



# Soil: A living, breathing ecosystem

By Jen Aron

It's challenging to properly care for something we cannot see. One of the most complex ecosystems on earth lives beneath our feet and is mostly invisible to the naked eye. There are billions (perhaps trillions) of organisms in a small handful of healthy soil, with millions of different species.

Less than 10 percent of these organisms have been identified, and only about 1 percent are culturable — meaning the rest are nearly impossible to study in a lab because they only live in complex community with each other in the soil.

Many publications tout the benefits of systems such as Regenerative Agriculture, No-Till, and Korean Natural Farming. These approaches employ methods such as reduced tillage, cover cropping, microbial inoculants, composting, and the like as ways to improve soil health.

While these are all important solutions, it's important to understand the role of soil microorganisms, the driving forces behind these techniques. Understanding a little about soil biology helps farmers take a peek into the mysteries that abound in the soil and hopefully can help shift perspectives on soil management practices.

## Unlearning conventional farming wisdom

One of the challenges in studying soil today is confronting the reality that many of the concepts soil science is based upon are no longer accurate. Advances in technology, largely through microscopy, have allowed scientists to see firsthand the organisms that are responsible for almost all terrestrial life on our planet.

Soil microbiologists estimate that roughly 95 percent of the soil functions we rely on are biologically driven. In other words, it's the biology in the soil that is fueling the



**Left:** It's amazing how much pressure can be applied to a single soil aggregate. Good soil aggregation helps prevent compaction and is a strong indicator of good soil health. **Right:** Aggregated soil at the author's Blue Raven Farm. It took several years for their soil to look like small pebbles. These aggregates are home to billions of microbes.

chemistry, not the other way around, as previously believed.

An example of this outdated thinking is our continued dependence on conventional soil tests developed in the 1960s. The soil tests that most growers rely on are rooted in chemistry, rather than biology. Dr. Christine Jones (PhD, Soil Biochemistry) notes: "A soil test will only tell



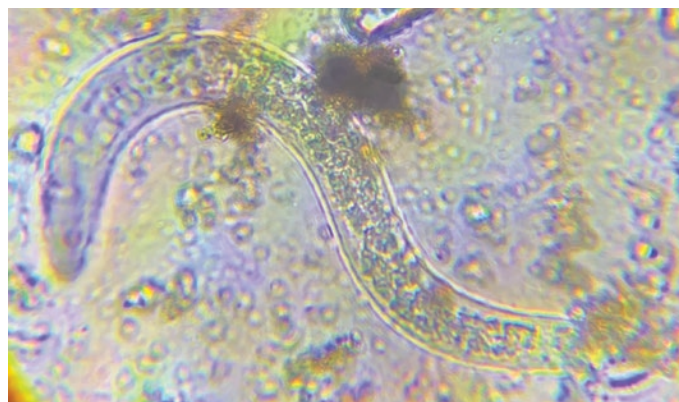
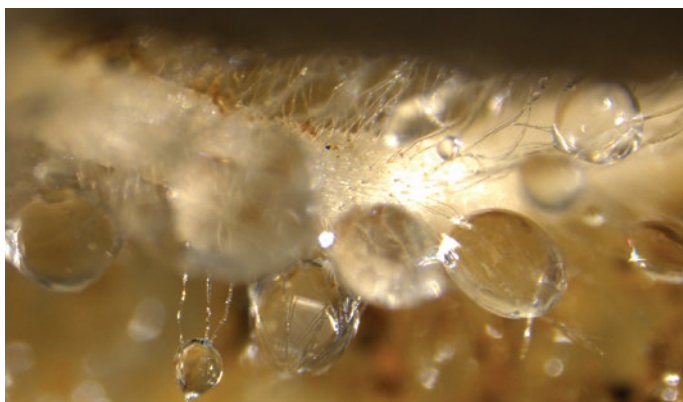
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**Left:** In this photo taken with a microscope, root exudates can be seen coming out of a living plant root. Root Exudates are a key element to plant-microbe communication. Plant roots excrete a diversity of unique compounds that attract specific microbial species to their root systems. Photo by Phill Lee of Rengenerate Earth. **Right:** Soil predators like nematodes prey on bacteria and fungi, resulting in the release of nutrients in a plant available form. This nematode is seen using 400x total magnification. All photos courtesy of the author except where noted otherwise.

you what is available to plants by passive uptake. The other 97 percent of minerals — made available by microbes — will not show up on a standard test.”

Submitting a soil sample that accounts for the biology, such as the Haney Test for Soil Health, in addition to your traditional soil test can help you gain a more complete understanding of how biology in your soil plays a part in your plants’ nutrient uptake. With good biology, fertilizer rates can be greatly reduced (and in some cases eliminated).

Last spring, I submitted soil samples to be evaluated utilizing both the Haney Test and the standard chemical analysis. We have been experimenting with reduced fertilizer application rates at Blue Raven Farm, and it was reassuring to see that the Haney recommendations were much more in line with what I was applying versus the recommendations from the standard test results.

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### Soil aggregates and their role in soil structure

Simply put, aggregates are like small, sturdy houses for microorganisms. Soil particles are formed into microaggregates and macroaggregates, which give your soil structure. Microaggregates are formed when bacteria adhere to soil particles and organic matter. Macroaggregates are formed when fungi glue microaggregates together using glomalin, a sticky protein substance only they can create. Aggregates are an important indicator of soil health. They help protect microbes, hold organic matter (carbon) in the soil, increase water availability for plants, improve drainage, and decrease soil compaction.

