# Cutting Edge: In Search of New Crops For Wisconsin

## Episode 5: Malting Barley with Guests Dr. Pat Hayes, Campbell Morrissy, Margaret Halstead

## Recorded July 23, 2020

**SPEAKERS**
Jerry Clark, Dr. Pat Hayes, Carl Duley, Margaret Halstead, Campbell Morrissy, JASON FISCHBACH

**JASON FISCHBACH** 00:00
This is a podcast about new crops. You're gonna love it. Join us on The Cutting Edge, a podcast in search of new crops for Wisconsin.

**Dr. Pat Hayes** 00:10
How do, you how do you proceed? Where do you even get going? Well, the first thing that growers are gonna want to do is visit with a maltser find out what the maltser wants because the maltser is probably going to say I want variety X or Y.

**Jerry Clark** 00:25
I'd like to welcome you to The Cutting Edge, a podcast in search of new crops for Wisconsin. I'll be your co-host today. I'm Jerry Clark, with the University of Wisconsin Madison Extension in Chippewa County serving as an agricultural agent and joining me today is Carl Duley. in Buffalo County.

**Carl Duley** 01:01
Yes, thanks a lot Jerry. And we're going to be talking about barley and really looking at barley flavor with some of our guests from Oregon State today. And we want to just mention we took off our winter barley. This year our yields are tremendous compared to what we had some years and I think next week, we'll be looking at doing some harvest in probably Chippewa County have your spring barley. How's it look, Jerry?

**Jerry Clark** 01:26
Yeah, actually, the barley looks looks really good. We've had substantial rainfall. It's a I think we've had three, three inch rains throughout the summer, sporadically. So it's been a wet year. And if anything, these kernels hopefully are nice and plump, so it makes better good beer, better beer and but I think that's kind of what we hope to learn today is, you know, what, what does this barley stuff do for beer and how can we make it taste better? Because I do like beer. That's one thing I should and you know, Carl, My office is only a block from Leinenkugel Brewery. So

**Carl Duley** 01:58
Yeah, I understand that.

**Jerry Clark** 02:00
I can't help but drink beer in Chippewa County

**Carl Duley** 02:01
It's a good spot for you to be and I should mention that Jerry's, Jerry's plots on pretty much sand, blow sand almost, there's a little bit of good soil in there. And so the rains really necessary. We've been a little bit almost on the dry side since planting so which is perfect for us because we're in pretty heavy silt loam soil. But with with that, let's um, let's start out with Dr. Pat Hayes. Pat has been in the barley breeding development business for a long, long time. Hopefully today he'll mention sometime about his his movie career because I did send that out to a number of people the I can't remember the exact title. So I'll let Pat address that but and Pat brought a couple of his students along with us today too. So Pat if you'd introduce a little bit more about yourself and Campbell and Margaret also.

**Dr. Pat Hayes** 02:52
Well, first, Carl, thanks so much for hosting us today. Always great working with folks out in Wisconsin, and like to give a shout out to some other colleagues in Wisconsin, that would be Cynthia Henson and her crew at the cereal crops research unit in Madison. They just performed this invaluable service to us across the nation, which is analyzing the malting quality of the experimental barley that we develop. And also Lucia Gutierrez, who is a small grains breeder based in Madison, and she's a collaborator on all things barley as well. Like Carl mentioned, I've been working on barley for a while now. Thanks for not mentioning how long Carl I think it all started about domestication around 10,000 years ago. And so we've been plugging along since. We there have been some movies made along the way. Carl referred to that. This one is called and he referred to I believe is, "How Beer Saved the World". You know, last I'd seen the reviews on that. I think it was three thumbs down but at any rate, there's are some messages in there.

**Carl Duley** 04:00
Yeah, the CG on it isn't quite up to 2020 standards. I think. Other than that, though, the information is pretty good.

**Dr. Pat Hayes** 04:09
Yeah, you know, it's a reasonable premise. I think that if it hadn't been for beer, we would not have the world we know today. And if it wasn't tough for barley, there would be no beer. And you know, that sort of message about barley in beer has served to attract some great people over the years into barley world and the most recent citizens that we have our most recent immigrants would be Campbell Morrissy and Margaret Halstead. So, Campbell, do you mind sharing a few words about yourself and what brought you to this curious place?

