Fritz Roka was born in Washington DC on July 6, 1955. Grew up in Maryland suburbs, outside of Washington, DC. He attended the University of Maryland and earned a BS and an MS in agricultural economics. He received his PHD in agricultural economics at NCSU, in Raleigh, NC. He came to Florida in 1995 to work on issues of agricultural labor. His work with mechanical harvesting of citrus began in 1999 (?) Roka looked at the impact of mechanical harvesting on agricultural labor.

The money to finance mechanical harvesting has come from Dept. of Citrus loans, and private investment. Development for the canopy shaker was financed by one of these loans. The trunk shaker has evolved from a machine developed to harvest nuts out in California. One man has devised a water cannon to harvest oranges, but it has yet to prove itself. Currently there are three mechanical harvesters, two different types of trunk shakers and a canopy shaker.

As its name implies the trunk shakers literally shake the trunk of the tree. A mechanical arm grasps the tree trunk and the shaking motion causes the fruit to drop to the ground. One of the trunk shakers uses a catch basin surrounding the base of the tree to collect the oranges. The other requires the oranges be gathered from the ground.

The canopy shaker knocks the oranges off of the branches of the tree. Drums, with arms extending from them, whirl through the branches of orange trees, dislodging the fruit.
Again, a catch bin collects the fallen fruit. With the canopy shaker, two machines move down the rows, parallel to one another.

A draw back to mechanical harvesting is that the trees need to be a uniform height and a uniform shape for the shakers to work most efficiently. The trees of a grove must have a uniform “skirt height” (the distance from the ground to the tree’s branches) for the catch basins. Canopy shakers work best with trees growing on level land with canopies of a consistent height and uniform shape. (Some people have described groves groomed for mechanical harvesting as looking more like hedges that like orange groves.)

Harvesting machines can get stuck and bog down in the sandy soil of the “Ridge” region of Florida’s orange country. The hard packed dirt and level land of south Florida makes this region ideal for mechanical harvesting.

A grove that’s been mechanically harvested looks pretty rough. Leaves and broken branches cover the ground. Growers, who take great pride in the orderly neat and orderly groves, react negatively to the torn and tattered appearance of a mechanically harvested grove.

Additionally growers fear mechanical harvesting will damage their trees. How does the violent shaking of the trunk affect the productivity and life expectancy of the tree? Because mechanical harvesting has only been around 10 years research can not answer this question.

Can the mechanical harvesters adapt to the tree as it grows? Can a trunk get too thick for the mechanical “hand” that shakes the trunk? Can canopy shakers adjust to trees of different heights as young shorter trees replace tall mature trees?

Another challenge to developing the mechanical harvester is harvesting only the ripe fruit. Late in the season mature oranges share the tree with next year’s crop. How can the mechanical harvester dislodge the ripe oranges without taking “fruitlettes” for next year’s
crop? Researchers are working on a chemical that will cause the ripe fruit to release for harvesting while the fruitlettes remain on the tree. As it stands growers can not use mechanical harvesters after early May.

Use of mechanical harvesters can result in an over abundance of fruit, overwhelming processing plants leaving the excess oranges sitting in the parking lot and spoiling.

Roka believes growers will accept mechanical harvesting when it improves the labor productivity.

Growers like the idea of mechanical harvesting because hand labor can be problematical. Paying a fair wage is almost out of the question. Other employment opportunities have made hand labor scarce. As the season wears on orange-pickers charge more because the work is harder (hotter) and there is less fruit to pick the box and fewer oranges means less pay for workers (fewer boxes.)

Mechanical harvesting will work best for growers with a lot of acreage. It’s not economically feasible for growers with 100 acres groves to pay for a mechanical harvester to come into the grove set up, harvest the crop, take down and then move on. It’s more cost effective to move the harvester into a large grove where there is more work to do.

Roka thinks mechanical harvesters will not replace hand harvesting for another 15 or 20 years, but as use of the machines become more wide spread the cost of mechanical harvesting will go down.

Mechanical harvesting is only good for oranges that will be processed (juiced). The force of mechanical harvesting mars the appearance of the oranges making them unless for the fresh fruit market.
Bill Mansfield: This is disc number two if Bill Mansfield’s interview with Dr. Fritz Roka, on June 22, 2005, here in—almost in Immokalee, outside of Immokalee.

Fritz Roka: Almost in Immokalee.

Mansfield: But you were talking about the—um—I’m afraid my train of thought was Completely de-railed.

Roka: [laughs] That’s okay, fresh fruit.

Mansfield: So we were talking about fresh fruit and the mechanical harvesting is out of the question for that?

Roka: This particular kind of mechanical harvesting [is]. I guess we call this mass harvesting, mass harvesting and removal. Because of the bouncing and kind of violent nature of this harvesting, it’s not suitable for fresh fruit. The peel would be damaged and within a couple of days the bruising that would show up on the peel, rendering that fruit unmarketable as a fresh piece of fruit in the grocery stores, whatever place up north they would ultimately end up.

