

## GROWING AND SAVING TRUE POTATO SEEDS

Growing from true seed. Most people don't know how to do it, or if they do do it, they mess up on one or more of the sequence. The main thing is, in the old days, especially 1981, they tried to promote a potato seed thing. Some seed companies had it. It was mostly F-2 Katahdin. People, especially nurseries, would sow the seed and try to sell the little six pack of plants. By the time they got a plant big enough, the plant was already dying down and producing tubers, and when they planted it out, it went ahead and died. It's a real important sequence: you don't want that plant too old when you set it out.

Sowing the seed. You should sow about six, seven, or eight weeks before setting the plants out in the ground, depending on how well they grow. You should probably experiment over a two-week period. If you put the potato plant out in May, I suggest starting somewhere in the middle of March. If you want to experiment, go toward the early part of March, towards latter part of March, or even the 1st of April but not later. For the seeds to come up it should be about 75-78 degrees. If you get up to 80, that's a little too hot. I barely

cover the seed. Normally I put them in trays, and I just poke my fingers down in the trays to make a little depression. I drop the seed in and just a bare amount of soil over the top — just cover it over and press it down. I water it up, and then I keep it warm. It doesn't matter if it's in light or in darkness. I prefer light because the soil dries out a little bit, and I think that's more of a natural way to keep damping-off avoided. If you put a wrap over the top, you're going to get mildew in the soil so it's very important that you use a disease-free soil. It could be a peat-like mix, a sphagnum peat moss, perlite, or vermiculite. I suggest anything organic. Just make sure it's as clean as possible and hasn't had anything growing in it so it doesn't have any pathogens started. Use anything fairly sterile. I used to bake the soil in the oven for two hours at 180-200 degrees, but that's not necessary. In fact, if you bake it then you have other molds that grow on it because everything else is dead. I like it to be alive. In my seeding mix, believe it or not, I purposely use a worm casting as part of the soil mix because it's a natural slow release feed, and it doesn't burn anything. The microbe activity of the earthworm castings is a natural way of growing seedlings. I use a little bit of dolomite lime to keep it somewhat balanced on the pH, otherwise, it has a low pH that interferes.

They should germinate in about five days. It will take anywhere from five days to three months for a seed to germinate. When the potato plant reseeds itself, the berries fallen, the plant means for those seeds to hibernate for several years in case the tubers of the mother are eaten or disrupted. When the potato produces the fruit, the vine can be totally killed by late blight, but the berry will still be laying around or hanging on the plant. As opposed to a tomato, potato berries will still ripen over a number of weeks after you pick them. Would the potato want those seedlings competing with the mother plant and the current tubers? No. The berries stay green so they can be carried further away over a longer period of time. They stay very green and very hard even in the presence of mud and wetness. Rodents will pick them up and carry them somewhere else and nibble on them a little bit, discovering the fruit is no good for them. Then another rodent will come along and take the fruit further. Usually you'll find berries where there's disturbed soil, away from the mother plant. Once the berry is

picked, I let it sit for a number of weeks, sometimes months. I currently have a whole room full of them at home waiting for me that I picked over two months ago, so I'll start extracting those soon.

I use a chemical trisodium phosphate to hot water treatment and clorox to prepare the seed. That primes the seed for germination better than anything else I've found. I usually just cut the berries open, put them in a blender, and whip them up. I float off the pulp in a colander, then I take the seed and put it in a strainer with a little sprinkle of trisodium phosphate, which looks like table salt. I put a plastic glove on and rub the trisodium phosphate around the seed. That breaks the gel down immediately. I rub it around until the gel starts dripping out like sugar water. You can see the sap and everything else come off. Potato seed has a tremendous amount of sugary sap of waxes and oil and all that around the gel of the seed, and you have to get rid of it because that complex is a seed inhibitor. If the seed dried with all that on it, it would prohibit the seed from germinating.