**Campbell Morrissy** 04:44

Yeah, thanks, Pat. So prior to venturing over to barley world, I came from the brewing and distilling segment, then brewing into selling professionally for the last nine years. Got, got quickly out of the Political Science game after undergrad and discovered that brewing beer was a lot more fun and community respectful, I'd suppose you know, but through that really learned to appreciate the agricultural side and the tie to the raw materials, you know, unlike wine or cider where you have just this one primary unit we have two, we have you know, barley as well as hops. So just became very interested in what was going on in the United States to promote that and, you know, slowly but surely kind of got in touch with Pat and decided to come on over and learn more about the breeding and genetic side in order to produce barley of real interest to a kind of dynamic and exciting Barley World.

**Carl Duley** 05:48
And maybe before Margaret jumps in both Pat and Campbell you both mentioned Barley World, we should explain that Barley World is kind of the name of your your group out at Oregon State. If I have it correct.

**Jerry Clark**
It sounds like some kind of amusement park or something. I've got to go to this!

**Dr. Pat Hayes** 06:11
So Margaret came to us in very much on the, you know, related to, I think the flavor question. And she comes to us with a unique background when we first started visiting, I think that it's fair to say she was attracted by the flavor bit and then the question of terroir as well. Margaret.

**Margaret Halstead** 06:33
Yeah, so I'm not too far out of undergrad, I've always been interested in extension, querying extensions. So, and I have a background in crop science and soil science and agronomy, from undergrad also at OSU. And I've always been more interested in product side of crop production and what we actually do with the crops and how what we do with the crops impacts that final project or product. So I'm kind of coming from the opposite direction of Campbell from crop science, matriculating into how our agronomic practices impact the food product and that's what caught my attention since it's it's not necessarily a widely studied kind of subject. So that's how I found Pat's research. And I ended up talking to him and now suddenly here I am.

**Jerry Clark**
I was just curious with with barley, it again, maybe it's geared more for Margaret, but anybody but what's the purpose of barley into beer? Is it the color, the flavor, what drive and what does barley do for beer?

**Campbell Morrissy** 07:48
So I guess the short answer is everything. You know, beer is nothing without barley and it's the fermentable substrate. It provides the yeast nutrient in addition to the sugars, it provides color, it provides flavor. And you know, a lot of when we talk about barley flavor, typically we're thinking of like main reaction products and kind of those browning and caramelization flavors. But some of the stuff we're working on is kind of Is there like a flavor or nuance outside of that? And then how does the

different barley varieties actually contributed there? But really, you know, barley is the soul of beer. I mean, it wasn't until, you know, 1000 ad so almost 11,000 years into the history of brewing that hops became common. Okay, so hops aren't critical to making beer by any means. yeast is obviously critical to making beer but you know, traditional beer was just spontaneously fermented you didn't need to grow it You didn't need just source it showed up. So of the three non water ingredients, you know, barley really does everything we need to make beer.

**Jerry Clark** 08:57
Great. Thanks.

**Carl Duley** 09:00
Let's Let's scoot over to the to the whole flavor thing, then I think that was a good introduction to it. We, we've had beer for a long time United States pretty mass volume did the advent of craft brewing and the did that kind of point you towards studying flavor was that kind of a pivotal point, if you want to say on moving into flavors on barley,

**Dr. Pat Hayes** 09:21
Yeah, I'll  jump into that one and then kind of lead on into the project that Margaret alluded to, or she and Campbell are collaborating, because that's kind of the latest iteration of our flavor research. For sure, it's all about the craft brewing industry in terms of  contributions to flavor. And the Brewers Association was really the agency that kicked this off with significant funding. But But before that, there were a group of kind of innovative craft brewers and one of them is Wisconsin's own New Glarus and Dan Carey was one of a group of an innovative craft brewers who gave us some seed money a number of years ago to just to ask the question, does the barley variety contribute to beer flavor? And so now it seems kind of like an obvious question, but at the time there was some temerity in asking that question, because the accepted dogma was that either the barley is going to work for malting and brewing, or it's going to give bad flavors. And so the whole system was designed to for defect elimination, rather than for trying to accentuate the positives, so that they could launch this series of projects that we've carried on now for a number of years. And the two of those are now published in the Journal for the American Society of Brewing Chemists, which is everybody's daily read, I trust. And there's some just great info there though, where we've tried to systematically document what it is that the barleys are bringing to the table and so we do that in terms of the genetics, we do that in terms of sensory traits. And then we've incorporated a heavily mixed dimension into that. So all that's kind of led to the study of where we're at. Now, where we're looking at some of our own varieties, we have Thunder and Lightning, names that sort of resonate with climate change, and two new winter varieties Lightening is, in fact, facultative but we have thunder and lightning, and those are planted at very different locations throughout Oregon. And we have them here in the high rainfall area, the blended family, we've got them in Southern Oregon, Northern California in your irrigation and high desert area. And then we have some dry land in Pendleton, Oregon in the Far East. And then Campbell just got back yesterday with very exciting data from Condon, Oregon, which may want to look up on your map and showed that in fact, you can generate some really outstanding barley grain quality data from a very non traditional production area. Since Wisconsin is kind of a non traditional area for malt barley production, at least for the past hundred years, we've seen it before. You know, it may resonate that when you can get really

great quality from an area you might not have expected. Campbell you want to relate just a bit of your adventures out in Central Oregon?