Soils with good aggregation (especially macroaggregates) resist erosion from tillage, water and wind. A well-structured soil with good aggregation has many small soil crumbs resembling small, brown peas. A soil that has

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been over tilled resembles a powdered sugar texture, with very little aggregation of the soil particles.

### Communication between plants and microbes

Soil is a living, breathing ecosystem that would not exist without microbes. Plants convert sunlight and CO<sub>2</sub> into energy in the form of proteins and carbohydrates via photosynthesis. However, plants cannot live on these compounds alone, they need many more nutrients to thrive. While the soil theoretically contains everything plants need, most of these compounds are not present in a form the plants can use. This is where the biology in the soil comes into play.

Bacteria and fungi pull nutrients out of the organic matter, sand, silt, clay and rock materials in the soil matrix. In order for plants to get these nutrients to their root systems, plants and microbes have evolved over millions of years, working out a mutually beneficial communication system that enables them to share resources with each other.

Plants send a percentage of the carbohydrates and proteins into their root systems, where they are released as exudates. By doing so, the plants are essentially setting out a buffet table, and these carbon-rich exudates attract bacteria and fungi to the party. This attracts an abundance of microbial life to the plant roots, which happily feast on the buffet and begin to reproduce.

This microbial rich area around the root system is called the rhizosphere. The exchange of nutrients between microbe and plant is not complete without the help of soil's microbial predators. Predators, such as amoebas, nema-



Here's a gorgeous web of mycelium or fungal "roots" running through the soil. Fungi play many key roles in plant health, including nutrient cycling, disease protection, organic matter breakdown, and carbon sequestering.

todes and microarthropods are attracted to the abundance of their favorite food, the bacteria and fungi. The microbial predators consume the nutrient dense bacteria and fungi and excrete excess nutrients in a solubilized form which the plants can readily absorb.

Scientists have recently discovered that plants have the ability to create unique combinations of exudates that are tailored for the specific microbial community they need at the precise time they need it. Biologists speculate there could be millions of combinations of carbon exudates, which are the plant's way of communicating what it needs to be healthy and resilient against pathogens and environmental stresses.

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### The importance of diversity: quorum sensing

The diversity of plants on our farms is directly correlated with the diversity of microbial species in our soils. Growers can encourage more diversity in their soils by growing different plant families in close proximity to each other to encourage root mingling. Plants function best with a diversity of microbes surrounding their root systems, which provide benefits such as nutrient availability, enhanced yield, plant vigor, and protection from disease and environmental stresses, such as cold or drought.

In the last decade, biologists have discovered quorum sensing in soil microbial communities, unlocking a whole new world of understanding how microbes communicate with each other and their host plants. Simply stated, the concept of quorum sensing is that there is a minimum number of microbes needed to make a collective decision.

When a quorum is reached, microbes can turn on or off specific genes in order to influence functions in each other or in their host. Many microorganisms (bacteria, fungi and viruses) use quorum sensing to communicate, and recent studies show their communication is not limited to within their species. Interspecies communication is in constant flux to ensure the entire community within the soil's ecosystem is functioning efficiently.

### Fungi: a missing link in agricultural soils

Like most soil microorganisms, biologists are only scratching the surface in their understanding of the mysterious world of fungi. There are at least 70,000 species of fungi in our soils, which thrive in undisturbed, aerobic (requiring oxygen) conditions. Fungi play many vital roles



Root mingling of different crop families interplanted within the bed helps diversify microbial species in the soil.

in the soil such as breaking down organic matter, pulling nutrients out of soil particles, and creating aggregates that are essential for soil structure.

Fungi also help regulate pests and diseases, mitigate environmental stress, and improve plant growth by forming synergistic relationships with plant roots. It's impossible to study healthy soil ecosystems without seeing the incredible benefits fungi have on our crops' health.

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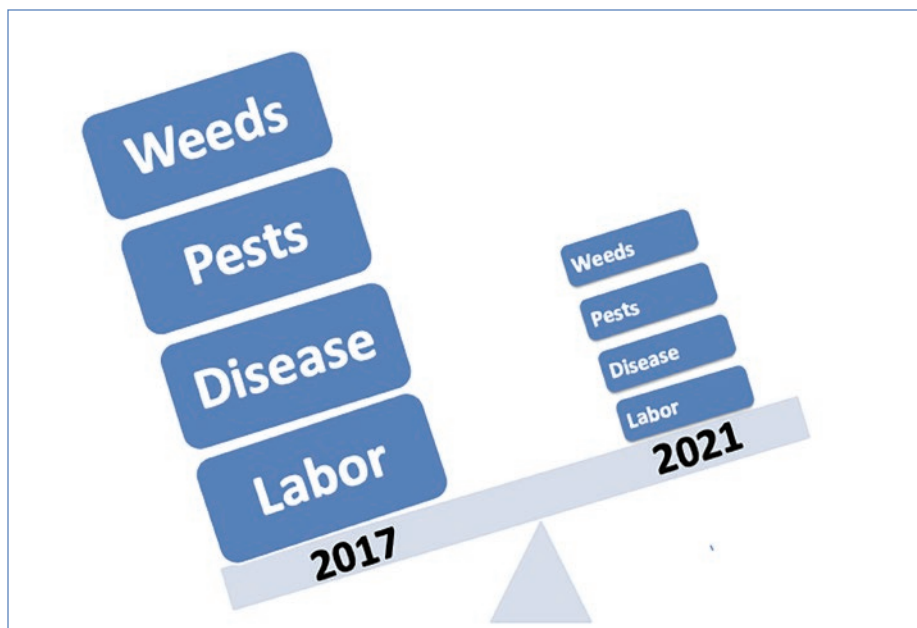
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### Fungal superstars: mycorrhizae and trichoderma

Mycorrhiza is a Greek word meaning “fungus root.” Many growers may think of mycorrhiza as a specific fungal species, but technically mycorrhiza refers to the relationship some fungi share with plant roots. About 85 to 90 percent of all plants form mycorrhizal relationships. Brassicaceae and Amaranthaceae are two notable crop families that do not.

