Jon Frank: If you want to make money in farming or if you want to have high quality, that people come back and say, “Man, your muskmelons are the best I’ve ever eaten. I got to buy your muskmelons,” then you want your leaves working right for you. You’ve got to get this working right. It all comes right down to how efficient are your leaves, okay? And that means that this leaf, when it needs copper to do a certain enzymatic reaction, it should have it. It shouldn’t be short. When it needs something else, it’s there. In other words, all the components of your manufacturing need to be present, and the minerals are very important.

Cooley Ludtke: That was soil specialist Jon Frank. Farms for Tomorrow’s Cliff Scholz recorded Jon’s presentation at the 2nd Annual Southwest Michigan Soils Program hosted by our friend Joe Scrimger.

Cliff Scholz: Jon called his presentation “Biological Theory of Ionization – Building Plants Cell by Cell”.

Cooley Ludtke: That’s a mouthful.

Cliff Scholz: The focus was on how you can achieve better crop quality by improving plant nutrition. The insights Jon shares are based on the work of Dr. Carey Reams. And Jon talked a lot about calcium, which is often overlooked in standard, NPK-based thinking.

His presentation really helped me see how I can translate Reams’ theory into practice.

Cooley Ludtke: Jon made some complicated ideas a lot easier to understand. It’s very clear that if your soil test says you need calcium, and you add it, you could make a big difference.

Cliff Scholz: I got a lot out of that conference. And Kaye’s lunch was delicious.

Cooley Ludtke: You're listening to Farms for Tomorrow. I'm Cooley Ludtke.

Cliff Scholz: And I'm Cliff Scholz.

Cooley Ludtke: So let's get into it.

[1:50]

Part 1: High-Brix Forage for Quality Milk Production | Length: 8:25

Jon Frank: This morning I'm going to talk about some of the principles of Reams' Biological Theory of Ionization. I'm going to tie it in so it is not too much theory all at once, but it's more practical.

We need high-energy foods, foods that are really nourishing, and it's not available in the marketplace. So the best thing is to grow a small plot and make sure that at least in a small area, you can get foods that are really high value, high energy, and nourishing your body. And I want to transition to animals and say that the same thing that's working with human nutrition works with animals and in animal performance.

And one of the most amazing things I experienced was, I had some Nubian dairy goats, and I was raising milk and selling milk, but I didn't have any land. So I had to buy hay. And so I was working with a refractometer and checking the Brix of milk. And so Nubians are very similar to a Jersey in the sense that they're going to give a fairly rich milk, higher in fat and protein, and a pretty good milk. The only thing is it doesn't have any color to it because the goat's body converts the beta carotene all the way into vitamin A, so it's a white milk.

But anyway, I was trying to buy some hay, so I got somebody who was in Kansas and he had some hay that he submitted to the sample lab, and it was really high quality. It was a grassy alfalfa mix. And when he cut it, it

was 16 Brix on the hay. And he had done a thorough forage analysis. And so I had dairy goats that were on forage. The hay that I had was a road ditch hay and the does were on hay. And then twice a day I would give them about a pint of grain on the milk stand. And they were losing flesh on their ribs. The milk was tested for the Brix, and it was about an 11 Brix.

Now when you have lower-Brix goat's milk, the aromatic compounds that make goats smell kind of funky can show up in that milk stronger. When you have a high-quality feed and diet for the goats, that kind of goes away and you get a really good flavor. Cattle don't seem to have those kind of aromatic compounds as much in their milk. So lower quality cattle milk, not so bad tasting. You get lower quality goat's milk, and it's not as good tasting.

And so I got this semi-load of hay and what I noticed when I switched out the hay to a grassy alfalfa hay, and it was really good hay. Really good. Immediately, I noticed a bump in yield. Immediately. And after about the course of two weeks, I observed the flesh on their ribs was coming back.

What's that mean? They were getting good energy. And what I also did in the same period of time, because the yield was up, I started reducing the grain because I could see their ribs closing up with the flesh. So I knew they were gaining a little bit. So I cut the grain down to two tablespoons twice a day, just a little something to put in the milk stand because they were used to it. Essentially, no grain. Okay? And then I measured the Brix of the milk: 16.3 Brix milk.

