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## Living Homegrown Podcast – Episode 159 Improve Your Food Garden with Dr. Lee Reich

Show Notes are at: [www.LivingHomegrown.com/159](http://www.LivingHomegrown.com/159)

Theresa: This is the Living Homegrown Podcast, episode 159.

Announcer: Welcome to the Living Homegrown Podcast, where it's all about how to live farm fresh without the farm to help guide the way to a more flavorful and sustainable lifestyle, is your host, national PBS TV producer and canning expert, Theresa Loe.

Theresa: Hey there, everybody. Welcome to the podcast. I'm your host Theresa Loe. This podcast is where we talk about living farm fresh without a farm. Now, that includes organic small space food gardening and artisan food crafts like canning, fermenting, and even baking your own bread. It's all about the different ways that we can live closer to our food and take small delicious steps toward living a more sustainable lifestyle. If you want to learn more about any of these topics or my farm fresh courses, my online business coaching, or my living homegrown membership, just visit my website, [livinghomegrown.com](http://livinghomegrown.com).

On today's episode, we're going to talk about the science that we can use to make ourselves better gardeners. I'm really excited about this episode, because I truly do believe that in anything that we do, if we understand the reasons behind some of the techniques, it makes it easier to troubleshoot things, and it makes it easier for us to apply new strategies when we understand what's really going on.

To help us do that today, I brought back Dr. Lee Reich. Now, Lee has been on the episode before. He was on an episode where we talked all about blueberries. I will link to that in the show notes. It was one of my most popular episodes when it came to growing food, because everyone always gets stuck when they're growing blueberries. Lee was able to give us some really solid information to tell us what we can do to make our blueberries even better.

He's doing the same thing today, but he's diving into all different aspects of growing food and even how we can get better flavor from what we grow. Some of the things that we're going to talk about in today's show, is we're going to talk about ripening tomatoes, how to speed that up, what it does when we do speed it up. We're going to talk about bagging fruit. We're going to talk about

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soil and organic matter, and all the benefits and reasons and different things that are happening in that soil when we add organic matter.

We're even going to bust a few myths today on today's episode. Lastly, we're going to dive into some tips for storing any seeds that you might be collecting over the next couple of months as you're shutting down your garden. I really am excited about this. Lee has a tremendous academic background and yet he can explain the science to us and really easy to understand ways. That's why I love having him on the show. It's a fascinating thing to talk to him. I always learn so much.

Let me tell you a little bit about Lee before we get started. Dr. Lee Reich dove into gardening over 40 years ago, initially with one foot in academia, as an agricultural scientist with the USDA and Cornell University, and one foot in the field, the organic field. He eventually expanded his field to a farm den, which is more than a garden, and less than than a farm. He left academia to lecture, consult, and write, and thank goodness he did.

Lee is the author of several books, a Northeast Gardener's Year, Uncommon Fruits for Every Garden, The Pruning Book, Weedless Gardening, Landscaping With Fruit, Growing Fruit Naturally, and most recently, his latest book is called, "The Ever Curious Gardener." I'm going to talk about that one in just a second. Lee also has a syndicated column for associated press that appears bimonthly in newspapers from coast to coast. His farm den has been featured in numerous magazines including Martha Stewart Living and even the New York Times.

Besides providing a year round supply of fruits and vegetables, the farm den has an educational mission and is a test site for innovative techniques in soil care, pruning, and food production. Science and an appreciation of natural systems underpin all of Lee's work. His goal is to help more people whether in their backyards or small farms to grow more foods sustainably and organically.

Now, I want to talk to you about his latest book, because that is really why I wanted to bring Lee on. I got a copy of this book and I love it. It's a fascinating read. It's an easy read and yet I felt like I had just learned so much that I practically had a degree in horticulture when I was done. It was just absolutely fascinating. The name of the book is The Ever Curious Gardener, using a little natural science for a much better garden.

Now, what Lee has done here with this book is he has basically used his backyard as a laboratory. He has been studying, and testing, and doing all sorts of research on what works and what doesn't. Then he also backs up everything that he has done with more research. It's just fascinating, some of the things that maybe we think we do, we don't have any reason why we do it, he explains the reasons that we're doing things and why things work and why things don't.

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He also bust down some of the myths of things that we may have just been doing for a long time and are actually counterproductive. It covers everything from flowering, and fruiting, and stems, and leaves, and the effects of stress on our plants to our soil, and what we can do and not do to make our soil better, even how to make our food taste better when we're gardening. That's why I was so excited to have Lee on, because I just wanted to dive into a little bit of everything, which is what we did.

Now, as always, I will have links in the show notes to everything that we talk about with Lee including all of his books. To get to the show notes, you just go to [livinghomegrown.com/159](http://livinghomegrown.com/159) and everything will be right there for you. Now, before we dive into the interview, I want you to know that today's podcast episode is brought to you by my Living homegrown Institute, which is my monthly membership site, where you get access to an entire library of monthly masterclasses to help you live farm fresh without the farm.