The mechanical harvesting option for fresh fruit is going to be robotics. There is work underway, looking at robotic technology that, in some ways will simulate hand picking. The pictures we’ve got now, the concepts that are being worked on are, basically, like three fingers grabbing the fruit, twisting it and pulling it off. So that
technology is already being explored as a viable way for the mechanically picking fresh fruit. Of course that’s not just true for citrus but it’s true for peaches in the Sand Hills of North Carolina and pears in Georgia—peaches in Georgia, I guess, apples in Washington State and New York. So all the tree crops that have a fresh fruit component are going to be interested in this technology.

Mansfield: What about, genetic engineering, or whatever. Somebody told me they were trying to develop a fruit that would—wouldn’t cling to the tree as tightly?

Roka: Okay. They’re not talking about genetic engineering, there. I think what we’re working on is a product called abscission. That’s a generic term for any chemical agent that enhances, or lessens the pull force attachment, by which this piece of fruit adheres to the tree, or to it’s individual stem. Abscission or abscission agents are going to be important in solving that last impediment we talked about, which is the fruitlettes, protecting the green fruitlettes for next year.

And, going back, to be clear, when we talked about tree health and tree yield and I said that; with each year, we’re getting more and more confident that we don’t impact the yield no next year’s crop. Well, that changes once you cross over this threshold in the late season Valencia’s time frame. When those little green fruitlettes start to size up when you shake a tree you will have a negative impact on next year’s crop. So that’s a fact that we’ve shown before. We just recently demonstrated that effect. So the issues of yield and no impact on yield only apply to the early crop, the midseason crop and even those Valencia’s that are harvested between March and the first part of May.

So once you get beyond May first, though, all bets are off. Now we do have to be concerned about impacting next year’s crop. So the strategy with abscission is that—we do have a product, there is a known abscission agent that has shown to dramatically reduce the pull force, attachment. It’s currently starting the registration process with the EPA, looking at all the residual toxicology issues, food safety issues and all of that—environmental issue. So that’s starting to undergo its testing now. But, what we also have to do is figure out away of incorporating this abscission agent with the existing machines.
It’s a product that will be sprayed on the tree, maybe three to four days in advance of harvesting. The pull force will lesson and then we come in with the machines and fundamentally change, or significantly reduce the amount of force that we apply to the tree, either trunk shaking or canopy shaking. We apply enough force that removes the loosened mature fruit but not so much force that it removes the green fruit.

**Mansfield:** The abscission spray doesn’t loosen the fruitlettes?

**Roka:** No. That’s something, again, where there has been a lot of work, even going back to the 1960’s, when they first started working with abscission agents. They show that it only affects the mature fruit. It does not have any impact on next year’s crop. So what we have is we have a known abscission agent that does work, that is selective—in its ability to abscise fruit. And we have these systems that will remove fruit, trunk shaking or canopy shaking. The challenge is packaging the two elements together, the abscission [agent] and the machine, in such a way that we can remove the fruit this year and not affect next year’s crop. And also work with the abscission [agent], so that we don’t have another effect, which is that abscission works almost to well and fruit ends up hitting the ground.

Probably the biggest management challenge, with respect to abscission, is that when we apply the abscission that we’re able to go back in and harvest the those trees while the fruit is still attached to the tree. Once it hits the ground, all value of abscission goes away.

**Mansfield:** You’ve talked about how they can’t mechanically harvest past May?

**Roka:** Right, May 1st, May 10th, yeah.

**Mansfield:** So the growers are just—the growers who use mechanical harvesting just let their trees—

**Roka:** No, they hand-pick. They have to come back in and hire hand crews to pick the rest of the crop. And that gets real expensive, very expensive. You have fewer people.
Um—it’s been interesting, at least in this local area, around Immokalee. I’ve heard several of the contract harvesters, that have hand crews complain about the fact that we’ve got a small group of growers that mechanically pick their early and mid season crop. Obviously without the need for a lot of hand crews and then they come back about May 1\textsuperscript{st} and they are bidding up the price for the remaining hand pickers to come in and get their crop. Well, they can afford to bid up the price because they’ve made all of this money in the early and mid season part. Yet, as a grower or a contract harvester, that has been working through the early and mid crop, now they are having to pay a higher price to the workers or being charged a higher price, if you’re a grower to get this fruit picked.

So there’s been an interesting market dynamic that sort of manifested itself in terms of those people who have gone to the mechanical system, verses those harvesters and growers who’ve stayed away. But, yes it’s going to be—and again we’ve talked about the economics of mechanical harvesting and its ability to lower the cost of harvesting is entirely a function of use and making those machines run. The longer they run, the more fruit they can pick in an hour’s time and the more hours they can work, not only in a day, but over the course of a season, then that starts to manifest itself in some real savings.