And I don't know if anybody's measured Brix of milk, but it's a pretty good indicator. If you just take it when it's fresh, it has not had any time for the cream to separate, it's a good indicator of quality. And let me tell you, the flavor went up substantially on that milk.

It was really, really good. Until you start to experience it, it's just kind of words. But when you actually taste it, it's like, wow, I never knew milk could taste so good, you know?

So this whole process of building up the soil works for animal performance. If you want weight gain, you can get it. So I'm going to make a statement. It's the easiest thing in the world to get high-Brix milk. What do you got to do? Just feed high-Brix, high-quality forage and you're going to automatically get it. Of course there's a catch. And the catch is, you've got to get that high-Brix or high-quality forage. And that's the part that takes some effort.

So what was this guy doing to get to 16 Brix, grassy alfalfa hay?

You know, soils around the country vary considerably. And especially when you start to see this from a lab testing perspective, you can start to categorize soil into types. And, there are some soils that are light and pretty poor. And there's some soils that are really heavy and maybe could be very good or could be starting to go poor. But lighter soils tend to respond pretty quickly to fertility. And if you have a light soil that's really, really poor, everything you do is going to make it a little bit better, just about.

And so this guy was in the rolling hills of Kansas. And what he was doing, he had a little strategy and he was buying degraded farms, farms that were not producing very good at all. And Kansas soil is, a lot like, say, Oklahoma soil, where you can do something and it responds very quickly. Not like Minnesota soil. You do something in Minnesota, and you got dark, rich soil, it takes time to make a change. It's like turning a big ship around versus a canoe. You can turn a canoe around really easy.

So, he was doing three things, essentially. And he was under the teaching and influence of Doctor Reams. So he was putting down soft rock phosphate with a colloidal clay. He was putting limestone down. He would use a little bit of gypsum, because there was such a problem of compaction at times. So he was using some gypsum, kind of supplemental to the limestone. The limestone was for raising the calcium. He would also use some ammonium sulfate if he needed some nitrogen,

depending on which crop he was raising. And if it was pasture, occasionally he'd put low doses of magnesium nitrate just to make sure there's a little bit of magnesium. He did a little K-Mag as well.

So that was the base program that he was doing across these larger acres, and he was able to bring up the quality after several years and get it to really pretty good quality. And then once it had those parameters there, he'd sell the farm as a higher-quality farm. And that was his strategy.

So if you think about it, soft rock phosphate is calcium phosphate. That's the base of soft rock phosphate. There's more things to it than that. Limestone is calcium carbonate, and gypsum is calcium sulfate. So he was hitting it really, really hard with calcium, which was critical.

That's a story that I wanted to share because this thing works with animals. And if you get it done right, the ability to take out grains, which is a purchased energy for your cattle, and to be able to get all your energy coming from forages is a really big deal. And the way it changes the omega three/omega six fatty acid profile in the milk is also important. So you're reducing a lot of the omega sixes coming from the grain. And you're getting an energy that the animal can get with the help of the microbes in the rumen, in a way that has got a lot of fiber and forages, and it keeps the rumen really healthy.

And so all that grain can tend to push that rumen acid. And it's harder on the biology. So it's a win-win-win for everything. And even the manure if you start with high-quality forages, the manure quality is much better and it's going to just keep cycling around.

[10:15]

Part 2: Calcium as a Key Crop Nutrient | Length: 11:38

There's a theory that Doctor Reams taught, and it was the idea of a basic primordial cell. So he talked about every living cell, from the smallest microbe to the largest tree or whale, everything that's alive starts with a basic, primordial cell. And in the very center of it is some kind of a life force. And then around that, the very first thing that is needed, is the element of nitrogen. So every single cell starts with this. But it doesn't stop with nitrogen. It also takes a carbon that is with that. Then a oxygen. And hydrogen.