In my membership, we cover everything from how to grow heirloom tomatoes, to raising chickens, and even making your own homemade cheese, yogurt, and fermented vegetables. Now, I believe that living an organic farm fresh lifestyle is really just a journey in learning. Just as we learn different skills such as food fermentation or food growing, we also have three distinct stages of growth. We start out being curious. We move into experimentation, and eventually we grow into mastery of some of these different skills.

Now, if you're looking at creating a farm fresh lifestyle for yourself, and you're curious where you fall on the growth scale with any of these skills, I have a free resource for you. It's called my farm fresh success path that my students use inside my learning institute. It will help you decide where you are on your own journey, the characteristics of that stage, and some action steps and information to take you to the next level.

To get a copy of The Success Path PDF, just go to [livinghomegrown.com/path](http://livinghomegrown.com/path) that's P-A-T-H, and you can download it there for free. Okay, so let's dive into our interview with Dr. Lee Reich, the author of *The Ever Curious Gardener*, using a little natural science for a much better garden. Hey, Lee. Thanks so much for coming back on the show.

Lee: It's great to be here again.

Theresa: Oh, good. I was so absolutely thrilled with getting a copy of your new book. It was a fascinating read and I'm recommending it already to all my gardener friends. So, I'm really excited to share it with my listeners, because I really do feel that if we can understand why things are going on in our garden, it makes us better gardeners. So, thank you so much for writing this book.

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Lee: You can't see me, but I'm blushing.

Theresa: Good. I'd love to first of all just dive in really quickly into what made you decide to write this particular book.

Lee: As I say in the introduction to my book, I have somewhat of a unique background in gardening. I did not come from a farm background or even a gardening background hardly, but I did at some age, while I was in my 20s, all of a sudden decide that I really wanted to get interested in gardening or really wanted to get dive into gardening. The way I dove into gardening was I went to graduate school in agriculture and I started to garden at the same time. I was in heaven, because I didn't know anything about gardening, or soils, or horticulture. Every day, I'd be learning so much. Then I'd go home and I was gardening like a maniac.

I also had access to a really good agriculture library. So I'd read everything I could read. I went from there. I have a strong academic background, but also I still garden as crazily as I did when I started. Then one day, I was making compost. I really like to make compost. It's one of my favorite things. Some people think I may have a garden just to do something with the compost. One day, as I was building my compost pile, and I was adding materials thoughtfully and patting them down and watering it in a certain way. I was thinking how everything I was doing, even though I've done it for a long time, but it really spoke to a lot of what I learned in graduate school about soil.

One of my graduate degrees is in soil science. So really, that guided what I was doing semi-consciously, sort of consciously and subconsciously. I was thinking how I do make really good compost. It's been tested many times. I was thinking, one reason my compost is so good is because I have that science underpinning. Making compost isn't all science, but there's just a lot of variables. There's also a certain amount of art to it, but you put it all together. I definitely thought that this science was a big help.

Then I started thinking about a lot of other stuff I do in the garden also reflects what I learned not only when I was in school, but also I was reading research journals, and also speaking with a lot of other gardeners, farmers, scientists, and a lot of experience. I've made compost for decades and garden for decades. I just began to really appreciate the science behind it all. I was thinking if I could convey some of that science to other gardeners. They could also not only have a better garden, but I think it also makes a garden more resilient.

For instance, changing climate conditions or even if a gardener, if you happen to have a new site that you're gardening at, if you garden in one place for say ten years and all of a sudden you move somewhere, if you know about something of the sciences going on behind the garden, this can actually help you garden

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better at the new site, because what you did at the old site might not work at the new site.

Then finally, I thought that knowing some of the science, it just makes gardening more interesting. I find gardening interesting, but just knowing what's going on makes it really just more fascinating. It's never boring. I think that's one reason why I'm still so crazy about gardening, because every year, I'm learning things new and discovering new things.

Theresa: I absolutely agree with you. I love what you say it's a blending of science and art so much of what we do is that. I loved I think the way you approach this book, because with all your background and your academia, you could very easily talk over all of our heads, and we wouldn't understand what you were saying, but instead you really brought this down to a really practical level and made it every easy for any of us to just dive right in to understanding what's really happening, and that you're absolutely right.

If you understand what's happening, then you can make judgements or make judgment calls anytime during the season when something comes up, because you have a better grasp as to instead of just guessing and throwing something out there and trying to make it work. I love one of the sections that you had in your book about ethylene and ripening tomatoes. I'd love to start there since we're recording this in August, and so many people are harvesting their tomatoes right now. Could you explain about the key role that ethylene plays in ripening a tomato?

Lee: I think ethylene first of all is really fascinating generally, because ethylene is a plant hormone. Just like humans have hormones, other animals have hormones, plants also have hormones. Hormones are generally really complicated compounds whereas ethylene, which is a plant hormone is very simple. It's two atoms of carbon and two atoms of hydrogen. It's a simple compound. Furthermore, it's a gas, which also seems odd or unique to me. Ethylene has effects on plants in a lot of different ways. One way, it has an effect is it speeds up ripening. Basically, different types of fruits can be affected differently by ethylene. There's basically two categories of fruits here, it's what I call, "Climacteric fruits and non-climacteric fruits."