**Campbell Morrissy** 12:28
Yeah, totally. And first of all, we should mention that Thunder and Lightning totally homage to Ron Dane great Wisconsin's running back, just throwing that one out there. Thus far we've we just got the malt back yesterday, kind of a whirlwind tour through through the state which is great. I just moved here so I got to get to really see everything and just really surprised with the quality the yields in particular were very, very good and the plump was much better than I expected and then the protein levels were very low. So we have the potential for a really high quality all malt Pilsner style malt. And we can talk further about those nuances about kind of why protein is important. And I feel like that's a big buzzword that a lot of growers use, maltsters will use, and brewers will use but I think not always do we understand that, what that role really plays and the implications thereof.

**Carl Duley** 13:24
Yeah, when you said really low proteins, how low were the proteins?

**Campbell Morrissy** 13:28
Uh, they were in the eights we did have one in the nines. Yeah, so I think it was Lightening, Tiki Barber, of course, that was 9% protein, but then Thunder, two samples I pulled of Thunder, we're low eights, and then our experimental variety was in the mid eights. So that's certainly quite low.

**Carl Duley** 13:48
Yeah, we struggle. We were pretty excited if we get below 12 in most of our soils in Wisconsin.

**Campbell Morrissy** 13:55
So Jerry, I'm just gonna partner you with distillers.

**Carl Duley** 13:58
Sure.

**Jerry Clark** 13:59
yeah, that's a question I think I have is, you know, with the with the quality part of this. And if I'm an average farmer who's grown corn and beans or alfalfa in Wisconsin forever, and I switch over to malt it's or to barley, which I could be familiar with, because it's, it's a small grain we grow oats and some of the rye and that kind of, and a few farmers do grow barley. But this is this is managed differently. This isn't just plant it, harvest it, and take it to a maltster you have you mentioned contracts and these kind of things, but maybe go through what those quality parameters kind of are in the industry. And then you know, what happens? How could my load of barley get rejected and that kind of thing?

**Dr. Pat Hayes** 14:43
When you're in the malting, barley game, you're doing something that's pretty unique in agriculture in the sense that you're raising this living thing. And so only in the seed industry, are you that concerned with the viability of your grain so seed growers are kind of a different breed in and of themselves

because In the in the barley malt game, you're creating this entity that is going to have to perform in the Malthouse, it's going to have to germinate perhaps up to a year later. And your harvest procedures are going to dictate the integrity of that grain. You can't skin it, you can't have broken grains, it's going to have to be stored properly in order to retain that viability and so you've got all these aspirations of making malting quality and if you don't, then sort the bottom kind of falls out of it and you're left with the...

**Carl Duley** 15:33
Cow feed...

**Dr. Pat Hayes** 15:34
Yeah, and feed is essential. I mean, it's 70% of the world's barley is used for feed barley is a wonderful feed but it has just lost you know that that market share and so that is dominated by by corn now, and Campbell, did you pick up any sense from from Mick or Sam about the feed dread if I were to call it that?

**Campbell Morrissy** 15:58
Yeah, and I kind of used that protein buzzword before I mean cause Pat's right, he hit the nail on the head I mean he just the the crew out in Condon they're their wheat farmers and so we talked a lot about how they're running their combines differently and you know really just trying to to make sure that they don't damage the seed as much because the one important thing that Pat alluded to is the skinning. It's like you know, husk integrity is so critical to the brewing and malting process which is one of the reasons barley is so uniquely suited for brewing. And the more you damage that then you start exposing the living layer around the seed, which damages enzymatic production. So you have a lot of these implications where he's saying if he were to send dirty wheat, you know, full of chaff and stuff to his broker, he would get that rejected. So it's a real mindset change just from the actual mechanical processing of it all. From the protein level, you know, maltsters will probably start thinking about rejecting anything in that 12% range. I joked about distillers earlier, there is some market now for slightly higher protein, variety, malt for distilling purposes, especially adjunct distilling, which distilling with multiple grains. You know, very traditional American standpoint. It's the opposite for all malt selling. But we're definitely seeing a movement towards lower protein for brewing, especially as adjunct lager production. You know, your big Miller, Coors, Budweiser, is losing a little bit of market share as craft brewing, all malt brewing is continuing to go up. So yeah, brutal maltsters will, just say, "Nope, too high protein" you know, full stop. And like that, you know, it's feed barley.