The next one is calcium. And what you see is, nitrogen, carbon, hydrogen and oxygen: These are the essential building blocks of an amino acid. And this was what Reams called a "basic primordial cell". And then from here, there's differentiation based on the genetics of that cell, the genetics to become whatever it is.

So all of this kind of makes sense. But then when you get to the calcium, I think it really plays an important role. Every single cell needs calcium. So, many times when you see deficiencies, you're seeing a calcium deficiency of some form or the other.

I went to a symposium in Thailand and it was The Mineral Nutrition of Fruit Trees, and I presented a presentation called Does It Pay to Spray? I am not credentialed and not degreed. I just learned on the job. I learned from asking a lot of questions and sticking around for the answers, doing a lot of thinking and especially listening to Doctor Reams' material, reading books on my own. So, I kind of copied the whole format of how you do and present a scientific paper. So my basic question was, if we have a foliar spray that can actually supply calcium, does it actually pay to do frequent applications? Not heavy amount but very, very frequent.

And so in this case we were looking at cherries, and we saw that they were foliar spraying two and three times per week with a calcium spray that we had that went through the leaf and went into the fruit. And we had yield data before this new management, then the new management with a high frequency of foliar spraying. And we looked at the yield on these

cherries. And we way more than doubled. In some cases it was up into the triple range, and it was consistent. Now it was always little variation year to year, but we had like six years of data before and four or five years of data after new ownership. And it was like, really high.

Now any farmer is going to look at that, and the control is what was happening beforehand. They were not spraying at all. And yes, we had a fertility program, but we were hitting it really hard. And I did good at the talk, but they rejected my paper because they said I didn't split it. And so my control was the previous years. So that was a control that a farmer would accept. But it wasn't what the scientific community… So it never got published. So I'm unpublished citizen scientist.

The point is, though, on that conference, I started looking at all these papers and all the presenters, and all of a sudden I saw a picture come in here: Half, half of all the presentations had something to do with calcium. Can you believe that? It was like this tropical produce has this problem, and it's a calcium problem. Half was calcium. And mine was about calcium too, only I was kind of in the positive side of making a big change. And so, when I look at soil tests, calcium keeps coming up. Calcium is very, very important. Let's look at one place where it's really important.

Before I get to that, let me just kind of ask a question here. We got a plant here, and we got leaves, and we have roots. So I'd like to ask a question: What is a plant?

And that's kind of a odd question. But I asked that question when I was writing in series of articles a long time ago in an email sequence I did: What is a plant?

And the conclusion that I came up with is: a plant is an energy accumulator. That's what a plant does. Now, notice I did not say it makes energy. It accumulates energy. It gathers up the energy in its environment.

Now if you go back and you really study what Doctor Reams taught, he taught that a plant is actually an antenna and it receives nutrients in the leaves. And in fact, it also receives nutrients in the roots through the electromagnetic lines of force that go across. And if you have a healthy plant, it's going to be receiving more nutrients.

So in reality, a plant is a double-pole antenna, he said. It's got a pole up above and it's got a pole below. So a plant is an energy accumulator, accumulating energy through its antennas. Now, Reams had a rule: Like things attract each other. Elements are that way. Gold, when it comes out as part of, an eruption from a volcano, over time, the gold consolidates into veins. Gold is attracted to gold, and it runs in veins.

This principle works on plants. So if we get a very healthy plant, we're attracting more to the plant. It has an electromagnetic property that attracts from the environment.

So one of the things that's really important is to have a good root system. Now, Doctor Reams taught, and we've seen this too: If you look at roots and you have a low-calcium soil, a lot of times you just got your main roots coming off. And that's really all you have. Now, when we talk about soil, we talk about plants, we're talking about something that is physics that's occurring all the time. Okay? So something is magnetically attracted to another element here. We're also talking about the chemistry that's happening all the time. And at the same time, we're also talking about biology, that's happening all the time. So the way we can talk and communicate is: we kind of just talk a little bit here, we talk a little here. But in reality it's happening simultaneously, all the time.