Tomato is a climacteric fruit. When it is exposed to ethylene, its ripening speeds up a lot. A practical application of this is for instance people sometimes, especially towards the end of the season, when outdoor ripening conditions aren't that good, that might put tomatoes on their windowsill to speed up ripening. Actually, putting them on the windowsill doesn't speed up ripening, because light has nothing to do with it, it's really ethylene. Not only does ethylene speed ripening of tomatoes, but ripening tomatoes give off ethylene.

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If you wanted to speed up ripening, if you put tomatoes say in a bag where the ethylene does not dissipate as much and you get ethylene built up in the bag, they'll ripen faster. This is why maybe sometimes people wrap them maybe not knowing this is where they do it, but say wrap individual tomatoes and newspaper or something like that, and then it speeds up the ripening. One fruit can speed ripening up on others. Sometimes people put say an apple into a bag with bananas. Then the apple gives off ethylene and speeds up banana ripening.

Ethylene has so many hormones. Ethylene has other effects depending on when and how much is applied. For instance, ethylene can also induce flowering and fruiting in plants. Hormones typically do not have just one effect. The thing with speeding up ripening is a very interesting one. There's a saying that one bad apple spoils the barrel?

Theresa: Yes.

Lee: That's 100% true. The reason for it is because when a fruit is damaged, damage also and this is ethylene. So, if you have a whole barrel of apples, and one of the apples is damaged, that gives off a lot of ethylene. Apples are also climacteric fruits whose ripening is speed up by ethylene. So, you have one bad apple in the barrel and the apple ripening is very speed up, so the apples get overripe and presumably spoiled faster than they would normally.

Theresa: Oh, I get it. Yeah, so whenever I harvest my apples, I'm always very careful not to have any dings. I knew that having dings would make that one go faster, but now that makes perfect sense why that can ruin the whole batch. Yes.

Lee: Often, if you look at an apple say with a ding in it, they'll be speed up ripening right near the ding even.

Theresa: Mm-hmm (affirmative), yes.

Lee: It'll be a little redder right there.

Theresa: Yes, exactly. That makes perfect sense. It does have to do with the ethylene. That's fascinating. I know, when you pick all your tomatoes, don't you store them down in the basement? Do you just check them every couple days? What do you do?

Lee: No, honestly I used to do that and now I have a greenhouse set on the-

Theresa: You cheat.

Lee: I do that that often. What I used to do is yes, I would just put them in the basement. I didn't want to speed up ripening too much, because I was trying to

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keep, extend the season by just having them ripen slowly in the basement, but they did ripen faster in say outdoor tomatoes where cold weather price slowed them down. I think in those days, I used to use my oil burner more, which is in the basement, and any type of burning gives off ethylene also. Maybe a little ethylene drifted from the oil burner. Just trace amounts are needed, very small amounts. So, that could have also affected ripening.

Theresa: Okay. Now, what about the difference like, okay we all talk about if we have a vine ripened tomato, that it will taste better than something perhaps that was picked a little under ripe and allowed to ripen on the shelf. Have you noticed that that's true?

Lee: Actually, I don't think that's totally true. First of all, tomato will be ripened by ethylene but it has to be a certain degree of maturity before it can do that. I think that if it's just about ready to ripen and be ready to be picked and you pick it, and then it ripens off the plant, I think the flavor would be pretty much the same. If you pick it a little too much before that, then the flavor I definitely think would be different. This touched on another topic. This one might pet peeves. People often, they buy say hard plums at a supermarket and they say the jute's going to leave them out to ripen a little.

Not all fruits will ripen off a plant. Generally, but not always, climacteric fruits like bananas, pears, apples, tomatoes will ripen off a plant and will ripen to good quality if they're picked sufficiently mature, but some fruits won't ripen at all once they're picked. If you pick a plum and let it sit on account there, I like to call it "incipient rot." The fruit will soften and actually any carbohydrates, starches in the fruit could actually change to sugar as bacteria and fungi break them down. They could actually get little sweeter, but there's a world of difference between the flavor components of a fruit that's showing incipient rot and actually ripening.

Theresa: Yeah, that doesn't sound too appetizing, absolutely. No, I know what you mean. There's layers of flavor when it's been on the tree. We do have a plum tree and when I pick them too soon, it's night and day it's like it's a different fruit.

Lee: Yeah, then that's supposed to taste like lemons.

Theresa: Yeah, true. That's so true. Yeah. No, what about sunlight in enhancing the flavor fruit? When I prune my apple trees, I'm always opening up the canopy so that sunlight hits the apples. It does seem to enhance the flavor versus if I just let my apple trees run a muck and they get really overgrown.

