing machine kick up a lot of dirt. Any germinating weed is pulled out of the ground and dries out and dies. It is very effective in killing small germinating weeds.

(Slide 21) There are some problems with the weed killing machines. One of the major problems is that you can't use these machines too close to the crop. In this picture of

corn plants, you can see that the weed killing machine did a great job between the rows of plants but there are weeds right in between the corn plants where the machines couldn't get. And so that's where you're going to have the weeds survive and you are going to have them competing with the crop for moisture, nutrients, sunlight and space.

(Slide 22) Another problem with the weed killing machines is that they cannot be used in wet fields. This operator, for example, wanted to till and it got too late. There was a rainfall. You can see the field is very muddy, and the farmer has to wait until the field dries out before running that tractor. The weeds aren't going to wait, they will continue to grow. And by the time the field's dried out, the weeds won't be little tiny weeds, they're going to be big weeds. Now to us, this just looks like a picture of a tractor stuck in a field. I'm telling you that this is a scary picture for farmers, this is a nightmare for them. But to try to convince you how scary this picture is, we thought we'd need a credible source to help you understand that.

(Slide 23) We found one. Jimmy Carter is our source. He was the 39th President of the United States. If you remember President Carter's biography, he was a peanut farmer and he lived on a peanut and cotton farm back in the day. Back in the 1930s and 40s, that's when President Carter was on the farm before there were herbicides.

(Slide 24) In President Carter's autobiography, An Hour Before Daylight, he writes about this problem when it wasn't possible to plow because it rained and the fields were muddy. The noxious plants would continue to grow and be uncontrollable. Jimmy Carter refers to the weeds as terrible creepy oozing things in horror movies. Jimmy Carter lived the war of the weeds. This isn't science fiction, this is reality. You can see how it used to be a clean field, weeds would come up and the whole crop would be submerged. His father would have to go out and find anybody who would be willing to pull the weeds by hand. President Carter does a great job of explaining exactly horrible the war of the weeds was back in the day.

(Slide 25) Another problem with the weed killing machines is that they loosen the soil. When you see this picture of an operator, going across the field, going to get it ready to plant some crops, he has to get rid of all the weeds before he can plant the crops. But running the machines like this leaves the soil prone to soil erosion.

(Slide 26) On the left you can see a picture of an eroding field, the raindrops hit that field, there's no cover on it, so it causes the soil to run off the field and into the streams. And the soil pollution in streams is a major cause of water pollution in this country.

(Slide 27) The soil scientists at the Department of Agriculture have known for years that if they could convince farmers to reduce or eliminate their tillage that it would have an enormous impact on soil erosion. What these numbers show is that with tillage, the average acre of crop in the United States erodes at 7000 pounds per acre a year. The same data shows that if you don't till, if you just stop tilling, that field is only going to erode at 1000 pounds a year. So you can reduce erosion 6000 pounds an acre if you can give up tillage. But there had to be a different way of controlling weeds.

(Slide 28) Scene 4: the chemical weed killers striking back. What happened was that 1000s of synthetic chemicals were being discovered and invented and synthesized back in the 1940s and they tested these chemicals in the fields to see if they could kill the weeds. In this picture, an early experiment in corn, you can see what they found. They put the chemical down the row of corn, right in the soil. They found that the chemical would kill the weeds and not harm the corn plants. Between the rows of corn, you can see where they left the weeds. So you can see that they had serious weed pressure. But what they found was amazing to them, only a few chemicals out of the hundreds of thousands that were tested, they killed the weeds but didn't kill the crop. These are truly amazing chemicals, and they are called herbicides.

(Slide 29) Now how do herbicides work? There are a couple of different ways. One of them is the residual power of chemical herbicides. You see this applicator is spraying an herbicide on a field where there is no crop and there are no weeds. It is a clean field, but he's spraying an herbicide. How will it work? The chemical will stay active in the soil for several weeks, and any weed seed that germinates over the next couple of weeks will absorb a little bit of the chemical and be killed. So there's residual power of the chemical staying in the soil for a couple of weeks.

(Slide 30) And you can see how powerful technology is. This is a picture of a peanut field down in Georgia, where they applied residual herbicides on the right. You can see peanut plants but you don't see any weeds. This is four weeks after the spray was put down. On the untreated portion, you can see a square where they didn't treat, you see this massive amount of weeds. Again, you can see the 2.5 million weeds per acre. So on the right, where it's treated, all the weed seeds that germinated absorbed a little of the chemical and were killed. This is four weeks after the spray.