**Carl Duley** 17:46
Jerry, please go ahead.

**Jerry Clark** 17:47
Oh, so barley then works better than corn, rice, wheat, those kind of things as far as that integrity of the grain. Why don't we use these other grains? Why? Why is barley always associated Beer. Is it because of that enzymatic process? I'm assuming?

**Dr. Pat Hayes** 18:06

Yeah, I've heard it expressed is the barley is encapsulated yeast food. Nothing else has that. Campbell in your senses as a brewer and distiller you know, and the load of malt comes in how did you think of those little capsules?

**Campbell Morrissy** 18:28
Usually, as a, you know, it's kind of weird to see, you know, 50,000 pounds of barley coming in or malt at this point coming into your, your brewery at once,and to always kind of think of it very commodity oriented, whereas like hops come in the smaller package and open them up and you throw them around, you smell them and they're just so intense, you know, but the thing is, we don't we didn't do nearly as much tracking on our hop quality as we did with our malt quality. And you know, I was on the phone with our maltsters you know, fairly regularly just talking about seasonality and changes there. But typically from a processing standpoint, because we do have this massive processing angle we have to look at from a quality standpoint, but also our flavor standpoint. And, you know, to the point of using adjuncts or other grains for brewing, it's not that these grains don't contribute really interesting flavors. I mean, if it weren't for rice and corn, we wouldn't have, you know, our Budweisers, our Millers. Wheat is obviously very traditional in brewing hefeweizens. But becoming more and more common with hazy IPAs and those kind of things. Like I I'm a big proponent of adjunct use, but just there's no one of them that produces that same package that's going to get that's going to produce beer you can you could make an all wheat beer if you had the correct processing side type, but you couldn't make an all rice or all corn beer.

**Carl Duley** 19:53
So what part of the barley the little package that little seed brings the flavor Very unique flavors. Any, any conclusions or guesses on where the flavor comes from? Or the unique flavors come from? Pat, With the research?

**Dr. Pat Hayes** 20:10
Well, I would Yeah, I mean, there's, there's the barley seed itself. And Campbell's commented on that unique aleurone layer of cells that are so near the surface, and then you've got a lot of enzyme synthesis there, you've got, then below that, then you've got the endosperm. And that's a source of starches, and, and then other carbohydrates, and then you've got the embryo. And so then you've got various proteins and so forth, sequester there. So all of that counts, so that so the entire three dimensional structure of the grain is going to be involved. As plant breeders, we tend to think about the genes. I mean, that's what we're always looking at is DNA level variants. And we need to back off of that a little bit and think about the very humbling fact that if a gene is not expressed, where and when you expect you're not going to get the trait that you're looking at, or certain environments may trigger expression levels. And that could be a very important part of terroir, right? That a certain gene is going to be expressed at a different level in a different environment. And not only expression, but you go from expression, and then you've got proteins and proteins get modified, and the proteins lead to different metabolites. And those are parts of the metabolic pathway. So there's just this incredible complexity and network of everything that's happening in those barley kernels. So kind of fast forwarding to where barley flavor research is right now we're partnering with some colleagues at Colorado State University, Maria Munoz Amatriene is heading up this project where we are finally getting at the genes that are driving some of these flavor components. And so we're using a technique called quantitative trait locus

mapping, and what that does is allows us to kind of put some GPS coordinates on where genes are that are, that are driving sensory attributes of beer and they're driving production of specific metabolites. And that whole metabolomics research angle is also something that we're pursuing with colleagues at Colorado State University and Heuberger in Harmony, Bentonhouse.

**Carl Duley** 22:22
Oh, Jerry would be, bringing the tasting aspect to that. Which I remember I was out to Oregon State a quite a few years ago. And, and Dan was there from New Glarus and we tasted three different beers on a panel. That was I think it was really all with full pint or three different barleys. I don't even remember. I'm assuming you've come a ways from from that that time. They were all pretty similar. There was a little bit of differences you could tell. But that I think, was that one of your first tastings and where are you at from that point, now?