Lee: One thing that sunlight definitely does with apples is it helps apples turn red. In Japan, they'd like to bag apples. They like pale apples, so they actually bag them so light doesn't hit the fruit and they don't turn that red. I do agree and I have to

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admit them, I'm not a 100% sure that this has been documented, but I do agree that it seems to me that the flavor is enhanced by light falling directly on the fruit. A lot of times, commercially people do that surely for turning the fruit color, but I think it affects flavor too. Also, once again, not all fruits are the same. Some fruits, their color at least is not affected at all by sunlight.

Theresa: Okay, but apples it is?

Lee: One fruit that's not affected is grapes. Grapes will turn color well then that they get sunlight. This relays to bagging grapes, which I do do to my grapes. I bag not every grape bunch, just because I have too many grapes, but I bag about a hundred bunches every season. That's only because to keep insects including bees off the fruit, birds, diseases, and it just makes fruit perfect bunches. The fruit will turn color, it does not need light. The fruit color is up speaking to a grape researcher, so it seems like this would be true, contended that the flavor also is improved by light falling directly on the grapes. My grapes, as I said, don't get light. The flavor I have to say is, not you said, overused word, but awesome.

Theresa: Okay. Now, so when you do this with the bagging of fruit, I've done something similar with the peach tree and I've experimented with apple trees where I'm bagging the fruit just to see what would happen, but I haven't done it in such large quantities as you have, but when you're bagging let's say your grapes, what bags are you using?

Lee: I just bought a thousand Delicatessen bags a number of years ago. On the outside of the bag I think it says, "Delicious baked goods." I figured that throws the birds and the insects off is that [crosstalk 00:21:08]-

Theresa: Yeah, don't go the other way.

Lee: ... grapes in there.

Theresa: Yeah, they'll never know.

Lee: I just use those kind of bags just because I have a slight coating on them so they'd last a little longer. You could also use paper bags I guess depending how much rainfall you get. It really is amazing to quality. Mostly because where I grow my plants where I live, there's a lot of grape disease problems. If they're not bagged, in some years such as this year, we've had continual rainfall. There'd just be so much disease that every bunch will have a lot of rotten berries if there's a bunch at all versus the bagged ones, it'll be like you open it up. In the idea world, you get this perfect bunch of grapes. In the real world, I have to admit that sometimes, I'll tear or open a bag and there'll be nothing in there.

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- Theresa: Oh no.
- Lee: I've worked a little with the timing and everything, and I'm not sure what the effect is, because just sometimes there's nothing in there.
- Theresa: How funny.
- Lee: It does seem to be related to any timing.
- Theresa: Okay. What about flavor though, do you think being bagged, do you think it enhances or just doesn't have any effect on flavor?
- Lee: I think it doesn't have any effect, but where I am if I'd let the fruit hang on the vine that long, first of all, as I said it gets exposed to insects and diseases, and so that could influence the flavor. The flavor could also be influenced by not getting any pest problems. As a matter of fact, to counter it, if I leave it that long, birds start pecking and bees start going for them. I probably can't let them get as ripe, because the fruit that I bag, I'd look up maturity dates that are given by Cornell, which has the same climate as I do for various varieties. I'll often go two weeks longer than that, because grapes will keep for a long time quite a while after their stated maturity date and that flavor just keeps up to a point. The flavor just keeps getting better and better.
- Theresa: Okay. All right. That's good to know. I'd love to shift gears and talk about soil, because you did a whole section on soil, which was absolutely fascinating, but you talk a lot about organic matter, which any good gardener loves organic matter and especially if you love to do composting. I loved what you were talking about the different benefits of organic matter. I have a lot of new gardeners and I have a lot of experienced gardeners who listen to the show. Let's talk a little bit about organic matter. First of all, I guess I should have you define what organic matter is.
- Lee: Yes. So, organic matter is anything that is or was living. It could be things like straw, it could be compost, it could be sawdust, pine needles, leaves, anything, weeds, dead weeds or it could be live weeds, cover crops. Organic matter is anything that is or was living and maneuver, because that's a lot of bacteria and fungi in there. There's raw organic matter, which would be things like fresh leaves, and straw, and say vegetable trimmings, things like that. Then once it's piled up say in a compost pile or added to the soil, it starts to decompose and then it becomes which could cause soil, organic matter, or compost if it's in a separate compost pile.
- There's a number of changes that occur as it decomposes basically bacteria and fungi, and other microorganisms true way at it and all sorts of compounds I've produced. It's really just, it becomes a witches brew of both known and

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unknown substances. People generally like to have complicated formulas for if you do this in the garden. The yields have increased or the flavor of everything would be increased. I hate to, well I do, I don't hate to, I actually like to simplify things, but I would say if you just continually enrich your soil with plenty of organic some sort of or many sorts of organic materials that you're 90% the way there to being a great gardener.

Theresa: You can't add too much, right? You can just keep adding to, I mean, you might add too much of one particular thing, you could put something out of balance, but organic matter in general we can't add too much.