Fungi that form these relationships infiltrate the root tip, where the fungi will benefit from nutrients provided by the plant host. As a result, the fungus grows, expanding its hyphae (microscopic thread like roots) into the soil matrix where it will obtain water and nutrients for the host plant.

The relationship is beneficial for both organisms. The fungus receives nutrients from the plant roots, and the hyphae on the plant’s root system stretch out well beyond the root system, accessing water and nutrients for the plant. It should be noted that frequent tillage decreases mycorrhizal associations, and fungicides are toxic to mycorrhizae fungi. High levels of nitrogen or phosphorus fertilizer also have been shown to reduce mycorrhizal inoculation of roots.

There are many groups of fungi that protect plants against disease-causing organisms and environmental stresses. One in particular is *Trichoderma* (which is not mycorrhizal). This genus includes several beneficial species that have the ability to colonize root systems and influence plants to produce disease-controlling properties.

These multifunctional fungi can also increase photosynthesis, resistance to cold and drought, root growth and plant yields. It’s worth noting that *Trichoderma* and mycorrhizal fungi may be antagonistic with each other in some cir-



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cumstances and with certain strains. In short, it's complicated. There are studies showing both positive as well as negative effects when these two fungi are paired together.

### **Humans, plants, animals are connected through soil**

Without soil, life as we know it would not exist. Plant life and all who consume it could not survive without microbial life. Countless studies confirm that the abundance and diversity of microbes in the soil results in plants that are healthier and more resilient. "By looking after the microbes in the soil we can increase the availability of a huge variety of minerals and trace elements — most of which are not in fertilizers," Dr. Jones said.

Thus, it's not a stretch to hypothesize that this will also benefit the animals and humans who consume these healthier plants. We are also learning that human and soil microbiomes are closely connected to each other. In fact, humans share many of the same microbes as are found in soil.

When we are in close relationship with healthy, microbially rich soil, we get the benefit of sharing the soil's microbiome through eating fruits and veggies, having direct contact with soil, and inhaling soil microbes in the air we breathe. By increasing the diversity of our gut microbiome, studies are beginning to show that we can increase our resilience to stress and disease.

It's disheartening that humans are suffering from more chronic disease than ever. Multiple studies show that the nutritional content of our food has declined over the past 50 to 70 years. As a result, we are not getting the same nutrients that our grandparents did, and modern farming practices are largely to blame.

The Rodale Institute is doing an incredible trial to show the variability in nutrient density between organic and conventionally grown crops. The Vegetable Systems Trial takes place in a field that had been farmed organically for 20 years and was divided into quadrants for the purpose of the trial.

The conventionally grown quadrants utilize farm techniques that include the use of herbicides or deep tillage. The organically grown quadrants utilize minimal tillage as well as no-till techniques. Within just a few years of production, the data Rodale has gleaned thus far is profound. Protein content, vitamin B6, and vitamin C levels in corn all proved to be substantially higher in the organically managed systems.

The trial is still in its infancy and some of the data Rodale is hoping to collect in the future will include comparisons of microbial diversity and its subsequent nutritional density. I am excited to have data that is based on a long-term farm trial. This will likely confirm what the early trials are already demonstrating, that soil health is directly connected with our own well-being.

### **Getting good biology into the soil**

You don't need a microscope to see the effects of unhealthy soil. If weeds, pests and diseases are affecting your crops negatively, this is a clear indication that something is not quite right with your soil biology. Rather than turning to band-aid solutions such as tillage and increased use of fertilizers, pesticides and herbicides, we need to step back and consider what is really out of balance. As our understanding of soil increases, we can rethink our soil management practices, favoring long-term health over short-

sighted solutions.

There are many opinions about the best way to repair soil biology. How farmers repair and maintain their soil is unique to their scale, climate, crops, soil condition, and so on. There isn't a one-size-fits-all approach to soil repair, and there is still a lot of research and infinite farm trials that need to be done in order to help farmers find solutions that fit their unique set of circumstances.

That said, biologists from around the world agree on a few points. First, disturb the soil as little as possible. Second, maximize photosynthesis with a diversity of plants growing at all times. Mounting evidence is pointing to the importance of multi-species cover crops to help stimulate a diversity of microbes in the soil. Finally, and perhaps most importantly, eliminating chemical fertilizers, herbicides, pesticides and fungicides plays a key role in increasing and maintaining soil diversity.

I have been researching and trying to learn more about biological inoculants (such as compost extracts, mycorrhizae, Trichoderma, and other biologically rich soil amendments). Many biologists suggest that inoculating at the time of seeding may help plants form relationships with beneficial microbes early in their development. It's also a great way to inoculate your entire field at the time of transplanting.

While studies show varying results depending on soil, climate, moisture level, etc., I am excited to begin a field study here in Oregon. For 2022, I am planning to incorporate a few different inoculants such as Trichoderma and a compost extract to my seeding medium to see if seedlings in spring will better acclimate and have increased resilience to our cold, wet weather.