**Dr. Pat Hayes** 23:00
First, I've got to confess that I am not a member of our sensory panels. And so I'm kind of with Jerry, you know, I like a cold. I like it at the end of the day, and you don't want the off flavor. But so yeah, we in fact, we started backing up a little bit when we first started this flavor research was was driven in part by, by something that in hindsight was really naive. And we were driven a bit by kind of the farmers market tomato example, where, you know, you get down to the farmers market, you see this succulent tomato, you take it home, you slice into it, and you go, Wow, that is what the tomato should taste like, that tastes like my grandma's tomato. And then you go to the market, you buy something that just doesn't really approximate that. And so when we started down this flavor quest, we were kind of driven by the same thing and maybe it was like, hey, maybe there's heirloom barleys out there that are contributing these absolutely unique flavors. And I think that's still a very important question to address, but we quickly ran afoul of that if you will, because those heirloom barleys performed very poorly in the malting process. And so the malts are so out of spec in terms of various components that are key to the brewing industries, that they could be driving all kinds of really wacky flavor things, and no maltster would want to deal with these things. No brewery is going to want to deal with these things except for perhaps really, except a exceptional kind of niche beers. So you mentioned the full pint that was this kind of accidental variety that that came out of our program, and it was picked up and marketed very successfully by an Oregon craft maltster, Mecca Grade State Malt. And so they've been producing then malts and and marketing those, at least regionally if not nationally, very successfully. Picking up particular flavors out of the full pint and then And also you know accentuating the terroir that their Central Oregon location brings to those malts. We did a project with him called the next pint project where we tried to upgrade full pint and crossed it to other more contemporary varieties. And the results of that research are in review now with the Journal of American Society of Brewing Chemists as our beers that were made out of thunder and other available winter barley varieties some of which you probably had in your winter trial there in Wisconsin. So those would be Witmalt,  Flavio and, and so on so that our European colleagues have been very active and very productive in developing and malting barley. We grew those at that same location and content where Campbell just picked up the grain that was going to be 2018 crop and we pasted those using "we" loosely here. The experts sensory panels tasted those beers and identified subtle nuance differences between. And so Margaret mentioned nuance a little earlier on, I'd say that's kind of a hallmark of our, of our findings is that there are differences that sensory panels can pick up, we can start to quantify those differences in terms of

genes and metabolites. But at the end of the day, it's really going to be in the hands of the brewer and the consumer to say, are these differences worth it?

**Carl Duley** 26:29
What about marketing? You know, the the whole flavor profile issues relatively new.Do you think there'll be a be a or how long or where do you think the marketing for flavor and I'm producing a malt here and I think it has a pretty cool flavor in Wisconsin. Any premiums do you think that might be available because our farmers are always looking at where we can pull in an extra Dollar, we're, where might we be at at marketing with, with flavor and malts.

**Dr. Pat Hayes** 27:07
I'm gonna just kind of grab that ball and then pass it to Campbell in his experience following along on some some metaphors of barley names and so from here, but, you know, I'd say that that's the dream. I mean, you see the hop variety, you see the location where the hop was raised, that's on the label. So the barley dream is that we see the variety name on that on that label and we see where that barley was grown. Campbell, as a brewer, do you think, is there, would you, What's the marketing potential for that identity?

**Campbell Morrissy** 27:41
Oh, yeah. And just to add one more layer to that, you know, starting to get different data on our certificates of analysis. You know, typically, those CLA's come from a very processing standpoint, and you can never really take that away from flavor. You know, processing is going to impact flavor. positively and negatively as well as, you know, beer, such a visual beverage, you know, clarity, or lack thereof nowadays, carbonation head retention, etc. But getting another set of tools for the brewer to utilize in determining that flavor profile, you and I get hops, you know, I get the kind of critical processing side, but I also get oil content and percentage of oil content that are going to have direct flavor impacts into the beer. You know, we're not getting that yet on a malting standpoint, and just some casual conversations I've had with colleagues both in the brewing side of things and now in the breeding side of things is, you know, the dream would be getting a true amino acid profile, you know, so we knew exactly what you know, amino acids were present in that malt variety which could really could lead to, you know, different flavor products coming out of the Malthouse and then again from the brewhouse, so the more tools we can eventually get in our toolbox. There's a lot more incentive to start bringing those things in. If they How to use them is a is another, another conversation but, you know, the more the more knowledge we have. But, you know, to allude back to my buddy's distillery in Madison, you know, there's a real interest in commitment from their, you know, brand and their customer base to have Wisconsin grown grains in their spirits. So there's an incentive there just to bring in something that's local. To do that. It's going to be pretty challenging in Wisconsin, though, without a small scale maltster to process that, because we do have this huge intermediate step that we tend to forget about. And, you know, is it local, if it's, you know, Wisconsin growing grain that's shipped to Minnesota or Michigan to get malted, and then coming back to Wisconsin to get used, you know, where do you draw that line? And I mentioned contracts earlier, and if you know, that grower needs to contract that malt, or barley to be grown by somebody or barley to be malted, So, you know, you have to build those relationships and usually those are long term. So there's just so many pieces involved. But uh, you know, I do think we're moving that correct direction as Pat alluded to craft malt, the smaller scale

malt houses who have the ability to malt different varieties without committing to, you know, 2000 ton batches or something.