(Slide 31) The other way herbicides work is through contact power. In this case, for example, this applicator is spraying chemicals over the top of soybean plants. So what happens here is that the chemical is absorbed by the weed and the weed is killed and the chemical does not harm the crop. So this is contact power, killing the weed on contact.

(Slide 32) So you can see how effective that technology is with this picture. Contact power of herbicides. Picture of a potato field, which has been sprayed. You can see the brown rows, those are weeds. They were growing quite nicely and then they were sprayed with the herbicide and were killed. You can see that the rows of potatoes, which were also sprayed. The herbicides don't harm those plants.

(Slide 33) They were quite excited about this technology back in the 40s. In the 1950s, there was an article in the American Vegetable Grower magazine. How do you kill 20 million weeds in an hour? This was totally amazing. You can spray 10 acres with one pint of an herbicide for 50 cents. That's about 2 million weeds per acre. They were very excited by this new technology and what it could do.

(Slide 34) The new technology, the use of chemicals to kill weeds was adopted pretty rapidly. This is cotton up until about 1965, relatively few acres treated. In 1965, close to 100% and it's been that way ever since. So for the last 40 years, just about all the cotton acres have been treated with herbicides

(Slide 35) Several economists have done studies on what the impact of adopting herbicides in cotton and what they found was that in Mississippi, in one state, back in the 1960s, when this technology was adopted, it reduced hand labor by 20 hours an acre on one million acres. It eliminated 20 million hours of drudgery with tools and workers in fields every year. And it was cheaper, that wage rate had crept up and the herbicides were cheaper by $10 an acre. Growers saved about $10 million a year and there were 20 million fewer hours of human drudgery in one state in one crop.

(Slide 36) When we look at the historical record, we find over and over again how herbicides replaced humans as weed killers. In an onion field in California, it required 120 hours of weeding per acre. The onion plants come up and they are really really tiny plants, and so very carefully people had to go through and remove the weeds from around those onion plants. How about 55 hours per acre in sugarcane fields in Louisiana in the summer? Truly horrible working conditions. And that's what herbicides replaced, that kind of drudgery, over and over again. The historical record is clear that herbicides replaced the use of humans as weed killers.

(Slide 37) Now there were some crops that we didn't use hand weeders in this country before there were herbicides. Rice is one of those crops. In rice, weeds were not well controlled before there were herbicides. We don't use hand weeders like they do in China and Japan and it's impossible to cultivate because rice is grown in wet conditions. So when they got with herbicides, you can see the untreated plot side of this field where the yellow weeds are topping the rice. On the right, you can see where the herbicides were used and you can see rice plants, and you don't see those weeds.

(Slide 38) So rice acres treated with herbicide was a fast adoption, primarily between 1959 and 1976. They got to 100% in 1976 and they've stayed up at 100% ever since. You can see the adoption of herbicides in rice between 1959 and 1976. What impact did it have?

(Slide 39) Look what happened to yields in rice in that same time period. Between 1959 and 1976, rice yields doubled in this country. They had been producing 2000 pounds an acre. By the time that herbicides were adopted on just about all the acres, by 1976, rice yields had gone up to 4000 pounds an acre. Basically, we estimate that rice yields doubled in this country because of the use of herbicides. The other way of thinking about this is for a long long time, our rice growers had been losing half of their potential yields to weeds that were not controlled.

(Slide 40) Here's another crop that was poorly controlled before there were herbicides: wild blueberries in Maine. These blueberries have been growing in the forest of Maine for centuries. But you can see that weeds can be a real problem. Weeds come up

amongst the blueberries and you can get blueberries out of fields where there are a lot of weeds. But when you treat with herbicides, look how much finer everything looks and how accessible the blueberries are.

(Slide 41) Blueberry production in Maine, they didn't get their first effective herbicide until 1976. You can see what happened, up until 1976, they were pulling about 20 million pounds of blueberry out of those blueberry fields, commercially. And then they got their first effective herbicide in 1976, and blueberry production went up to 80 million pounds and that's due to an herbicide that's controlling weeds in wild fields where weeds hadn't been controlled before. So we're getting 60 million more pounds of blueberries out of Maine every year because of herbicides. The other way to think about it is that for centuries there was a loss of 60 million pounds per year due to weeds that weren't controlled.