### **Want to stay current about the amazing world of soil?**

If this article left you with more questions than when you started reading, I have done my job well. If you are yearning to learn more, one of my favorite resources is the podcast "In Search of Soil." Some of my favorite microbiologists and researchers are: Dr. Christine Jones (quorum sensing), Dr. Gary Harman (Trichoderma), James Hoorman, Dr. Elaine Ingham (one of the pioneers in soil microbiology), Peter McCoy (mycology), Rick Haney (Haney Soil Test), and Dr. David Johnson (fungal-dominated compost).

YouTube is an incredible resource for watching soil health conferences from around the world. It's a great way to hear from lots of biologists whose research is current. There are so many soil biologists and researchers doing incredible work. I have deep gratitude for what they are doing.

Stay tuned for part 2: Getting good soil biology back into the soil with compost, multi-species cover crops, and inoculants.

*Jen Aron has been a farmer and educator for the past 12 years and currently lives and farms at Blue Raven Farm in Corbett, Oregon. Jen is passionate about soil health and offers classes, consulting, and full-day workshops. You can find her at [blueravenfarm.org](http://blueravenfarm.org) and on Instagram @blue\_raven\_farm.*



# Trap boxes for the scourge of winter growing- voles

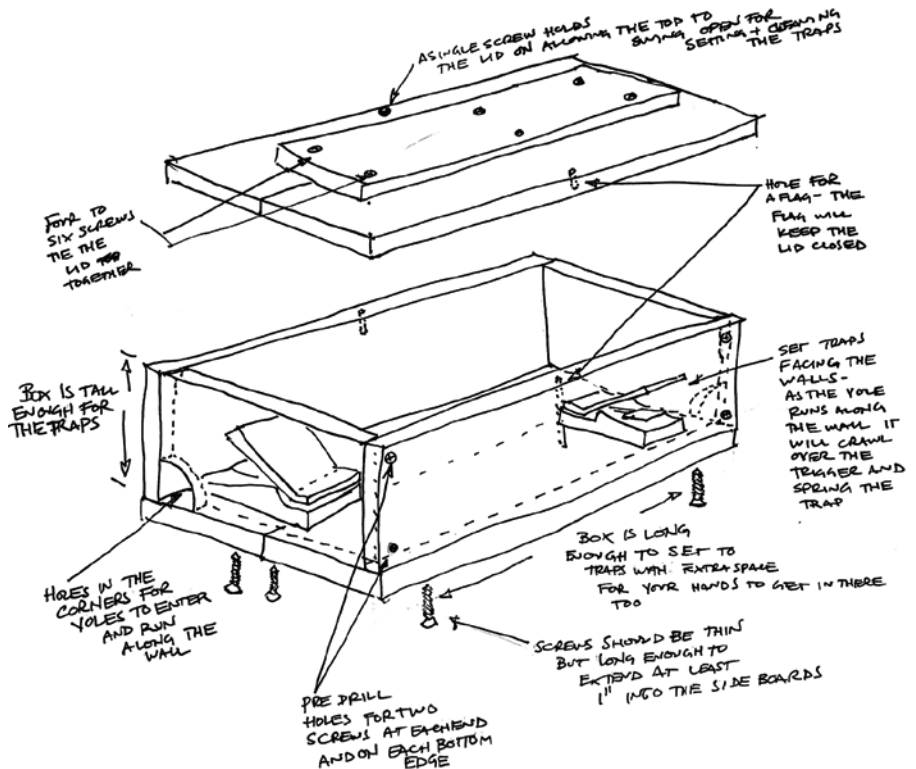
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By Josh Volk

I've seen a few posts recently showing vole damage and one asking for suggestions on controlling voles, and winter is prime time for voles in the field and in tunnels. Years ago, I read something by Eliot Coleman mentioning using boxes for setting the traps in and recommending Better Mouse Traps by Intruder. The combination worked really well for us.

The advantage of the Intruder traps is that they are very easy to set and to empty. At this point I've seen a few others that are similar, maybe



The author's trap box diagram. All images courtesy of the author.

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even better, like the Tomcat Press 'N Set, but I haven't tried them myself. The weak point for the Intruder traps is that the tracks for the spring get worn and over time the trigger becomes overly sensitive. I don't love that they're plastic, but it does keep the price down. I've also used the classic Victor traps and while they're harder to set and empty they work, too.

Putting the traps in a box, and how you set the trap in the box makes a huge difference. Voles and mice like to crawl into dark spaces and then they travel along walls, not in the open, exposed spaces. A box with a hole in the side is an inviting refuge for the vole and once inside they'll simply travel along the wall. If you set the trap facing the wall they'll run right over the trigger. We never bait our traps, we just set them with the trigger facing the wall. We put two holes in opposite sides of each box, and a trap by each hole. We don't always catch two voles, but it does happen.

The box has a couple of other benefits: they work under row cover that's not held up with hoops; they keep the traps from being triggered or dragged off by other animals; they keep the dead voles or mice dry which makes emptying the traps slightly less unappealing; and they're easier to find, especially when you use an irrigation flag to mark their location.