As with any piece of equipment, you’ve got a certain amount of fixed costs that go into that piece of equipment and you’ve got to pay that cost, whether you run it or not. So the more you run it the more units you have to spread over that fixed cost and that’s when we’re going to see real savings start to accrue.

So abscission is going to do a couple of things. Number one, it’s going to extend the hours that these machines can work in a season. In other words, instead of having to stop May 1\textsuperscript{st}, or May 10\textsuperscript{th}, whatever the date is, now maybe they can work through June 1\textsuperscript{st}, maybe even through June 15\textsuperscript{th}. So you’re adding four to six weeks of available time that those machines can run.

\textbf{Mansfield:} And eliminating the hand crews, or seriously reducing them?

\textbf{Roka:} And not having the number of people that you [currently] need. Also recognizing that historically, even before machines came into the area, the price of a hand crew would
start to go up as you got later and later into the Valencia season. [This happens] for two reasons: number one, just the overall work environment gets nastier. It’s hotter and more humid. So now, to induce people to continue to pick, you got to pay more. But also the later the Valencia crop goes the fewer boxes per acre are out there, so again to have a hand crew come in and pick on a piece rate, you’ve got to increase the level of the piece rate. So, it gets more expensive to harvest by hand, as you go later into the season.

So having an abscission agent, that works with the machines, now allows the machines to go further into the season, thereby reducing the over all cost of running that equipment, which then translates back to the early and mid season crop as well. Now your whole cost structure has changed and now you can afford, back in December and January, to lower your costs to mechanically harvest, there by increasing that differential between hand and mechanical [harvesting]. Getting that reluctant grower to [say]: Oh, before it was a twenty cent differential and now you’re taking about a fifty cent differential? Well, fifty cents times five–hundred boxes now we’re talking about $250.00 that are in my pocket, as a grower. Now I’m starting to get interested [in mechanical harvesting]. If it only cost me $100.00 to prep the trees, now in one season I’m getting all of that money back, plus some. So as that differential gets wider and wider, more growers are going to get interested in it.

In a sense it kind of feeds on itself. Because as more growers get interested in mechanical harvesting, the machines are being employed more, longer and then the cost keeps going down. Now, eventually, it will get to some point, some equilibrium. And I have made the statement that we can get down to, certainly below seventy-five cents a box, but maybe go as low as fifty cents a box—verses where we are now, which is at $1.50. So the potential for mechanical harvesting, in my opinion, is enormous. I mean it has enormous financial potential. If you’re talking about [saving] $1.00 per box in harvesting costs, and that’s net, then [if you’ve got a nice grove that’s producing five hundred boxes per acre] then you’re talking and additional $500 per acre, per year a grower can earn, that he wouldn’t have had before.

So there is a significant amount of potential out there. It’s not going to be realized right way. It’s going to take a lot of time, a lot of investment and a lot of learning for people to fully realize the potential.
Mansfield: Do you think that would make Florida competitive with Brazil, without the tariff?

Roka: That’s a tough question. It would help enormously, yes. But there are still other factors, so I would hesitate to say that only mechanical will save Florida citrus. I would be over reaching to say that. [But,] it would help significantly.

If you’re being partisan, you’re hoping that the Brazilian’s cost might start to increase. It’s the relative difference between the two that is really the competitive edge. So as Brazilian costs go up, for whatever reason—maybe labor cost start to go up—and Florida can keep her costs down and there will be more of an equilibrium between them. But now you’re relying on the Brazilian economy to work in direction that’s favorable to Florida.

Mansfield: I guess if Brazil were to go to mechanical harvesting then you’re right back to where you started.

Roka: Well, except I wouldn’t be too concerned about that. This is one area where I would not worry about technology being transferred. Because if Brazil can hand harvest, (and this is of course what Ron [Muraro] is saying) netting from thirty to forty cents a box—I mean if they bring in the machines, well—their costs can only go up. A machine can’t achieve anymore of a cost reduction than they already have now. It’s just doesn’t compute in my head that you can have a significant cost savings.

You know, not to be facetious, but [someone] jokingly said that the [Florida] Department of Citrus should pay the freight to send some machines down to Brazil, if they would guarantee that they would use them.

Mansfield: [laughs]

Roka: Because their costs would only go up. I can’t see their costs going down, with Brazilians using mechanical harvesting.
But the issue of competitiveness is still an open question. I mean, right now we’re looking at tremendous increase of land prices within the State of Florida and this is outside of the competitive area, but it still has bearing. It’s not just labor in Brazil, it’s also land costs and right now we’re seeing a tremendous explosion of land values in Florida. The grower has got to seriously think about it. That becomes a cost of operation as well. And regulatory costs are also in there. So, there are a number of factors that are going to impact whether Florida stays competitive or can become more competitive, even with the tariff.