And so if you have a plant that has very poor root structure, say it's a very low-calcium soil. You have the main roots. Well, what are roots? Besides being an antenna, they're also a microbial feeding station. This is where the plant, if you are building this right, and you've got the leaves working for you, they're making more sugars and they're sending it out from the leaves, they're sending it out to the roots. So, we want to get the calcium

built properly because as we get more calcium, we're increasing the microbial feeding stations, and we're then enhancing the biology to digest.

So maybe a moderate level of calcium would be 1,500lbs an acre. 700 is low. Medium could be like 1,500. And you start getting really high: 3,500lbs an acre. This is just some basic numbers. You can go a little higher, especially if you're growing alfalfa. It's good to go higher. What happens is, you get the side roots coming. Then you get the tiny little root hairs all over, and you just get a profusion of roots on the plant when you get this built up. So this is very important. Just one more aspect of why we need to address the calcium.

I have to throw out this warning that if you subscribe to the belief that everything you need to grow the crop is in the soil, therefore you don't need to add anything, you might be stuck right here. Do you want to grow a crop based on medium potential? Or do you want to grow it on a high potential? So there is a movement in a lot of different groups that are tending to move away from applying nutrients, and people want to look at their farm and be holistic or to be self-sustaining on their farm. And it's a nice idea. And in theory, it really rings true. It kind of sounds good. But if you're cycling your organic material and you're staying in your same basic pattern of low calcium, you're achieving lower potential. You're in a lower potential environment.

And here's the thing: limestone is cheap. Okay? Now if you're selling milk, you're selling minerals off your farm. Hopefully you're retailing that. But if you can buy in bulk and sell in retail, that's a great place to be. But even if you're selling in bulk, if you can buy that calcium in bulk, it's cheap.

If you have a soft ball and you want to bounce it on the ground and you're playing tennis, okay, you need something hard to bounce that ball against. So it might be this, whether it's liquid fish or you put something out, you want it to work, humates, or lots of different things. It could be the fertilizer, and you want to get that working for you. You need to have that

reaction against something that gives it a return. And that something is calcium. So if you get your calcium built up, then you can put a little bit of fish or ammonium sulfate and you get a good response of energy because calcium is a growth energy element.

And a lot of these other ones are reproductive. And so you want to get that good reaction occurring.

[21:53]

Part 3: | **Balancing Elements – Reams' Theory Simplified** | Length: 9:32

Jon Frank: Keeping in the theme of calcium, I want to just kind of go back to one other thing that Doctor Reams presented. What he looked at is that every element has a frequency. And he basically divided elements into three categories. One category creates a response of reproduction or blooming, flowering and pod set. There's another group, which is growth energy, which is stalks, stems and leaf promotion. And there's a third group, where elements can flip-flop. And they can be in one form and cause growth, or they could be in another form and cause reproduction. So three groups: growth, reproduction and a combination of the two. But this is very important.

So let's start with the growth. He put in chlorides, sodium, nitrate nitrogen, potassium, and calcium. These are the elements for growth energy.

So let's just do the flip-floppers. Flip-flop is: oxygen, hydrogen, and nitrogen.

And then the reproductive. So that would be carbons and nitrogen: that's urea, ammonia, protein. And everything else, all the traces, sulfates, magnesium, phosphates, would be reproductive.

So, carbons are reproductive. And then all of the nitrogen in the non-nitrate form are reproductive.

Now imagine a teeter-totter and you want to create some balance. If you're raising your alfalfa, you want to be just slightly dominant in growth energy. And if you're raising tomatoes, which is a reproductive crop, you want to be slightly reproductive.

So a lot of the strategy of Reams' work was to create enough energy. So you create energy by pushing the reproductive against the growth side, or the growth side against the reproductive. Now, you can do some energy by putting growth versus growth and reproductive versus reproductive. But the best energy would be growth versus reproductive. One of the fertilizers that's well known is ammonium nitrate. Because if it's handled improperly it can be very reactive, right? So you have these explosions in history that we know about. What's actually happening, you have nitrate and you have ammonia. So you have a growth and a reproduction. And then they basically reacted suddenly and they released all their energy with a great big boom.