Once it's pretty clean, I rinse it off with hot water at 120 degrees fahrenheit, which helps activate it. I have my water heater set up so the water comes out at 120 degrees. Next I float it off in water until I've gotten rid of all the pulp. The seed sinks to the bottom. I put it in a mixture of one part Clorox and five parts water, and let that sit for a while. Once the Clorox lightens that seed a little bit — it might go from a yellow to almost a white depending on the variety of potato — you can rinse. It's important to pay attention to the original color. Another way of identifying your germ plants is by the color of the seed. Most people don't know this. Some seeds are naturally dark-colored. That means they have a tendency to be more colorful potatoes. Most white and red potatoes have a tan seed.

While the seed is soaking in the Clorox, I note the potato pedigree and other relevant information on some paper. I record the time I got the extraction done, how many seeds I extracted, when it was picked, the pedigree of the different parents, and whether it's an F1 or an F2. (F2 implies that it could be open-pollinated. It could be from hybrid, but I call

it F2 anyway.) I also examine and describe the potato berry. It can tell you what kind of flesh color you're going to have on your tuber. You can tell whether the potato will have red skin or a Désirée-type skin. Once you can identify and describe your berry and your potato seed, you can start making short cuts on what you're looking for. Note whether the berry is dappled, it's size, and whether it's pointed or round. The round berries are tetraploid. The Mayan series have a pointed end indicating that they're diploid. That shape I call the strawberry-type berry. I have the strawberry-type berry in all colors. I love them because I can breed them to be entirely purple including into the flesh. That's another earmark of the type of potato.

How do you get a tetraploid out of a diploid? I take a *tuberosa* mother, quite a few of them, and then I take as many kinds of diploid plants as I can and collect their pollen. Some plants are more apt to produce unreduced gametes in their pollen. Some produce a lot, others very little. It ranges from almost zero to as high as one or two percent of unreduced gametes. By crossing time after time, the pollen from the diploid to the tetraploid you'll get in those hybrids. It usually will set berries but often there's no seed in the berry. Occasionally you'll find a berry that's nice and plump, and you'll cut it open and find two or three seeds in it. That's all you need to get the tetraploid. When you put an unreduced gamete with a tetraploid, you've got a tetraploid, and it stays tetraploid from there on out. I'm doing this over and over again to get uniqueness of the diploid of all kinds of different crosses into the tetraploid. The more crossing I do, the more chances I have to get the unreduced gamete. Because of diploid being traditionally outbreeders, when you have a berry from a diploid plant it's almost invariable that it will not be self-pollinized seed because it wants to be outcrossed. It has incompatible pollen-fruit characteristics so it has to have a sibling or a cousin or some other diploid to cross to it. I'm using this also to get the outcrossing potential to transfer to tetraploid so my tetraploid will produce incompatible pollen. Doing this I can develop a line that is very free blooming and produces lots of berries but won't produce their own seed. Therefore, I can plant those next to another tetraploid and get all the hybrids I want between those two at a very low cost.

This is another technique for providing food for the future—collecting and breeding, collecting and breeding, then putting the unreduced gamete in the tetraploid, selecting those that have incompatible pollen, and using those to produce the hybrids. I can get all kinds of hybrid seeds to people in developing countries at a very low cost. They can grow those hybrids out. Many of those plants will also have incompatible pollen so they can save the seeds from those hybrids and get a lot of hybrids once again and grow it again and again and again. I'm trying to get developing countries where they have very low financial capital but they have some ground and they have some labor available to do this. They can grow a lot of seedlings and then transplant them and get all the potatoes they need, and then just flesh them out every year from true seed to seedlings to tubers, and so on.

You have to get rid of all the residue of the Clorox using hot water, at 120 degrees again. Once it's well rinsed, tap the sieve on a towel, dump the seeds on a clean paper, and let them dry. I don't spread the seed out too much. I just let it dry in a lump like a pancake batter and then I just break it up later on. I dry it to whatever the humidity is in the room. The seed, if you preserve it in a heat seal, or maybe even a shrink wrap, and then put it in a cold storage or a freezer if you have that kind of access, your seeds could be good for 50 years.

