When Marko Davinic came to the United States from Serbia in 1998, the then-high school student figured he would eventually become a dentist. But after earning a pre-dentistry degree at Northwestern State University in Louisiana, Davinic found himself not in dental school but in graduate school studying microbiology. At Texas Tech University in Lubbock, he investigated the astonishingly versatile human pathogen, Pseudomonas aeruginosa, at the university’s Health Sciences Center. From there, he tackled an even more complex subject—the universe of microbes in soil.

He now holds three advanced degrees (none dental-related): a master’s in microbiology, an MBA, and a Ph.D. in soil microbiology, which he completed in 2012. Where is he now? Soil Horizons recently caught up with him to find out.

Soil Horizons: So, you planned to go into dentistry but got turned onto research instead?

Davinic: Yes, my brother is actually a dentist. But even he is into [oral] bacteria, and he did some research as well. So I always liked research more than dentistry—getting into people’s mouths (laughs). I also had microbiology in high school in Serbia, so I was really into it since then.

Soil Horizons: What fascinates you so much about microorganisms?

Davinic: I like their diversity and their ability to adapt to anything and everything. Pseudomonas, for example, is a really amazing pathogen and has a lot of diversity just by itself. It can be a pathogen of humans or plants. And it’s always in soil.

But working with one organism is totally different from thinking about all bacteria in soil. Pseudomonas is amazing, but then I started thinking: how will it react when there are so many other bacteria around it in this setting? Soil is such a complex setting. You have pockets of air, and soil aggregates of different sizes with different nutrients inside them. I like to think about each aggregate as a small planet that can harbor totally different communities of bacteria.

Soil Horizons: You also grow bacteria and fungi as a hobby, right?

Davinic: Yes, I do it at my house. Right now I’m in a fungi mode. During the last year of my Ph.D., I started growing pink oyster mushrooms. I grow them and I like to eat them. They taste like bacon—full of protein. But also they’re nematode trappers in soil, and they can degrade anything, really. They can degrade terrestrial oil spills, for example, into forms of carbon that are non-toxic. Afterward, you can actually use the soil as potting soil. I have mushrooms right now starting to grow, and I would like to mix them up with different ratios of soil and oil because I’m in North Dakota, and we have a lot of oil drilling here.

Soil Horizons: What are you doing in North Dakota?

Davinic: I work for a company, Western Ag. Toward the end of my Ph.D., I had a job offer from a company in Lubbock, and I almost accepted it. But then, I had met the CEO of Western Ag at the [Soil Science Society of America] Annual Meetings in San Antonio, TX, in 2011, and then I met him again at the 2012 Annual Meetings in Cincinnati. And in Cincinnati, he actually gave me an offer. Yes,
networking at the SSSA meetings really helps.

**Soil Horizons:** And what do you do for Western Ag?

**Davinic:** Part of my job is to work with the company’s Plant Root Simulator (PRS) probes. What the technology does is measure bioavailable soil nutrients [nutrients that are available for uptake by plants and other organisms]. Basically it’s a resin membrane in a plastic support that can be easily inserted into soil. You measure the ion supply with minimal disturbance to soil. We have clients all over the globe: South Africa, Asia…I had some of them calling me at 6:30 this morning. I think they don’t understand the time difference (laughs).

But I like that part of my job because I talk with clients about how to use our probes in different settings: tundra soil from Russia or wet soils in Louisiana. And we talk not only about how to use the probes, but also how to [design] their projects. We collaborate on setting up the projects, and then we deliver probes to them and get the probes back. Then we deliver the data and help them with data interpretation and sometimes even statistics.

**Soil Horizons:** So, mostly researchers use these probes?

**Davinic:** Yes. But that’s just one aspect of what I do. I have a research and development position, but because I also have an MBA and I’m so outgoing, I got the general manager position for Western Ag Professional Agronomy. We consult with farmers on the amount of fertilizer they need to apply, for example, and we have this super-cool program called CropCaster. We take samples, measure bioavailable nutrients using our probes, and then we add all the data into CropCaster, along with environmental data. And CropCaster basically calculates for us how many pounds of nitrogen, phosphate, or sulfur the farmer needs to put on the field to generate the best economic return.