(Slide 42) The other thing that we know historically is that the use of herbicides reduced the use of those cultivators, those machines that killed weeds. The typical almond acre in California had been tilled 16 times, just going back and forth, all year to get the weeds out. Herbicides reduced those applications. In cotton, in addition to reducing human labor, there were 5 cultivation trips that were eliminated in cotton. 5 in peanuts and 6 in potatoes and so on.

(Slide 43) Finally, they had a way of reducing tillage and eliminating it. Traditional tillage that you can see on the left, is a way of clearing the field or they could go across the field with an herbicide on the right side, one pound of an herbicide per acre, and kill all the weeds before planting, without any tillage. What's the difference between tillage and no tillage? 6000 pounds less erosion, just by eliminating tillage. The field on the right will erode 6000 pounds more per acre than the field on the left.

(Slide 44) No till farming, herbicides made it possible for farmers to give up tillage entirely on many acres. And on those acres, weeds are killed by herbicides, there is no disturbance of the soil with tillage, and we have no till farming in this country on 60 million acres, and as a result of reducing erosion by 6000 pounds per acre, we estimate 360 billion pounds of erosion is prevented because of the use of herbicides and the elimination of tillage on 60 million acres.

(Slide 45) Herbicide performance. This is a fantastic technology, there is a high bar for weed control. No other method of controlling weeds quite measures up. Here's what farmers expect. One to two pounds of chemicals per acre. 95 to 100% of the key weeds species are controlled. Don't just kill one of the weed species, I have 5 major weed species in my field and you have to get them all out with the herbicide. Season long control, farmer wants to make one or two applications and have season long control for three and four months with this technology. With no crop injury. You better not have an herbicide that damages the crop. This is the technology that we call herbicides, and it's high bar technologically.

(Slide 46) To give you a status report of herbicides in the United States, our farmers use about 410 million pounds of herbicides on 220 million acres. That's that 2 pounds of chemicals per acre, they spend 7 billion dollars a year on the herbicides and their application. They kill 550 trillion weeds a year. Being in Washington D.C., we finally have a number that's larger than the federal debt. 550 trillion weeds are killed with the 410 million pounds of herbicide every year.

(Slide 47) Now onto scene 5, and the rise of the organics growers. This has been a big phenomenon in the United States. We know that these organic growers do not use chemical herbicides so what we have to talk about now is what can we learn from the experience of organic growers. How do they fight the war of the weeds?

(Slide 48) So we went to the website for Earthbound Organics. This is the largest organic operation in North America, and this is right from their website. They make it very clear that controlling weeds without herbicides is very costly for them, they do all their weeding by tractor or by hand, just what I told you the alternatives are. It's very labor intensive, conventional farmers spend $50 an acre to knock out every weed in sight, organic growers have to spend $1000 an acre. Earthbound Organic has verified everything that I've found in my studies about the use of herbicides. The alternatives are hand labor, cultivation, and much more expensive and labor intensive.

(Slide 49) And the reason why it's so expensive, you can see in this chart of U.S. hired farm worker wage rate. I told you earlier that farm workers used to get 10 cents an hour, and you can see that up until 1940, and then the wage rate started to go up to 1 to 2 dollars an hour and now in the last 20 years, the wage rate for farm workers is now up to about 8 dollars. So for Earthbound farm, employing laborers to hoe weeds out of fields, it's 8 dollars an hour for that labor and it's very very expensive. If you put 100 hours of labor out there at 8 dollars an hour, and all of a sudden you have $800 for pulling weeds.

(Slide 50) How about organic rice? You can go into the supermarket and find organic rice. It's usually Lundberg rice from California, from a well known farm. It's been studied for many years, and we know a lot about it. One of the things that we know about this farm is that their yields are 50% lower and they talk about how difficult it is to control weeds. I talked about how rice yields doubled in the U.S. with herbicides, and Lundberg, they are organic growers that do not use herbicides, suffer the yield loss. They have no real way to control the weeds during the growing season, and their yields are 50% lower.

(Slide 51) North Dakota is the leading organic corn state, and this is a picture of an organic corn field in North Dakota. And look at the weed pressure. North Dakota State University estimates that they lose 25% of their yields every year of organic corn.