**Carl Duley** 30:19
I think you hit a real key there. And one of the things that we're, we've done some study on in Wisconsin we got a ways to go is we don't really have that that key or the any real small maltsters here that would be willing to take that on. We had a great relationship with one of our larger malters over in Minnesota, they were very supportive, but their minimum bat size is 180,000 pounds. We we met all their specs three years in a row with commercial farms here in Buffalo County. And then we had two really bad years where our down levels were too high, and farmers just can't take that. And so I think smaller volumes are key to make this work here in Wisconsin anyway, so that we don't have to do 200 acres in one farm to, to make that happen. So good key point. One other thing. And and Pat, you talked a little bit and as a breeder it's a it's maybe a little different breeding barleys because of some of the limitations on on using genetic engineering etc. But how long does it take to bring a new variety on and and and get it okayed for the, for the malting industry and the brewing industry?

**Dr. Pat Hayes** 31:35
Yeah, so excellent question with multiple answers. And so I'll try to keep this short.

**Carl Duley** 31:42
You expected this to be easy, huh, Pat?

**Dr. Pat Hayes** 31:45
So you can kind of use a rule of thumb of 10 to 12 years or something. And so there's all various tricks of the trade that we can use to try to speed things up. And so in our research group, we use a technique called double hop labeling. production. So we basically turn pollen grains into plants. And so that really reduces the time that the potential variety is kicking around in our breeding program. But there is there's no substitute for growing an experimental barley in as large a plot as possible over as many locations and years as possible. And there's just no substitute no genetic engineering, no mapping, no nothing is going to replace that. And we found in our in our brewing research and flavor research and so forth, is that size is everything and so brewers will have, rightfully a bit skeptical about nano brewing. But as a research project, we have to use that and so you mentioned a key partner in in Minnesota, and so a shout out to Rahr Malting because they stepped up early in the process and collaborated with us on doing what we called nano brews. So they were brewing a single bottle of barley from a single sample of malt. And then we did sensory on that that was our first paper that we published on the barley contributions to beer flavor, but you fast forward and we need barrels of beer, so that you can have extensive sensory panel assessment. And that the, in that you're approximating all the complexities of the brewing process, so so that that all takes time. The other bit though, is where there's a will, there's a way in so if you can get an industry champion, who wants to really pursue and promote a variety, then things can really get some traction. And so thanks to Great Western Malting, for example, out here in the Pacific Northwest, where they looked at our new variety Thunder and they said, We want to make this happen. And so they really grabbed that and then they took it and got it into commercial production demonstrated that it was producing the kinds of malts that they were interested in marketing, so it's it's got its place in the market now. We're looking at a potential project with the

proximity malt people. That's with a selection that we have that was approved by the American malting barley Association. It's a winter barley, but there just was no one who was ready to pick up yet another winter malting variety at that point. And so they needed to be into that last step of the testing, which is called plant scale. And that requires car loads of barley. So they're testing it with the proximity malts steps up and says, Hey, we want to try this in Delaware. And so if if proximity and Dave like the variety, then suddenly that could burst on the scene, and that could get us someplace. That particular cross was made. And that selection was started less than 10 years,

**Jerry Clark** 34:57
but I just like to go back to that processing of the malt a little bit. Is that so, you know, we talked about what it adds to the beer, what it does, but like Campbell said, there's a step in here, what is the malting process? I mean, we don't just grind up barley there and make what you know, we refer to it as feed. What some people might refer to grinding oats or something for cattle feed. But malting is actual a whole different proc- another process that is different. So could you explain that just a little bit?

**Dr. Pat Hayes** 35:29
Let's start in on it and then both throw it up to Margaret in Campbell, because they'll be spending a good part of the next several years in the OSU malthouse. Working through this process, so it's a process of control germination that is followed by killing and killing is essentially a like baking sort of operation. So what you're trying to do is, is control the germination of that barley and then halt that germination, by heat to then recover the Appropriate colors that you'd like, and to manage the levels of the enzymes because you want to, you know, stimulate enzyme production, but you don't want to denature the enzymes by the application, too much heat for many of the styles of malts. So, your your moistures in that grain are going to range say from 9% and they're going to get all the way up to almost 50% you're going to have temperatures that are going to range from ambience to cooler to then whatever temperature you're malts going to be killed at and that whole process is going to take like a week. And so you think of all the ways that there are to screw something up. It takes that many days and has that kind of fluctuation of airflow and temperature and moisture. So Margaret given all that what with what degree of potential  you know enthusiasm versus panic do you approach to malting?