Here's a sketch of the kind of wooden boxes we built. I use whatever scrap is handy and find 1" x 4" or fence boards which are about 5/8" x 5 1/2" good sized lumber to work with. They make boxes that are plenty durable, and not too heavy to carry around. I don't treat the wood, and I usually use thin, #8 coarse thread drywall screws to put them together, although any screw should work with a predrilled hole, or even nails or staples. At a minimum you want the box to hold a trap or two, and you'll be happier if there's plenty of room in the box to make it easy to set the trap in it without contorting your hand. I



**Right:** The box just sits on the ground and an attached flag makes it easy to find for checking and emptying the traps regularly. **Above:** You can see the open box with holes drilled in the sides for the voles and traps sitting next to the holes.

find something about 6x8" to 8x10" a good size, but exact dimensions depend on the materials I'm starting with.

When I visited Eliot Coleman and mentioned how well the boxes worked for us, he showed me the plastic tackle boxes they were using at the time. Again, I don't love that they're plastic, but they're inexpensive, light weight, it's easy to put holes in the sides, they come with a convenient carrying handle, and you can just buy them off the shelf, no need to build your own if you don't want to.

The other key to effective trapping is to pay attention to where the voles are and to check and reset the traps regularly. We would empty the traps when we caught voles, but unless they were super dirty we don't actually clean them, working on the theory that the vole scent would attract more voles to the traps, and that does seem to work.

*Josh Volk farms in Portland, Oregon, and does consulting and education under the name Slow Hand Farm. He is the author of the book Build Your Own Farm Tools and Compact Farms: 15 Proven Plans for Market Farms on 5 Acres or Less, both available from Growing for Market. He can be found at [slowhandfarm.com](http://slowhandfarm.com).*






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# Planting and greensprouting potatoes

By Pam Dawling

Potatoes are a rewarding crop to grow, with a lot more flexibility about planting dates than the traditional instruction to plant on St. Patrick's Day might have you believe.

## Planting dates and temperatures

Potatoes are a cool-weather crop, but the tops are not frost tolerant. A good guideline for suitable spring planting conditions is three consecutive days with a temperature exceeding 43°F (6°C) at a depth of four inches (10 cm). Some growers wait for soil temperatures to reach 50°F (10°C) before planting. A traditional phenology sign is that the daffodils should be blooming.

The spring planting is timed with the goal of having most of the shoots emerge after the frosts. A light frost will only nip the tops of the leaves and do no real damage (the plants will regrow), so a small risk is worth taking. It takes a temperature of 29°F (-2°C) to kill the shoots, and even then regrowth is possible.

The practice of hilling soil over most of the leaves once the plants are six inches (15 cm) tall will protect against frost. So, if you have plants growing and a frost is predicted, a hilling that day may save them. In the fall, frosts will kill the foliage and growth will stop, so late plantings should be timed to get the tubers to maturity before the



**Left:** A frosted, hilled potato plant. **Right:** A frosted potato plant that made a complete recovery.

expected frost date. Some late varieties do not bulk up until the last moment, so if you are pushing the late end of your planting season, plant early varieties or fingerlings ("early" equals fast-maturing).

Here in central Virginia, we plant our first crop in mid-March, about four weeks before our last spring frost, and plant a second crop in mid-to-late June, which allows three and a half to four months before our average first frost date. We could plant any time mid-March to mid-June and harvest mature potatoes.

In summer, the ideal soil temperature is 60°F to 75°F (15°C to 24°C). It's possible to pre-irrigate to reduce the

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soil temperature in summer. We could plant a fast-maturing variety in July. An advantage of summer planting is that the harvested crop need only be stored from October or November, not over the hotter months.

### Buying seed potatoes

A grower specializing in many kinds of fingerlings might want to plant once a month during their season for a continuous supply of fresh new potatoes. If you want to plant at unusual times of year, you may need to plan ahead, buy your seed when it's available and store it in a cool dark place below 50°F (10°C), such as a refrigerator, until you need it.

Many suppliers only ship in March and April. Growers in zones 8 through 10 may need to buy their spring seed potatoes the previous fall. We buy our seed potatoes for the June planting in April, before suppliers sell out of spring stocks.

Potatoes have a dormant period of four to eight weeks after harvest before they will sprout, so if you plan to dig up an early crop and immediately replant some of the potatoes for a later crop, it won't work. Work around this problem by refrigerating them for sixteen days, then pre-sprouting them in the light for two weeks.

If using 10" (25 cm) spacing, we buy enough to plant 16–17 lbs/100' of row (around 1.2 kg/10 m). More common is 12" (30 cm) spacing, providing bigger potatoes than at 10" (25 cm), although yields may be lower. For 12" (30 cm) spacing, the recommendation is to allow 10–12 lbs/100' (7–9 kg/10 m). In practice, we need a higher seed rate, maybe 15 lbs/100' (11 kg/10 m).



The potato patch two weeks after near-death from frost.

### Varieties

Varieties of potatoes are generally divided into four categories. Early potatoes take 55 to 65 days from planting to harvest. The more famous ones include 'Yukon Gold,' 'Irish Cobbler,' 'Red Pontiac' and 'Caribe.' Mid-season potatoes mature in 70 to 80 days, and include 'Kennebec,' 'Katahdin,' 'Desirée' and 'Yellow Finn.' Late-maturing varieties take a full 85 to 120 days to mature and include 'Russet Burbank,' 'Butte' and 'Green Mountain.' The fourth category is fingerling potatoes, which are small, attractive and have a high market value. They are prolific and no harder to grow than other potatoes.

Farms that are not certified organic have the option of buying non-organic seed potatoes locally, which saves money on shipping. Be sure, though, to buy seed potatoes

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**Left:** Seed potato cutting. **Right:** Cut pieces of presprouted seed potatoes. Photos by Kati Falger.

that are certified disease-free. Late blight is a disease not worth risking. Some growers buy “B” potatoes that are small enough to plant without cutting. For most growers, “B” potatoes are not available, and we settle for larger seed potatoes, which have fewer eyes for the weight than small ones do, and need to be cut into pieces before planting.