But, in terms of—I guess not a short-term fix, but in terms of a more immediate help, then I would say mechanical harvesting would be one [solution, and] probably the most important aspect.

But we’ve only been talking about production and cost. The other side of the equation is demand. The industry has certainly has been backing up, in terms of demand. Maybe [the Atkins diet] had something to do with it, low [carbohydrates] diets and all of that—and juice being perceived as high sugar and therefore high carbs. For whatever reason, there has been a significant drop in the demand for orange juice, whether fresh or frozen concentrate.

That probably has had a big hurt on the industry. If that can be turned around and you looked at other areas of the world, like China, or even Latin America, or Europe and seeing an increase in demand for orange juice. Then as you see the price of juice goes up, then the competitive forces between Florida and Brazil will also go away. Because now, the markets are broadening and prices are going up and so the issues of [the] tariff and competitiveness go away, under the conditions of increasing demand.

**Mansfield:** Okay, maybe that would be a good place to wrap this up and let you get on to your safety meeting. But, I’ve been throwing questions at you for the past hour or so, is there anything you want to tell me about that I haven’t asked about?

**Roka:** [pause] I’m sure there is, but when you force me to think about it, probably not. I mean Florida and citrus are pretty synonymous. It’s a—you know sometimes when people argue about—you know—
As an economist, certainly being trained and NC State [University, Raleigh, NC], I was ingrained with the philosophy of free trade. It’s the way to go. And, yes there are arguments for efficiencies and trade and most of the benefits accruing to the consumers, in terms of high-quality, cheap food. I probably should say “inexpensive” and not “cheap” food.

Mansfield: Affordable food.

Roka: Affordable food, whatever. So I was strongly indoctrinated in that philosophy and to a large extent I still hold to [the philosophy of free trade]. But as people discuss the tariff and this issue, when you get out to the front lines and see the actual issues that people are dealing with and you see some of the challenges that growers are having to deal with, you become sensitized. [You become sensitized] to the fact that tariffs might have a valuable function.

We haven’t talked about the cultural aspect of Florida citrus. I know we [talked earlier about the highly important cultural aspect of Florida’s] cattle industry, in terms of how the state has developed. A lot of times these arguments of tariffs and trade get wrapped up in solely economic arguments and we sometimes forget that there’s a cultural side to the state, or the economy. You can’t put a dollar value on it, but never the less it’s still important. And maintaining citrus [in Florida] would probably be as much of a cultural importance to the state as it would be [economically important].

Then another reason would be environmental. There are some environmental issues that we could get into. When I first came here, to Florida, ten years ago, I was struck by the acrimony between environmental interests and agricultural interests. Environmental interests were saying that agricultural was destroying the environment and this and that. [That was] something I’d not found in North Carolina or previously in Maryland. Usually environmental interests and agricultural interests were a little more aligned and against urban growth. So I think that argument, even, down here is starting to turn around. But there are possibilities for agricultural lands to be used for environmental purposes as well as for the food commodity that they produce. So, again once the land goes away, once the land is converted out of agriculture into subdivisions, or what ever,
then we’ve pretty much lost whatever opportunity we would have for those other types of services.

So again, a reason for the tariff might be economic, might be cultural, but maybe more of a risk management idea. If the tariff can preserve citrus a little while longer, not only will technology, like mechanical harvesting be developed, but we also might better understand how citrus properties can fit better into the environmental landscape and allow those properties to be compensated for the environmental services. And without the tariff—just a straight economic calculation, given the cost of land, given the price of juice from Brazil and given all of these other factors, well let’s just dump citrus and get out of citrus.

**Mansfield:** Let the market have its way?

**Roka:** Let the market have its way. And while [I’m] as much of a proponent as I can be, I’ve also come to realize that there are certain things that the market can’t capture. And especially the longer-term vision that might be more appropriate out there, the market simply can’t capture [it]. So sometimes these policies, while they might work against the short-term economic interests of free trade, might have some longer-term benefits that will be economically advantageous to the community that will preserve some.

I don’t know. That’s a long-winded answer.

**Mansfield:** Well, it’s a good answer and I appreciate you bringing it up, because other people have mentioned that.

And let em remind you again that the information you’ve shared with me will be deposited in the University of South Florida’s Special Collections—

**Roka:** [laughs]

**Mansfield:** —I’ve got to put this on tape for the record—and I’ve got to ask you to sign a release form.
Roka:  Sure, does that mean my grand kids can come to the University of South Florida and dig this up?

Mansfield:  And hear what granddad sounded like, back in 2005.

Roka: [laughs] That can be kind of exciting, thank you for the opportunity.

Mansfield:  Okay, great. Let me shut this [recorder] off.

[End of interview]