(Slide 52) Now California organic lettuce growers had a special weed problem. What happens is that the lettuce, one of these small plants, they come up and the weeds grow very close to it, and if they gave workers long handled hoes, those tools where you have to stand up straight and use the tool to kill the weed, you might hit the crop. These

organic crops are very very valuable, as you know. The short-handled hoe was banned in CA and so they have a serious problem.

(Slide 53) And you can see that problem in this picture, where the red plants are the lettuce crop and the green plant is the weed. So again, these are really small and you're standing there with a long handled hoe and you might hit the red and miss the green. The organic farmers had to find a way of controlling the weeds. What they did was that they took a close look at the regulation that banned the short handled hoe.

(Slide 54) And they found a loophole. When the state of CA banned the use of the shorthandled hoe back in the 1960s they did not ban hand weeding. That was not banned with the short handled hoe. That's what the organic growers started doing in CA. They said that they could start using these laborers just pulling the weeds by hand, and that's okay.

(Slide 55) And the organic growers in CA use a lot of human labor, pulling weeds by hand. These are estimates that the organic growers sent in to the state, saying that the average organic lettuce field in CA, 50 hours of that labor, 70 hours in carrots, 50 hours in celery.

(Slide 56) The state of CA in 2004 decided to ban the practice of hand weeding. The state occupational safety board said that they banned the short handled hoe because that was permanently damaging workers' backs. Well, when they looked at the practice of hand weeding, that's even more damaging on workers backs because workers bend over even further without the short handled hoe. They have no tool and so if they are standing in that position for a long period of time that's going to damage their backs too. So the state of CA banned the practice of hand weeding in 2004.

(Slide 57) But they made an exception, and the exception was for organic growers. The organic growers came in and they said "We want an exemption from this. We've got to have these workers out there, hand weeding. We're going to have significant yield loss and profit losses without the practice of hand weeding, you have to give us an exemption." And they were granted an exemption. They couldn't use the workers with the short handled hoe, but they could use the workers bending over at the waist with no hoe, and pulling weeds.

(Slide 58) So we have this picture of an organic lettuce field, where you can see the red crop and all the green weeds need to be removed, to bring this organic lettuce crop into the marketplace. Workers are going to have to go through there and hours of drudgery pulling those weeds out of the fields. Really back-breaking labor. A lot of people want to know how their food is produced. Well, organic lettuce is produced with back breaking labor that's exempt from worker protection laws in the state of CA.

(Slide 59) Now as the man said, the conventional farmer can use an herbicide called Kerb to knock out every weed in sight for $50 an acre. You know what's going on there on the left, you can see the little lettuce plants and you don't see any weeds because the

herbicide controlled them with residual action. On the right, you can see untreated. Again, our 2.5 million weeds per acre, you can't see the lettuce plants because of all those weeds out there. So again, this is why non-organic growers use herbicides.

(Slide 60) Scene 6. What happens if U.S. growers no longer have an herbicide to use? Now we get back to our plot theme, the only hope is America's teenagers.

(Slide 61) I came onto this idea by reading an article in Agricultural History in the summer of 2005. There was an article about North Dakota and Minnesota in the 1950s, about how people were worried about teenage juvenile delinquency back in the day. They said "Let's get the kids out there, out of their cars in the summer, and get them into the fields to pull weeds." They had a program that encouraged kids to get out and pull weeds in sugarbeet fields in the summer.

(Slide 62) Well, the program wasn't a big success. Teenagers complained about what you'd expect them to complain about. Blisters, heat, insects, sunburn, monotony, low wages. They got $1 an hour, 50% dropped out of the program each summer. The reason I bring this program up is because we got a really important factoid out of this teen weeding program.

(Slide 63) And that factoid is that, during the summer, each teenager could kill weeds on an average of 4 acres every summer. Each kid would go across 4 acres of cropland, and do 2-3 hoeings and pulling weeds.

(Slide 64) What does 4 acres look like? Well, this is a picture of a football field. We all know what a football field looks like, and how big it is. What's four acres? 4 acres is 3 football fields. So you put 3 football fields side by side and that's what the average teenager can weed during the summer. Up and down, all summer, and pull weeds.

(Slide 65) So how many teens do we need to replace herbicides? If we treat 220 million acres with herbicides and each kid can pull weeds on 4 acres, that's 55 million teenagers that are needed to go out there and pull the weeds every summer. We need just about all the teenagers in America to pull weeds like their grandparents did.