### Pre-sprouting seed potatoes

We routinely pre-sprout our seed potatoes before planting. Pre-sprouting, also called chitting or green-sprouting, is a technique to encourage seed potatoes to start growing sprouts before you put them in the ground.

It's not essential, but advantages are: getting an earlier start on growth in the spring; being less dependent on outdoor weather conditions; giving the potatoes ideal

growing conditions early on and so increasing final emergence rate; bringing harvest forward 10 to 14 days; increasing yields by optimizing the number of sprouts per plant; making the cutting of seed potato pieces easier (the sprouts are more obvious than eyes); enabling cover crops or food crops to grow longer before the land is needed for the potatoes; and giving more time to prepare and irrigate the soil as needed before planting.

To start the sprouting process, bring seed potatoes into a warm well-lit room, around 65°F–70°F (18°C–21°C), and set them upright in shallow crates or boxes, rose (eye) end up, stem (belly button) end down, for two to four weeks in spring, or one to two weeks in summer. If you have no space or time for chitting, warming the potatoes for a couple of weeks (maybe even just a couple of days)



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will be beneficial.

Some people like to warm the potatoes in the dark for two weeks, then spread them out in the light for the last two weeks before planting. I don't know if the two-part process offers advantages, because I've never tried it. In the light, the growing shoots will grow green and sturdy, not leggy and fragile. Make sure the potatoes have a moist atmosphere so they don't shrivel while they are sprouting. At this point don't worry if a few sprouts break off; more will grow later.

In spring, the sprouts will grow considerably faster with indoor warmth than they would if planted unsprouted in cold ground, where they could take as long as four weeks to appear. Once planted, chitted potatoes will emerge sooner, and more evenly, which is always reassuring, and the weed competition will not be as fierce. Fewer seed pieces will die before emerging. And if weather prevents soil preparation when you had planned, just wait and know that your plants are growing anyway.

For summer planting, encourage sprouting success by storing seed potatoes in a cool place like a refrigerator, at 45°F–50°F (7°C–10°C) until two weeks before planting time, before sprouting and cutting them. This encourages the lower eyes as well as those at the rose end to sprout. Tubers with many sprouts can be cut into many seed pieces, which can save money.

### Cutting seed pieces

Before planting, cut the seed potatoes (unless already small) into chunks about the volume of a ping-pong ball and weighing 1–2 oz (30–60 g) each, with the smaller fingerlings at 0.7–1 oz (20–30 g). Within a reasonable range, the size of the seed piece has little effect on the final yield, so long as it doesn't shrivel before growing, and has enough food reserves to get the stem up into the sunshine. Cutting large potatoes is more economical than planting them whole.

For cold-weather planting early in the year, aim for two sprouts per piece, which allows one for insurance if the first one gets frosted off after emergence. For warm-weather plantings, one sprout per piece is enough. Planting seed pieces with too many

sprouts will cause only small potatoes to grow, as each stem is effectively a single plant and will be competing with the others for light and nutrients. Also, overcrowding can force tubers up through the soil, and they will turn green if they reach the surface.

We usually cut our seed one to three days before planting. Varieties like 'Atlantic' and 'Kennebec' have slow healing abilities, and are best cut ahead of time. Up to 14 days ahead of planting is okay for cutting pre-sprouted potatoes.

Unsprouted potatoes can be cut as much as a month ahead, although my choice would be to sprout them for at least two weeks and then cut pieces. It is more challenging to cut unsprouted potatoes because there's no knowing which eyes will actually sprout. I think cutting immediately before planting only works in warm, dry conditions, as the unhealed surfaces can rot in cool, wet conditions.

Delayed emergence and patchy stands are signs of planting the seed in soil that was too cold, too wet or even too dry. Erratic and slow plant growth interferes with timely hilling; smaller plant canopies offer less weed competition.

Make clean cuts with a sharp knife, aiming for blocky pieces about 1 to 2 oz (30–60 g) each. Avoid cutting thin slices or slivers, as these may dry out and die rather than grow. The cuts should not be too close to the eyes. Reject any potatoes with no sprouts.

Some people cut their potatoes a few days ahead of planting and put the pieces back into the crates to allow the cut surfaces to heal over. For large quantities you may need several layers deep. If so, use fans to keep a good air circulation. Relative humidity of 85 to 95 percent is needed to promote

healing and avoid dehydration.

See the University of Maine Extension Service Bulletin #2412, *Potato Facts: Selecting, Cutting and Handling Potato Seed* for lots of details. Avoid tiny pieces, thin slivers or slices and ragged edges.

### Planting

Potatoes benefit from generous amounts of compost or other organic matter (they can use 10 tons/ac, 22,400 kg/ha) and will grow in soils with a pH of 5.0–6.5. They use high amounts of phosphorus (P) and potassium (K), and need adequate soil levels of iron and manganese. They are less affected by low levels of copper and boron. As Carol Deppe points out, potatoes will still produce an okay crop in poor soil, where you might not be able to grow much else. See the ATTRA publication *Potatoes: Organic Production and Marketing*.

Potatoes need to have a good final depth of soil and or organic mulch above the seed piece. All the new potatoes grow from the stem that grows up from the seed piece. None will grow below the seed piece, so be sure to plant deep enough and hill up and or lay on thick organic mulch to provide plenty of space for your crop.