Once the seed is sown and is coming up, give it as much light as you can. In fact, put it out in the direct sunlight as fast as you can, if you have a nice day, even for only a couple hours. The reason is, if you don't have that, the potato seedling will grow very, very thinly and collapse and fall over. Any time you've ever grown tomatoes and you try to get an earlier start and you grow those tomatoes inside, what do they do? They grow so tall your cotyledons are up high, and you don't want that. The reason for potatoes that you don't want them so tall is that they're very tiny, very thin, and apt to break or collapse, and you can't transplant them. The sunlight forces the plant to be very stocky, very green, and very thick stemmed, and the sunlight gives it the natural toxins. You can't get enough toxins in that potato plant under glass. They try to do it. You can't do it, I'm trying to tell them. You can't get enough sunlight in a greenhouse with glass. You have to have the ultraviolet rays

on it. Potatoes grew in a very sunny climate, in a very intense light. Thin air and the light intensity comes down heavy. The number one reason people don't have success with potatoes is that they didn't give it the high, light intensity, direct sunlight on it because later on if you don't give it the light then you put it out in the light you get sun scald on the plant—withered leaves that are yellow and white, papery. By giving it that extra intensity you get the thicker stem and the cotyledons that pick up the nutrients better, because that's the only thing you got on there to start with—cotyledons. The cotyledons have to generate energy. A few hours a day of sunlight a day really helps. To protect it, put it down in a box. It gets sunlight, but the wind's not blowing it. It's very important that the wind isn't blowing over it.

You're getting it warm to start with, and then you don't want it quite so warm to grow the plant. If you keep it really warm at like 85 degrees it will stretch, so you want to keep the weather a little bit cool. Once it starts growing, you can take it back indoors. That's when you want it to start stretching—once you have the first true leaves on it. Don't plant a single seed in a little container or it's not going to stretch. How are you going to transplant it if it only has two or three leaves on it and it's not very tall? How are you going to bury the leaves? On the little seedlings you have to bury the leaves because that's where the roots and the stolon come out. Put several seeds in a cube, and they'll compete with each other. In fact, put five or six seeds together. The one that germinates fastest causes the rest to germinate. By sprouting, one causes a brother-sister competition. Then, because they're all trying to grow in that little cluster and grow taller than the other, you're favoring the strongest of those seedlings—either a little more hybrid vigor or less inbreeding depression or whatever is happening. You're encouraging the stronger plant, and you're using that for your benefit.

Get them to where they are about an inch and a half or two inches high. That's when you want to transplant them. You want to bury them so they're just barely sticking out of the ground with one or two leaves. The rest of the leaves are buried. You don't have to pull the leaves off. Take them out of that cube where you had them before and put them in a

new cube as a single plant buried down. Let that grow up a little bit more. By then, it is warm enough to go outside. You bury them again at least another two inches in the ground in a trough. If it's really raining, it might get flooded, so be careful. Make sure to have a little drainage. I usually plant it on a little bit of a slope so it's not just sitting in the water. Once it's at the bottom of the trough, it's protected from the wind. It also traps the heat there. I like to put them going from south to north. By that time in May going onto June, going from south to north I'm actually getting the morning light when it's really important. It's so important on a potato plant because I'm trying to get that rapid growth, and I'm also trying to get the potatoes adapted to long days. By having it where it gets that morning light really soon, I'm pre-adapting the plant to do well under the long days. The sooner they get that light, the more they're going to be triggered to have them reacting well.

They're growing, and as soon as they grow a little bit more, give them some soil. You don't want that seedling blowing in the wind. They have a really tiny stem on them. You do that with the soil, and it helps them be supported. By that time, they're getting nutrients. They're rooting out. You don't want them to branch out at all to start with. If you have them branching out, you're not going to get the potato you want. You want a single stem as long as possible. If you sowed a seed in a pot, one seed by itself, and didn't do anything with it, it's going to branch out. You have all these branches, but no place to put all the potatoes and the few potatoes it has are going to be right on the surface, and they're going to be like little, gnarly apples. You have them covered up above the second transplant, and do this two or three more times after that so hopefully your original roots are as much as eight inches below the surface. A major advantage of covering up the plants with soil is avoiding weed pressure. Most people just let them go, and weeds grow, and they don't want to weed them. You also want to get those potatoes deep enough so they're not sun-greening. You can't taste the flavor of potatoes with sun-greening, because they're bitter. You can just get your hoe in there and pull the soil up over the plant. You don't have to worry about covering up the leaves on a potato. Too many people don't get it in far enough, and they put it on a level platform, and it just doesn't know what to do if it's growing

on a flat. Potatoes like it where it's mounded up. The potatoes will put out small tubers at first and then another batch and another batch. When you're doing your transplanting like this, you're trying to mimic real life and get a full yield potential.