**Margaret Halstead** 37:00
Well, I'm suspending my judgment till I try it. With all the variables, for sure. I mean, Pat, totally covered the process just while at is Campbell mentioned previously the maillard reactions which is the browning and caramelization, which is a big flavor contributor, the kilning which is like Pat said essentially baking the sprouted grains is a big way to control some of that flavor with the with the level of toastiness I didn't know that. So that's just one of the factors that we'll be controlling when we're malting. And I'm sure Campbell has a lot more to add about that.

**Dr. Pat Hayes** 37:48
Campbell cheers

**Campbell Morrissy** 37:51
Yeah, I mean, just continuing on that conversation of flavor, you know that killing step is just been so traditionally the the area where the research is focused on which flavor development and kind of

bringing the flavor development side into the Malthouse. And you're just tying back to what we were talking about our research, we're trying to pull that back to the breeding side of things. But even that is still fairly misunderstood or not misunderstood, just not a ton of understanding. And we're starting to see especially that craft maltsters, real experimentation on how things are kilned even on the light side, to produce kind of unique flavor profiles and trying to add different specialty malts. Those are kind of adjunct level usage. So So let me just bring that back. We as brewers talk about base malt, which is the majority of our beer, that's our enzymatic activity. That's the majority of our starch package, some flavor contributions, but then we use in lower percentages, specialty malts and those will provide those have color contributions and everything from you know, 10 degrees lava bond, which is kind of a very light orange to you know, for 100 degrees level bond, which is basically dark black. And we'll use those in about, you know, one to 50% of the beer to get our color and our flavor profile that we're looking for.

**Carl Duley** 39:12
And maybe this is a dangerous assumption, but I'm assuming the the flavor profile from barley going into malt, we're probably talking more about base malt correct? Because once you make like a muted malt out of it, you're, you're burning it up anyway, and what flavors are going to make it through that process? Is that a dangerous assumption that we're mainly talking about base? Or is that kind of where your focus is right now?

**Dr. Pat Hayes** 39:40
Every assumptions dangerous. But, yeah, you had to start somewhere. And so we started out with base malts. And so our research today has been on on beers that would be on the lighter side of the spectrum that are as malt forward as we can make them that are hopped so that you know they taste like a beer, but the hop is not overly assertive. And so that's one of the questions that is pending for Campbell's thesis research out here is that in addition to picking up grain and content, he's flown by Deschutes brewery in Bend and picked up the beers that Deschutes has brewed for us with some experimental barleys derived from crosses with Maris Otter so Maris Otter is this iconic British, you know, winter malting, barley and these this experiment we call the romp of otters because the plural like when you get a bunch of otters together it's called romp, so romp of otter beers

**Carl Duley** 40:40
Thank you for explaining that Pat. Anyways, their full disclosure here, make no assumptions about the wrong. So we, those malts were generated by our colleague Scott Fisk, who runs the Wishing Malthouse and they were intentionally lighter sorts of malts. But a lot of brewers will say that they want a little more color in Maris Otter, and that's where some of the unique Maris Otter flavors are coming from. And so one of the questions that we have out there that Campbell may or may not pursue as a project, or Well, let's sort of repeat this project, but with a little more higher color in the malt, and then ask the question, what that does for the beer flavor? Does that's chapter 20. Campbell, do you want to go there? Do you want to commit today to this one or not?

**Campbell Morrissy** 41:32
I think it's it's in a podcast in the state of Wisconsin. I think that's a legally binding agreement. Just saying and like, I think we keep coming back to you know, we're kind of dually researching, you know, direct flavor contributions that would just be inherent in the barley that survives the malting process, but

then we're also looking at those kind of indirect flavor contributions, you know, what different varieties are more suited for Different types of malt. You know, Carl mentioned Munich malt, which if those not familiar, Munich malt is a hybrid specialty base malt. You know, traditional Munich beers had a little bit of a darker, slightly darker color. You know, I don't mean like stout level, but just more towards that orange Amber. And they use a slightly higher kilned malt that does have enough enzymatic activity remaining to be a full conversion. So is there something, you know, inherent in the barley variety that could actually produce a more ideal Munich malt versus another variety that might just be better just standard basemalt or Pilsner malt.