Lee: I've said that many times and I'm tempering it just a little. I could just segue into that for a second. Typically, a soil will be less than 5% organic matter. So, this is the amount when organic, fresh organic materials have decomposed and they've been incorporated to the soil, this would be what this percentage represents. Usually, soils are just a few percent organic matter. Rich prairie soils might be 6% organic matter. My garden, I've had a lot of compost every year and I don't till the soil so the organic matter doesn't decompose.

What happen is even organic matter is in the soil continues to decompose even after it's broken down at a slow rate, well first as initial flush of decomposition and then it continues forever at a very slow rate. Over time, organic matter can just disappear. It will disappear. Tilling a soil by adding a lot of oxygen to the soil gives bacteria and fungi this extra oomph and speeds the composition. So, it's harder to maintain organic matter levels in the soil. That was just to say that I have not tilled my soil for many decades and I add a lot of our compost so my organic matter levels are very high there about 15%.

Theresa: Wow.

Lee: What's your question? I need your question.

Theresa: Yeah, so the question was, can we add too much?

Lee: Oh yeah, so I often wondered, the soil feels good, everything looks good, and everything grows well and can you add too much? It turns out, when you add a lot of organic materials, this tend to be rich in phosphorous and potassium, which are plant nutrients. The question is can you have too much of either of these things? Generally, potassium does really no concern and excess will just wash out of the soil eventually. Phosphorous was always thought to be tied up in the soil. It precipitates, because it reacts with the things in the soil and then precipitates into something that really becomes just slowly [reciablized 00:27:28].

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I've figured that phosphorous was okay also. Then more recently, they've found that if you have enough phosphorous in a soil, it can actually start leaching out being washed into the ground water, which is not a good thing. One reason they started looking at this is, because typically on farms, regular farms not necessarily organic farms, a lot of phosphorous fertilizers add it and the reason I like to add it is because it is precipitated. So you got it a lot, because a lot of it is just going to become unavailable, but so much has been added over so many years that now it is starting to leach out and maybe plants take up a lot.

This is something I'm interested in, and I'm going to be following up with some researchers from University of Vermont who are looking at the groundwater to see how much actually gets there. I was actually going to bore some holes myself and see how much phosphorous was in my groundwater. My groundwater level is very high, so I don't have to go that deep.

Theresa: That was my next question was like, yeah how far do you have to go?

Lee: It's only 10-feet deep.

Theresa: Okay. Oh, wow.

Lee: Sometimes it's only 3-feet deep.

Theresa: Wow.

Lee: Then also I recently had tissue test, which means you test the leaves of a plant to see if how, one thing is to do a soil test to see what's in the soil. A tissue test sees what plants actually took up. I thought a tissue test would be interesting to see how phosphorous and potassium levels were. It turns out they were both in the normal range. A little high in the normal range, but nothing of concern. I guess I'm still standing by you can't add too much organic matter, but I'm looking into this further.

Theresa: Okay. Probably the average person, because they may not have area where they haven't tilled in decades and you're so scientific about everything else. An average gardener probably couldn't add too much. I could see how in your situation though maybe with already having 15%, that's incredible. I can't believe it.

Lee: Yeah, you have to be a little crazy to add that much.

Theresa: Yeah, but still even with that, so far you don't see anything, so that's a good sign.

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- Lee: Yeah, and also just working the soil. That gets back to your question about, so there's many benefits of organic matter in all of the specks. One benefit is absolutely nutritional benefit, because the organic matter actually helps feed plants. It does this in a number of ways. One way is as it slowly decomposes, it releases nutrients the plants can take up. Another way is that it releases assets and other compounds that actually help release nutrients from the rocks that make up the soil, rocks that are broken down to very small particles. They actually are source of nutrients and especially so when you have organic matter helping that along. Then the third way organic matter helps is there's a real promo for organic matter.
- Theresa: Yeah, it is. It's like a commercial.
- Lee: Right. The third way organic matter will help feel your soil, is it has these components called, "Chelating compounds." Some nutrients that are in the soil, plants might not be able to take up. By these chelating compounds or organic compounds that form around different mineral nutrients that actually help plants take up to nutrients. Three ways.
- Theresa: Yeah, that's fascinating.
- Lee: That's just nutritional benefit.
- Theresa: Also, that just means that by adding it, anything else that's in the soil becomes more available because it's in different ways, in different actions, things that it's not just what the organic matter is that you're adding, but it has an effect on the soil to release other nutrients to the plants?
- Lee: Right and the organic matter itself has nutrients in it too.
- Theresa: Right, okay.
- Lee: So much so that typically if people use a reasonable amount of organic matter getting to the soil every year and that's the important thing is you don't just it at once and that's that, because it's always decomposing, but typically if you do that, the only nutrient that might be lacking is the nutrient that plants need in greatest amounts and that would be nitrogen. I used to add a source of nitrogen in addition to the compost. Then every year, I'd make these calculations that for this amount of organic matter meeting, which would be compost, is what I add to my vegetable grown, which vegetables need a lot of food especially when intensively grown.
- I made this calculation that kept telling me that this amount of compost that I'm adding should be enough to feed plants for a year. I actually stopped adding any other fertilizers so the only thing my vegetables get and very intensively

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planted, the only thing they get is a one inch depth of compost every year, and that's it. That's all the feed they get and feeds them.