**Soil Horizons:** Where does microbiology fit in?

**Davinic:** My goal when I first approached Western Ag was to update CropCaster—not just to measure nutrients, but also microbial communities and microbial diversity. Because if we detect symbiotic microorganisms in the soil even at what we call a “medium” level, then we can discourage farmers from putting on too much phosphate and encourage this [symbiotic] relationship. That’s my goal: I want to bring fertilizer recommendations to another level. I want to link the nutrients that are available to plants—measured with PRS technology—to why they are available, using microbial community assessment. Then we can make the system more efficient, meaning in this case, less fertilizer.

**Soil Horizons:** In others words, rather than assuming all the plant-available phosphate in a field comes from fertilizer or what’s already in soil, you want people to recognize there’s the potential to have even more because of the microbes?

**Davinic:** Exactly. And that if you put less fertilizer on, you will encourage those relationships, whereas if you give everything to the plants, those relationships [between crop plants and microbes] won’t develop.

**Soil Horizons:** Are farmers open to this?

**Davinic:** Yes, what I’ve seen is that a lot of North Dakota farmers are accepting of no-till and some of the more eco-friendly practices and thinking about soil microbial communities and how they affect nutrient cycling. They know that if they leave a field fallow or don’t till, then more nutrients will be available because of the microbes, but they want to see that difference. So by measuring both soil nutrients and the soil microbial community, I think we can give them the full picture.

**Soil Horizons:** Wow, your job seems to have a great mix of opportunities.

**Davinic:** Yes, it’s so diverse. I don’t easily get bored, but I’m not meant for work where I do the same thing over and over again.

The other thing I do is management, and my MBA really helps with that because I hire employees, do accounting, and so on. I also like to deal with customers. I go to the field and do some of the fertilizer recommendations myself. We have certified agronomists who do that also. But I just like going out there and touching soil and smelling actinomycetes in soil.

**Soil Horizons:** Why did you decide to get your MBA on top of your science degrees?

**Davinic:** When I was at the Health Sciences Center, we did a project with Johnson & Johnson. They had new contact lenses that *Pseudomonas* would not attach to. (*Pseudomonas* can cause an eye infection and you can lose your sight very quickly.) For that project, they sent a liaison—a guy who had an MBA and a bachelor’s in biology—and I liked the position. He was reading our papers and doing a lot of ‘science-y’ stuff, but still he was doing better financially than the average scientist. So as soon as I figured out I could get a profitable and exciting
career in science outside the university setting, I started thinking about the MBA. And actually from that lab, three of us started the MBA program the same year. It was kind of contagious.

**Soil Horizons:** Do you have any advice for students who want to follow in your footsteps?

**Davinic:** Since I hire people now, I’ve interviewed people from the United States, Canada, and all over the world: Bangladesh, India, and China. The problem I’ve found is that they’re not capable of selling their talents. You have to be an amazing scientist to understand soil because it’s so complex: You cannot just know chemistry; you also need to know physics and microbiology. But when students approach companies, they have to be able to relate their skills to the company’s needs and make their thesis or dissertation applicable to the industry setting.

Also do not waste your time on jobs that do not fit. Last week, I interviewed eight people, and I think half of them did not know the details of the position—what they would do. If you don’t know what you are going to do, how can you sell yourself?

**Soil Horizons:** Anything else?

**Davinic:** I don’t know, maybe North Dakota is different, or maybe I was not talking to farmers enough before—I was always talking with researchers. But now that I’m exposed to farmers, my perception of them has changed totally. I think the farmers here are up for learning about the microbial community, and that makes me feel good. If I stay in North Dakota with its crazy cold winters, it will be because I think I can do something positive.