(Slide 66) Of course, these kids have easy lives now. These kids using their cell phones, their GameBoys, and their leisure activities in sports. They will have to give those up and go into the fields.

(Slide 67) Some kids are now doing it. This is a picture that I got from National Geographic, one of those glowing articles on organic farming. National Geographic says to look at this father and he's marching out to kill weeds with his kids. So again, it is reality. If we're going to do without herbicides in the U.S., we are going to have a need for a lot of kids in the fields, killing weeds like these kids are in the organic field.

(Slide 68) Scene 7, it's time for a reality check. I've talked about what would happen if we don't have herbicides, but can I give you some examples of what has happened when our farmers did not have an herbicide in the last few years?

(Slide 69) It happened in FL with lettuce and you see these soils in FL, these really dark soils, they're really high in organic content. A lot of these residual herbicides don't work real well in FL. Well they had an herbicide that worked really great in their soils up until 1985, and starting in 1985, that herbicide was cancelled. It was dropped, it was no longer available for them. So what did they do?

(Slide 70) They started using hand laborers to pull weeds. This is a picture of FL lettuce fields, you can see pulling weeds by hand. You can see those rows of lettuce going into the horizon. Between 1985 and 1993, for 8 years in FL, the lettuce growers spent $200 to $750 an acre for hand weeding. That was reality, that actually happened. They no longer had an herbicide that was registered in their fields so they had to employ laborers.

(Slide 71) Not all of the FL lettuce growers made it. A lot of lettuce growers went out of business, this is FL lettuce acreage. Between 1986 and 1993, they lost about 1/3 of their acres. Those growers just went out of business because they couldn't afford that extra expense.

(Slide 72) What saved the day? They got a new a herbicide registered in 1993 and that's what's been used in the last 12 years. A cost of $20 to $30 an acre for the herbicide, that replaces $200 to $750 for handweeding. This is a reality. This actually happened when the growers didn't have an herbicide, they had to use the hand weeding at a great expense. A lot of them went out of business and it was herbicides that saved the day.

(Slide 73) Let's continue our reality check, most U.S. crop are sprayed with herbicides every year. This is reality. These are items that you see in your supermarket, asparagus, carrots, oranges, cranberries, and green beans, just about every crop in America, more than 90 to 95% of that crop acreage is treated with herbicides every year. And it's been going on as I've showed you, some crops for 30 years, some crops for 50 years. This is the technology that works, that's safe to use with the crop, it's the least costly, the least burdensome in its demand for labor.

(Slide 74) Let's visualize U.S. crop production without herbicides. What are some of the choices that we'd have to talk about? Would we accept less food production? We can grow corn like they do in ND, 25% less corn production, are we ready to accept that? Do we pay higher prices for food if we're growing less of the crop? Do we expand crop acreage? We could do with rice, if we're going to have 50% less rice off of our acres, let's just double the rice acres and we can keep our rice production up with twice as many acres. But are we going to be pulling parkland, forestland, wet land into production? Do we want to expand acreage? Do we want to put more workers out on the field with tools? Migrant labor in agriculture is a huge issue right now, is that what we want to do? Millions of more workers, either migrant or kids out in the fields. Do we want to cultivate more? We have 360 billion pounds less erosion in the U.S. as a result of using

herbicides. If we stop using herbicides, do we accept that erosion? Export less, import more? Maybe we could import more food from countries where they spend 10 cents an hour for people with hoes and we could do without herbicides that way. These are choices that we have to make when we consider the importance of this technology.

(Slide 75) So finally, I always wind up this way whether I'm talking to college kids or Congress or EPA, and that is that if we accept the idea that herbicides are an important technology, should we step back and have policies in this country to make sure that farmers have the products that they need in the future? It's just the opposite that's happening now, it's getting harder and harder to keep herbicides in the marketplace. There is a lot of regulation, new regulations. It's becoming harder to keep older herbicides in the market, and more expensive. We have policies right now that are discouraging the commercial development of these herbicides. All I'm saying here is that maybe we should step back and say, "what do we need in the future for each one of our crops? Let's make sure that growers have the technology they need in the future."

(Slide 76) Everything that we've done in this area, all of the reports and summaries for every state, are available on our website. Please visit us. Thank you.