Theresa: Yeah, fantastic. Yeah, or as an organic gardener, that's what we wanted to do. My listeners don't want to use any chemicals. They want to use everything natural and that's the most natural way you can feed. Like they say, feed the soil and that's how you feed the plants.

Lee: Right.

Theresa: Yeah.

Lee: Not only is it so-called natural way to feed, but it's also more sustainable, because everything that goes to my compost would otherwise be a waste product. It's like old garden plants. There's a horse farm nearby that I get horse manure and that's a big problem. They have all these waste horse manure that they have to get rid of. So, I'm helping them out.

Theresa: Yeah, and they're helping you out at the same time.

Lee: Yeah, so when people talk about sustainable and organic, organic isn't always sustainable. There's plenty of organic fertilizers you can buy that they take energy to make. Sometimes, if you don't have the time or the means for getting enough organic materials to make compost, enough compost to feed your plants, you have to do that. Gardening, it's not a, this is the only way to do it, but you can have a goal and I don't get enough compost.

Going out to other benefits of the organic matter in the soil, another one is biological. When you add these organic materials to the soil, you're really promoting growth of a myriad of micro and macro organisms. When you have a well-made compost or a lot of organic matter in the soil, unless something very strange is going on, you have a lot of beneficial organisms that really help fight diseases and also help plants take up nutrients. There's for instance fungi called, "Mycorrhizae fungi" that actually infect plant roots, but it's a symbiotic infection where the fungi put their hyphae into the plant roots. These are thin threads of makeup to fungi. They actually take some of the carbohydrates that plants make through sunlight.

In return, they act like extensions of the root system. It had plants take up both nutrients and water. That's just one example, and there's all sorts of known and unknown interactions in the soil like that. That's another benefit. The third benefit of these organic materials is basically is just physical on the soil. They help aerate a soil and they also help soils hold moisture. That's two things. Actually, it's like two opposing things it would seem, because usually soils had a

very wet, don't have a lot of room for air in them, but it's a soil particles are aggregated into larger units.

Then in between those large units is large basis. In these aggregates, these small spaces that can hold capillary water and then the organic matter itself is like a sponge, which can also hold water, so you get the best of all worlds. That's my case for organic matter.

Theresa: It's a good case, but no absolutely that's the whole point is it brings all of this together. It does everything that we need. It makes less work for us and makes everything easier for the plant. I think you sold your case. I think that was an excellent commercial.

Lee: As far as organic matter, those of you that, any listeners that are consider themselves to be organic gardeners, organic matter is what put the organic in the phrase "organic gardening," because that's always been the linchpin of organic gardening is plenty of organic matter.

Theresa: Yes, it's like the key to everything. Yeah, if you have that then you're on the right road and you're heading the right direction. Absolutely. Something else I wanted to touch on that can step off of this when we're talking about soil and having moisture and even drainage, there's something that we've focused on before on growing a greener world. That is drainage where people think they should put rocks, or stones, or things like that in the bottom of their flower pots for good drainage and it actually has the opposite effect. You do talk about that in the book.

I love the way you explained it, because it's really is counterintuitive. You think, well, I'll just put stones in the bottom of the pot and in that way the water will drain right out, but actually the opposite happens. Could you talk to us about that?

Lee: Right. This is another one of my pet peeves. I should say I was first introduced to this concept when I was in graduate school. It was a movie made it from Washington State University that you can actually find in the internet. It's a movie from 1961. It's a fun movie to watch, because it's very dated, because there's two men that demonstrate this effect with a lab set-up, and it's very convincing, and also but they're dressed in suits, which is interesting. Then suits of 1961 vintage too. If anybody is interested in seeing that, the movie is called, I actually bought a copy of the movie. I'm so into it. It's called, "Water Movement in Soils."

Theresa: Sounds really exciting.

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Lee: Basically, the point is, as you said on the edge of my chair each time I see it. The point of the movie is that if you had say clay soil and you're going to plant a tree or you had a soil for a flower pot, a potting mix, and you wanted to make the water drain better, because basically plants like good drainage, most people what they would do would be put either a layer of gravel in the bottom of the flower pot or even under, say if you're planting a tree, if you read some old gardening books and more recently actually on the internet, I saw a web series of some gardener in England who showed nameless, but he was talking about planting lavender. His lavender likes but drainage that the way you do that is you dig a hole, and then you put gravel on the bottom of the hole. Then you put the soil back in.