So a fertilizer is a package of energy.

So this is a basic strategy, but I really want to come to the growth side here. How much sodium and chlorides does your crop need on an acre basis? Let's just call it a few pounds. How much nitrates do we need on an acre? Call it tens of pounds, some tens of pounds, maybe 20, 30, 40, 50, somewhere in there. Tens of pounds.

Now, what do you see for potassium? How much do we need? Over 100, less than 1000, typically. So we need hundreds of pounds. Hundreds. And I think you can see the pattern. So what do we need for calcium? Thousands of pounds. Thousands. How much?

Audience Speaker: 3000.

Jon Frank: Yeah. Somewhere in there is a pretty good number. Some of the soils you get out in Pennsylvania if you can get 2000, you're doing pretty well to start with. It's a pretty good number. Thousands of pounds. Okay? So there's not many elements that are growth. Sodium and your chlorides, you need them, but you don't need much.

You need to have some nitrogen. But if you start over-applying nitrogen, it creates a lot of problems. And what we find is, production agriculture has used potassium pretty aggressively because it gives some results. But if you overdo potassium, it substitutes for calcium in the cell wall. And this is what we see in production agriculture, is an over-application. So if you take potassium that's bonded with a chloride – potassium chloride – that's a double growth energy fertilizer. And if you've got a fair bit of reproductive elements out in your field, it can get a response. But if you're not having this in ratio with the calcium correctly, then you're going to build weak, watery cells. So this is why we have to be very careful.

Organic folks have the same problem. They are using compost and compost and compost and compost. And what is compost? Compost is three things. It is a soil amendment. It is a soil amendment. Yes. It is a great supply of carbon.

Compost is an organic fertilizer. Is compost soil? No. It is an organic fertilizer. Is it burning to your crop? Not so much. Sort of, maybe, if you got a lot of high sodium, it could burn. So let's just say it's not so burning, but it is a fertilizer. So then in that environment, people will have a tendency to use a fair bit of it. So the same problem of too much potassium, say, that you could see in a cornfield because it's being applied with way too much potassium chloride or muriate, you can actually see the same thing happening in an organic garden. There's too much compost applied.

Now, compost has got something else. It's got everything and the kitchen sink with that potassium. So you've got a lot of other good things there with it. So here's my litmus test for potassium as compost. You look and

say: “Am I excessive in potassium right now?” If I’m way over, then compost, being a potassium fertilizer, should be avoided for that year. I have a rule: you have to earn the right to use compost. Now, I know that goes against what a lot of people would promote and say, but my perspective in saying that is, I want to go after the highest quality. And what I find is an excess of potassium in relation to calcium or in relation to phosphorus is a detriment to quality. So I’m not against compost or manure. I’m for it being properly applied.

Looking at what happens in the soil test when you apply compost. If you analyze compost, you will find it to contain between 1% and 2% potassium, maybe a little more. Somewhere in there. Okay, now there’s a strange phenomenon that happens when you put a ton down and you calculate out what 1% is. What’s 1% of 2,000lbs? It’s 20lbs. Okay. And if your potassium is 2%, it’s 40lbs. But if you put a ton on the land and you work it in and you watch it, in a year, you might start calculating based on your next soil test: “You know, that compost didn’t give me 20lbs. That gave me 80lbs.” I’ve seen that happen again and again and again. And can I explain it? Not exactly. But when compost is made, that potassium seems to be complexed, and it doesn’t really show up until you start putting it in the soil and looking at it, and all of a sudden you realize compost is a potent potassium supplier.

Is it bad? No, it’s an organic fertilizer. It’s good. And if you have high yield that you’re pulling off of your land, it’s going to be sucking that potassium and you’re going to need it. But, don’t put it on when you already have excess. That’s my suggestion when quality is the goal. Especially when you have forages, you really need to get the calcium up, start removing a lot of that potassium and then put the compost on a little bit later.