The secret on potatoes is understanding what its yield potential is the first seedling year. The problem with most breeders is they put the seedling in the greenhouse. Usually they sow the seed in August, they transplant in a little pot, and they grow them out just enough and kill the plant. They just barely put out a little tuber in a pot. They take those tubers, bulk it, then put it out in the field like that. But I think it's more important to understand the first year seedling process in the ground, treating like it's an adult plant and seeing if you can't get it to show you what it's really made of, because a seedling year is different from a tuber year, and the breeders are just doing a tuber year, and they're not evaluating every seedling year. That probably wouldn't mean anything to a lot of people, but there's something about the seedling year. It's so magical to select at that time. Most people aren't doing it right—the amount of light, the transplanting, the hilling out, the fertility, the watering. Once you've got that out, you've got to let nature take its course. I put them out about the same time as tomato plants or a tad earlier. I don't like it to do it earlier because of danger of frost. They can tolerate a little bit of frost, but the plants just sit there. I like the 21st of May.

I put my seedlings from about six inches to somewhere about ten inches apart—no more than 12 inches apart on the ground. It's good to have them close together so they don't get too many weeds next to them. It's important to make sure the varmints stay away from the plants, too. Once you fertilize that ground, you don't have to refertilize. If you're a stickler for that, and you want to put a top dressing on it, that's fine. I've found that it does help if you have comfrey. Take the comfrey leaves and put them on the ground around the plant just before it starts laying over. If you've got comfrey, use it. The potatoes love it.

Because potatoes need calcium to heal themselves and to keep. If you want to keep potatoes over, you have to have plenty of calcium in the ground. Some people are afraid of calcium

causing scabs, especially if it's dry and the pH is too high, but without the calcium, and quite a bit of available calcium, you're going to have the potato develop black spots, and it won't store well, and you'll have more of an increase of hollow parts. Calcium is so important. It's almost like tomatoes and that blossom-end rot. You have to have that magnesium-calcium. I use lime or dolomite lime. It's been proven a good number of times that lime was one of the critical points of producing good-quality potatoes, especially for storage for months and so on in cold storage. Most growers don't know how to prevent black spots well enough, but you can down near almost flood the row with calcium—powdered limestone. It's critical. I don't think phosphorus is so hard to come by. Compost is good because the natural organisms in there help. I've been trying to use a lot of mycorrhizals to put in the soil. In terms of nutrients, it's basically a 1:1 ratio for the fertility. You don't want too much nitrogen but you do want lots of phosphorus to get a good rooting. You want the potatoes to bloom. I like to breed potatoes, encouraging them to bloom because that's the way I want potatoes to grow. I'm trying to encourage my seedlings to accommodate my needs. I'm trying to get the potato to evolve with the way I want to do my work. I'm collecting my varieties that work for my blooming potential each year, so therefore, I'm selecting the ones that adapt to my needs.

Harvesting. There are going to be different maturities. The main thing is you have at least 90-110 days from transplanting, probably in some cases maybe a little more than that. I like to dig them and then lay them out on the ground and let them dry out for a few hours before I put them away. More than two hours out in the sunlight, they develop some greening so you don't want them out in the sunlight too long. I prefer to harvest potatoes when there's a little bit of wind so it can dry the potatoes off. If it's raining, it's probably not a good day to dig potatoes because you pay for it. You have to have a way for them to dry off. You have to be able to observe them almost everyday for a while because you want to get rid of the ones that are susceptible to soft-rot. If you have late blight, you have to look for late blight on the tubers. I try to individually harvest in a separate bag each of my varieties. Sometimes, I'll save a single tuber from each hill. Then just regular potato storage and planting, with cutting the tubers up for planting.