It actually has the exact opposite effect. Most people intuitively would be able to figure out say if you had a soil that's very porous and then you had an underlayment of clay soil, the water would go quickly to the pore soil and then since it goes very slowly into the clay, you'd get what's called a perched water table. A layer of water would build up and that wouldn't be good for plants. What turns out if you have a soil that doesn't drain well or a potting soil that does drain well, but you add a layer of very coarse gravel beneath it, any other change in soil porosity that's dramatic, you even in that case gets this perched water table.

That has to do without getting in too much detail with a suction and what it takes to withdraw water out of the soil beyond what gravity would do. Gravity pushes water to the soil, but then when it gets to a certain place, it won't leave them that has enough suction. One way you could demonstrate this yourself at home very easily is if you take a big sponge and you soak it in water, and then you hold it up in the air. So, you can feel that sponge there's water in it. It's holding it by capillary attraction. To just show how this layer of water right at the lower point in that sponge, if you hold the sponge so it's flat in the air and then you turn it-

Theresa: Like horizontal? You'd hold it horizontal first? Okay.

Lee: Yeah, but then you turn it so that it still hires out, but only one of the narrower edges is now facing the ground. When you had it the other way, you had a large area. Say that large area had say it was holding a half an inch of water, so if you turn it upright and now you have just a narrower area, but that sponge is still capable of holding a half an inch of water, but that wider area is going to add more than a half an inch of water when it's turned upright. Then if you turn it upright, some water will come out. Let's just try it and it'll be more believable as you see it.

You have it flat with the biggest surface facing down. It's saturated. You turn it upright and then you have a narrower part facing down and that's when water

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comes out. It's really easy to show this and to describe it, but that sponge is only capable of holding say a half an inch of water against gravity. If that half inch of water spread over a large area, okay so it can hold it, but if you [inaudible 00:40:28] on like by tipping it up, spread whatever water was in that large area over a smaller area, it's going to be more than half an inch, so enough water will then leave the sponge so that's all half an inch on that surface facing down.

Theresa: Got it. Yes. This approves your point though that because it's hitting a difference that that's what's holding that water inside that sponge.

Lee: Right. This really has a lot of practical implications. One is say when you're planting a tree, you don't add a lot of even organic matter, which improves drainage and makes the soil in more porous. You don't add pretty much anything. Ideally, you just put the soil you took out of the hole, put it back in the hole, so that there's no big difference between the soil in the hole and surrounding. Because basically, you don't want otherwise that you're going to get this water layer at the bottom.

Furthermore, the roots won't be that inclined to leave anyway, because it'll be a pot within the soil if it's too dramatic a difference out of. It's really nice soft aerated soil on that planting hole, why would the roots want to leave?

Theresa: Right. They'll think, "This is where the good stuff is. I'll just stay right here."

Lee: Yeah, right. Then also in flower pot, the idea is you don't put anything in the bottom. You just start out with the porous potting mix and you just put it right to the bottom of the pot. There is an unavoidable perched water table at the bottom of any flower pot, because you have this dramatic change in porosity either from the soil to non-porous pot another pot or if the drainage hole can be to air. If it's just perched somewhere where there's just air in the bottom exposed. The whole reason why you can't take straight garden soil and put in the pot is because the depth of that unavoidable perched water table from that change in porosity at the bottom of the pot is determined by the capillary attraction within that soil.

If you took straight garden soil, which is good out in the garden where you have a great depth of soil put in a flower pot, you'll have too great of depth of perched water table, which is a soil with water in it and not air. So, there'll be less root out there. If you'd make a potting soil more porous, which is what one thing that makes potting soil as potting soil, you had extra say perlite or vermiculite or sand, then this makes it more porous. So you still have that perched water table, but since it doesn't have as much capillarity, it's only much more shallow. It's right at the bottom of the pot.

- Theresa: Yeah, so the bottom line is to just fill it with the potting soil and not put anything at the bottom so that it's all the same all the way throughout.
- Lee: Right.
- Theresa: Then the only place you could have the perched water table is at the bottom when you hit the bottom of the pot.
- Lee: Right. You still have a perched water table, but it'd be very shallow one as opposed to if you had a straight gardens, well, even good gardens so it would be much deeper.
- Theresa: Got it.
- Lee: So you add, so a potting soil should have some aggregate to increase its porosity.
- Theresa: Got it. Yes. Yeah, and that's really, it is counterintuitive. It makes sense when you hear it like, "Oh, put rocks in the bottom of your flower pot." I know when I first start started gardening years and years ago, I did that. Then when I learned differently, it was like, this just doesn't sound right, but it does from a scientific standpoint totally makes sense.
- Lee: Right.
- Theresa: Yeah.
- Lee: If you watch the movie Water Movement in Soil, it shows that they do a slow motion video of a soil between two glass plates, different types of soils and you can see the wedding front desk that's moving down or what happens to it.
- Theresa: Wow. Okay. Yeah, I am going to try and find that. Only us gardeners probably would find that fascinating, but I think my kids would even find that fascinating, because it's just not what you think would happen, but it does make sense, yes.
- Lee: Right. It's slow motion though. Let's speed it up. It's normally very slow, but speed it up a little.
- Theresa: Yeah, you need a whole bowl of popcorn to get through that. Yeah. One of the other things I wanted to ask you since we're at the end of August here and a lot of people are starting to save seed or they're going to be saving their seed. The last thing I wanted to talk to you about was, how you save your seed because you had some, you talked a little bit about that in the book as well, and things that you found that help and that don't help.