Row spacing of 32"–45" (80–115 cm) is common, with in-row spacing of 10"–15" (25–38 cm). In early spring when the soil is cold, if you want fast emergence and can hill up two or three times, you could plant shallow: as little as one inch (2.5 cm) deep in the North and four inches (10 cm) deep in the South. This technique helps avoid *Sclerotinia* problems. When the chilliness of deeper soil is not an issue, plant deeper, especially if your chances to hill might be



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June-planted Potatoes with hay mulch.

restricted (for instance, by too much rain).

Make furrows at the chosen depth, normally 4-6" (10-15 cm). Add compost if possible. Plant the potatoes, sprouts up. Take care not to bruise the seed pieces when planting. If you are planting by hand, have some kind of measure — your foot, a stick or the width of the crate. Cover with at least 2" (5 cm) of soil. Later more soil will be piled up against the stems, in the process of hilling, which encourages stem growth and provides more sites for tubers to form.

#### Potato development stages and crop requirements

For the first 30 to 70 days the potato plant produces roots, stems and leaves. Bigger plants have more yield potential, so the goal for this stage is to produce large robust plants. Vegetative (leafy) growth of potatoes is favored by warm, 80°F (27°C) moist weather, but tuber growth is favored by cooler soil conditions of 60°F–70°F (15.5°C–

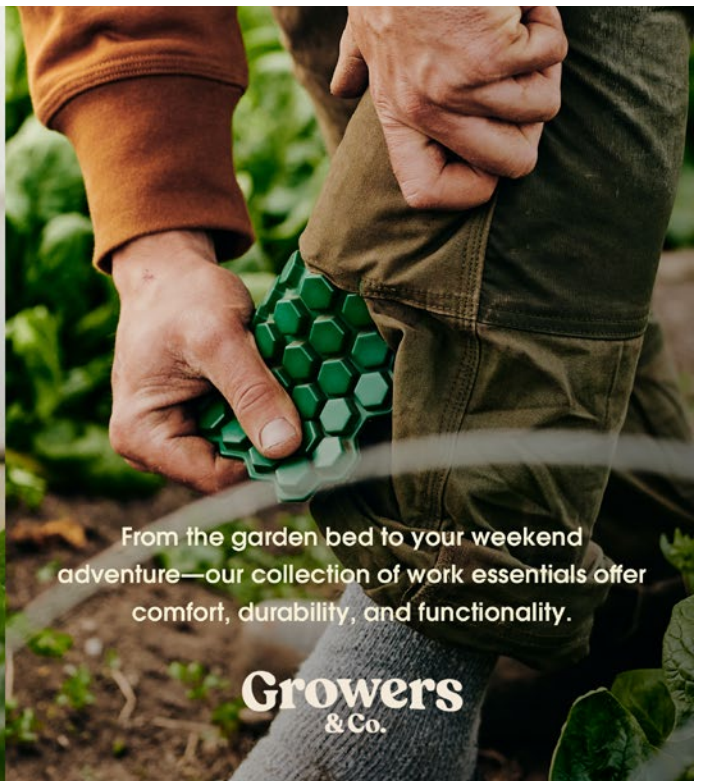
21°C). This combination can be achieved either by planting in spring, when the soil temperature lags behind increasing air temperatures and is still cool enough for tuber formation, or by adding organic mulches to keep the soil cool if planting in early summer.

The second stage is a two-week process of tuber formation and branching of the stems. All the tubers (potatoes) that will grow on that plant are formed in those two weeks. The number of tubers produced per plant depends on hours of daylight, temperature and available water in that short period of tuber initiation. Watering stimulates the production of more tubers. A good amount to supply when tuber formation begins is 5 gal/yd<sup>2</sup> (about 24,200 gals/acre) (22.8 l/m<sup>2</sup>).

Short day length is optimal, with a night temperature of 54°F (12°C). If temperatures at night are 68°F (20°C), initiation will be reduced; and at 84°F (29°C), will be inhibited. High nitrogen also inhibits initiation. During this stage, leaf growth continues. Flowering can happen too, but it's not essential, so don't worry if you get few or no flowers.

In the third stage, the tubers grow larger, but don't increase in number. When the leaves start to turn pale, the plant has finished its leaf-growing stage and will be putting energy into sizing up the tubers under the ground. Adequate water and nutrients are important during this critical stage which lasts until the plant reaches maturity. Try to ensure at least one inch (2.5 cm) of water per week, up until two weeks before harvest. Avoid very uneven watering, or overwatering, as hollow heart could result.

The size of the tubers depends on various growing conditions. Two or three weeks after flowers appear (if they do), the baby potatoes will be 1–1.6" (2.5–4 cm) across. The best temperature is around 65°F (18°C), and I've read that potato size decreases by 4 percent for every Fahren-





heit degree (7 percent per Celsius degree) above the optimal. Spacing is another factor. We got large potatoes one summer because we had poor emergence and therefore wide spacing. The heat of the summer didn't stop them. Finally, the tops naturally yellow and die. The skins of the tubers thicken, which makes them suitable for storage. No more growth is possible.

## Hilling

Start hilling (pulling soil up over the plants in a ridge, leaving only a tuft of leaf tips exposed) when the plants are 6" (15 cm) tall. Hill again two or three weeks later and two more weeks after that, if the plant canopy has not already closed over, making access impossible. Hilling also provides an opportunity for dealing with weeds, so if possible do this task in sunny breezy weather which won't let the weeds re-root.