[31:25]

Part 4: Optimizing for Plant Performance Through Mineral Management | Length: 06:07

So I'm going to kind of wrap this up with some of the principles to bring it all together. There is a scripture verse that says, "To he who has more will be given, and to he who has less, even what he has, will be taken from him."

Now, this is a principle that works in agriculture, too. When you have more, you get more. And when you have less, you lose more than what you had before. Reams had a way of saying, if you will supply 20%, God will provide 80%. So this is going back again to the principle that if you have a healthy plant and it's an energy accumulator, then you're going to get more.

You could have a field and you've got all these plants and these leaves are out there. They're working for you. The question is, how much solar energy can you grab and convert into the crop you're selling? So a good indicator of how well you're doing is to take a check on the Brix of that leaf. What is a leaf? It brings components in. It uses energy to reformulate those components. It makes something. And it ships it out. So in this case, it's bringing in energy from the sunlight. It's bringing in carbon dioxide from the atmosphere.

Now, it has to have tools and to be well equipped. So the thing is, if you want to make money in farming or if you want to have high quality, that people come back and say, "Man, your muskmelons are the best I've ever eaten. I got to buy your muskmelons," then you want your leaves working right for you. You've got to get this working right. It all comes right down to how efficient are your leaves.

And that means that this leaf, when it needs copper to do a certain enzymatic reaction, it should have it. It shouldn't be short. When it needs something else, it's there. In other words, all the components of your manufacturing need to be present, and the minerals are very important. So take a Brix reading on your leaves. Say it's 10:00. It's been sunny for two days. And then you've got a good baseline right there. Take it, and then check as it goes. You keep checking where you at, and if your Brix is

up higher, that means you're grabbing more solar energy. You're converting it into carbohydrates, you're converting it into the protein, and you're converting it into the crop that that plant is producing.

The other thing is, is that it's kind of "as above, so below" when you're producing more carbohydrates, you are sending them down to the roots and you are now feeding your microbes more energy. So, provided you put some minerals out there, there's more digestion, there's a larger microbial population, and you're digesting more mineral. And the biology has got this bigger population that's turning over. So they live for a short time, they die, the minerals are being taken up. And that's what's endowing that leaf to be more efficient. So in all of this, you're the conductor, right? You're the one doing it. Are you creating a mineral deficiency here by not supplying the calcium? It's up to you.

If you're providing it correctly, the microbes can have all the building blocks they need to build their protoplasm. Now they just need the energy. So, that's kind of the summary of what I wanted to cover.

I only talked about calcium. I didn't talk about phosphorus and the quality it makes. Boron relates to calcium. It's really important. And what I notice with soil tests is that our standard for what we need in boron is actually kind of low. And most people aren't even hitting that low standard. And so the amount that I would like to see for boron is 4lbs an acre

The best illustration is if you're building a garage and you're putting up the wall and you got this bunch of studs in the wall, that's calcium: the load bearing studs are the calcium. But you still want to take those studs and attach them on both ends. So that's boron, attaching. And now you have boron holding the calcium in place so the calcium can do its job.

It really is important. From what I'm seeing, with the standard that I have for boron, I'm recommending boron in about 80 to 90% of the soils. But with trace minerals, first of all, they're a little expensive. But second of all,

I treat them carefully, incrementally. I don't prefer to just dump them on too much.

I didn't have the time to really delve into all the minerals. They're all important, and they all work together. But we have the knowledge. We have the resources. We have the systems in place in America to produce the highest quality food and the highest quality forages and crops. All we need is two things: We need the knowledge to do it. We have that. And we need the people actually just doing it. And I know it's a little bit expensive, and so I would always suggest if you want to prove this concept, start small in an area that you know you can afford, and just do it fully and see what it does. And I think what you'll find is you'll be expanding rapidly from there to larger areas, doing it with full nutrition supplied to the environment.

[37:32]

That was Jon Frank. You can hear more farm stories on the FarmsForTomorrow.org website. And we'd really appreciate you following us on Instagram, Facebook and Twitter. Thanks for listening, and spread the word!

*** END OF TRANSCRIPT ***