**Jerry Clark** 42:38
So one of the, I mean, again, as a, as a farmer trying to, if I was to grow this as a new crop, kind of that that mid step, that malting process, that's where that contract has to come in, or at least the, the quality parameters, so I grow it, it gets tested for, I'm assuming Fusarium and all these kinds of things that could have a too high of a disease level within the kernel. And then if it passes that inspection, that variety then gets malted and sold to the market, or at least the farmer has fulfilled their contract at that point. Is that kind of how the marketing works?

**Dr. Pat Hayes** 43:20
Yeah. So if we get a lot of queries from from folks who, you know, are either producing other crops and then like beer and sort of saying, Hey, why don't I grow for the beer market? Or their granddad grew barley and so maybe this is something I want to do. And so we do have a publication out there, which Wisconsin growers might be interested in. It's real Oregon centric, but it's called growing malting Barley in Oregon Valley and, but we try to address those kind of bigger picture things, you know, how do you how do you proceed? Where do you even get going? Well, the first thing that growers going to want to do is visit with a maltster and Find out what the maltster wants because the maltsters probably going to say I want variety X or Y and so the farmer may have heard about variety z. And so then if they really want to do variety z, they're gonna have to convince that maltster to accept that. So there's that variety choice bit that's in there. That is we've mentioned already earlier, during this discussion. There's there are contract terms. And so that contract is going to specify the protein level and the skinned and broken and in your neck of the woods, the fusaria, and the headlight levels and so forth. And if that contract is not met, then you know what's the grower going to do? And so when I first visit with people about growing malting barley, my first question is well, what's your alternative market? Don't Don't count on the on the malt. I mean, think of that is the premium situation. What is your feed market? And pencil that out.

**Carl Duley** 44:54
Yeah, just for the listeners sake, a couple years ago, I didn't price it out recently. But the difference between malt graded feed grade was about $5.25 cents a bushel for malt grade barley and $1.85 for feed barley. So you need to be prepared for a little bit of that hit and one of the things are our commercial growers in Buffalo County in western Wisconsin have been pretty much all dairy farmers or beef farmers so they have their own outlet and it's not quite as much of it yet. And that's one of our challenges to bring our proteins down low enough because they also have manure they need to apply to fields in and so it's a little bit harder to control the proteins with animal manure application so there's it's kind of a double headed sword there you got it you gave your market but you also have the The

other aspect we got to deal with with proteins etc. We are approaching the end of our time I think we'd like to hold this to about an hour but let me throw it out there any other any other aspects? Pat,Margaret, or Campbell that we missed that we should get.

**Dr. Pat Hayes** 46:04
Just the Thank you. It's all over again. You know, the only kind of, I guess, concern that I have about this podcast is that we're not joining Jerry for that flight.

**Jerry Clark** 46:15
Next time here in Chippewa Falls, just I could give that tour. I've heard it so much.

**Dr. Pat Hayes** 46:20
Here we are, just zooming  in the morning and invest in better coffee cups.

**Jerry Clark** 46:24
So I gotto do this over happy hour next time.

**Dr. Pat Hayes** 46:27
Exactly. Yeah,

**Carl Duley** 46:29
That would be great. Well, I really appreciate Pat, Margaret Campbell for for joining us today. This has been this has been great, great information. We should mention that. Jerry, Jerry and I are doing a field day, the end of July on just the basics of growing malting barley in Wisconsin. So we didn't cover that today. That was one of the reasons because we'll, we'll talk about some of those challenges a little bit more and that will be available off some of our extension. Resources pages, webpages, etc. and but one other shout out I want to give out is to AMBA the American Malting Barley Association, also to Rahr Malt and to New Glarus. They've all helped fund some of the things that we've done in western Wisconsin, both in Chippewa county and Buffalo County to get us this far anyway what we know and what we don't know yet with the whole malting barley industry so thank you to them and a shout out.

**Dr. Pat Hayes** 47:30
 I would just follow a shout out there certainly AMBA and a good Wisconsinite Mike Davis, who heads up AMBA because that entity is it does so many things. They go through a very rigorous they've managed a very rigorous approval process for barley varieties, but they also spearhead the whole research investment in barley and so AMBA funding directly supports all the malt and barley breeding programs in the US the public program With research funding, and then they also spearhead the federal investment in research. And if it weren't for those funds, there would simply be no barley research in the United States. Right? No public sector, you'd have some very limited production, perhaps by private programs for their own in house use. So shout out to AMBA.

**Carl Duley** 48:21
Definitely, great people, Mike and Scott, that head up AMBA. (music)

**JASON FISCHBACH** 48:45
Brought to you by the University of Wisconsin Madison Division of Extension.