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Lee: The packets.

Theresa: Yes, so they last.

Lee: Yeah, so basically the thing is the things that keep seed lasting longer or cooler or colder temperatures and lower humidity to a point, the humidity. What I've started out doing is I had these plastic storage box or maybe there are shoe box on it, but they sealed pretty well. I would keep my seeds in that and then I originally had this little silica gel packets that would keep absorb the humidity. Of course over time, I've had the same seed boxes for many, many years. They've cracked, so they're not longer airtight.

The silica gel I keep forgetting to renew. So then that stored that well. The problem is in the summer when I have where my seeds are in my garage and it's humid and hot, so that's not that great. I was thinking that some seeds I'd like to keep longer. Where to do it would be you can keep them in a freezer. The main problem of the freezer, when you take them out of the freezer on a humid day, you're going to get all this condensation, which will add moisture, which won't be good for them.

What I was starting to do is I would keep seeds, started to keep them in mason jars. The seeds that I don't have to get back to, well summer like I plant onions once and lay winter or mid-winter actually. So, I could just put them in a jar, seal them up. Then I thought that maybe if I decreased the oxygen level, because basically seeds even though they look like they're dead, they're really alive and they're undergoing respiration, breathing essentially at a very slow rate. If you decrease the oxygen or conversely increase the carbon dioxide, this also could slow aging of the seeds.

What I did is I also found on the internet, which I'd seen many years ago that finally got around to doing it, I reverse-engineered a bicycle pump. So, instead of pumping air, it was taking out air. Then I got one of these things that's used for, I'm trying to think what it is used for, it's used for preserving vegetables or-

Theresa: Oh, like a food saver?

Lee: Yeah, it's called like food saver.

Theresa: Yeah, food saver.

Lee: Yeah, that's what it's called. They had one that would actually fit on top of a mason jar. I started putting the seeds in a mason jar, put this food saver device over it and then I made it so that I could put a tube from my reversed bicycle pump and then to evacuate the air from it. It worked pretty well. In case the seal would be broken, which is disappointing, but it kept pretty well. It's

somewhat of a hassle so I can only do it for seed, so I'm not going to keep getting back to. The other problem is that mason jars, the seeds don't fit that easily and so I just try and put more seeds than I should, but that worked pretty well.

Then in winter, I keep them in the same garage, and so the temperatures are cold where I am and it worked pretty well.

Theresa: Yeah, that's fun.

Lee: Yeah, and the other thing to keep in mind is that different seeds vary in how long they innately will keep. Onion seeds, which I mentioned are among the seeds that keeps the shortest amount of time, so I was trying to preserve them. Because I never use the whole pack out of onion seeds. I was thinking if I could keep them, then I could use them for a few years.

Theresa: Yeah, very true. Onion seeds go pretty quickly so that gives you a way to extend them for longer than one year, which is fantastic. Yeah, I found that really curious and I loved your whole reverse engineering thing and pumping out the air, which makes a lot of sense. I thought that was fun.

Lee: Yeah, and the important thing also is just to realize it, that seeds are alive even. I've used seeds for so many years, plant seeds, I'm just always amazed how this lifeless appearing little specks and bigger specks can actually grow into, a corn seed grows into this giant plant, or tomato seeds, the plants are 8-feet tall now. It's just amazing.

Theresa: Yeah, it is amazing. All of that genetics is in that tiny little seed. It's just amazing.

Lee: Yeah.

Theresa: Lee, I so appreciate you sharing all your knowledge with us today. I just love it. I do feel that you're helping so many of us become better gardeners by just understanding a little bit of the science that's going on in the garden. Thank you so much for coming on today.

Lee: Thanks for having me. I had a great time.

Theresa: I hope you enjoyed that interview with Dr. Lee Reich, the author of *The Ever Curious Gardener*, using a little natural science for a much better garden. I love that interview. It just was so fascinating to me. I think I could talk to Lee all day long. As always, I will have in the show notes for today's episode links to everything that we talked about including all of Lee's books. To get to the show notes, you just go to [livinghomegrown.com/159](http://livinghomegrown.com/159). I hope you found that as interesting as I did, and that you learned a little bit along the way. Just



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remember, don't put little pebbles in the bottom of your flower pots, okay? All right. Until next time. Just try to live a little more local, seasonal, and homegrown. Take care everybody.

Announcer: That's all for this episode of The Living homegrown Podcast. Visit [livinghomegrown.com](http://livinghomegrown.com) to download Theresa's free canning resource guide and find more tips on how to live farm fresh without the farm. Be sure to join Theresa Loe next time on the Living Homegrown Podcast.