On a manual scale, use a rake or standard hoe to pull soil up from the side of the row opposite to where you are standing. If you are sharing the job, one person can work each side

of the row at the same time. If you are alone, turn round and work back when you get to the end of the row. Don't be tempted to twist your arms around and move the soil up the side nearest you. You will damage your body by this distortion of your spine and shoulders.

At the next scale up, use a rototiller with a hilling attachment, or perhaps a wheel hoe with a hiller, if your soil and stamina allows. We have used a semi-manual planting method, making single furrows with our BCS walk-behind tiller, planting by hand in the furrows, then using the tiller again to cover the seed pieces and hill. Nowadays we use a tractor-mounted furrower that can make two furrows in each pass, and disks turned inwards in pairs to ridge the soil.

If you can't hill, you can increase the effective depth of planting by covering the rows with thick straw or hay mulch. This is easiest to do immediately after planting, before the plants emerge. We don't mulch our spring-planted potatoes because we want the soil to warm up some from its winter temperatures.

When we plant in June, we cover the seed pieces, then hill, then unroll round bales of spoiled hay immediately, like wall-to-wall carpeting. We choose this method to help keep the soil cooler through the summer. In warm conditions, deeper planting, hilling and thick organic mulches all help keep the plants cooler, as does irrigation.

I will write more about potato plant development, weed control, pests and diseases and early harvesting in the June-July issue, with more about summer planting.

*Pam Dawling works in the 3.5 acres of vegetable gardens at Twin Oaks Community in central Virginia. Her books, Sustainable Market Farming: Intensive Vegetable Production on a Few Acres, and The Year-Round Hoophouse, are available from Growing for Market. Her weekly blog is on her website and on facebook.com/SustainableMarketFarming.*

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# A farmer's guide to politics

## *How and why to get involved locally*

By Katie Kulla

When my husband Casey and I first became interested in farming as a career in the early 2000s, we were also young voters who had become disillusioned with electoral politics. In spite of our youthful idealism and desire to contribute, our first significant campaigning and voting experience (the messy 2000 U.S. presidential election) left us looking for other ways to make a positive difference in our communities and world. We'd continue to vote, but we longed to see more immediate and direct results of our time and actions.

Market farming became that venue for us — we saw it as a way to make a living that represented our values about sustainability and community. Starting our Oregon farm in 2006 felt like a way to make a difference that felt more tangible than through political involvement.

### **Pulled into local politics**

The longer we lived in one place and put down roots, however, the more we realized that traditional politics (especially on the local scale) played a big role in our life and business, whether we wanted it to or not. Farmers as a group have a significant stake in local politics. Because our work as farmers is very place-based, we tend to live in a single community longer than the average American, and local decisions (especially around land-use) can have direct impacts on our farms, families, homes and businesses.

This is what Casey and I realized in 2009 when a gravel quarry applied to convert 225 acres of prime farmland near us from farming usage to extraction zoning. We live on a 3,000-acre river island that is almost entirely agricultural, and this proposed change felt like something that would be hugely negative for all the farms on our island. But the zoning change could only happen if two of three elected Yamhill County Commissioners voted to approve the application.

Thus began our crash course in community organizing and local political action. We learned about Oregon's complicated and unique land-use system, how these decisions are made, and what kinds of arguments have legal influence over the commissioner's votes. We put ads in the paper, met weekly with our neighbors for almost a year, testified in multiple meetings, gathered signatures from the wider community, started a non-profit and hired a lawyer. We did not ultimately prevent the zoning change, but we did raise awareness of many issues, and to this day that quarry is not yet operating on our island.

The quarry opposition was a massive project that immersed us in the world of local politics, and since then we've stayed very involved. I still don't enjoy the work of politics — it still feels messy, frustrating and an uphill battle. It's so much less immediately satisfying than delivering a bin of beautiful carrots to our customers.

But we've also learned that big decisions are being made every day that affect us (and our community), whether we



The author's farm box truck became a mobile campaign sign when her husband Casey ran for local office in 2018. They had a sign maker paint this custom wooden sign, and Casey drove the truck to all his campaign events (as well as on the usual vegetable delivery routes!). In the final days before the election, he also parked it alongside major roads and waved at passers-by.

get involved or not. That realization has kept us engaged, and ultimately led Casey to run for office himself in 2018. He was elected and is now one of those three elected Yamhill County Commissioners who vote on items like proposed gravel quarries.

### **Farmer needs, perspectives, and skills**

Certainly, running for office is an extreme level of commitment, but wherever you live and farm, there are accessible ways you also could plug in and increase your involvement in the ongoing political work of your community. If a goal of your farm is sustainability, then it's important to consider the factors beyond the edges of your property that affect your business' long-term livelihood and the long-term health of your soil, water sources, workers, and customers.

Farmers also have particularly important voices to offer because of our long tenure on the land, our needs for specific resources (land, water, infrastructure, workers), and our commitment to the local economy and community. Believe it or not, many market farmers also have useful marketing skills that can be applied to political action on many levels — knowing how to grow a thriving local business is very similar work to community organizing and campaigning.

Ultimately, that bigger picture of sustainability and believing we had a unique and important perspective to offer are what inspired Casey and me to dive back in to politics.

Here are tips, starting with the simplest political ac-



tions and moving to the highest level of commitment. Local politics operate differently from place to place, of course, especially in regard to issues like land-use decisions (i.e., land use, zoning, etc.). Position titles and processes also vary. But I aim to keep the suggestions general enough that they should apply wherever you live.

### Ways farmers can get involved

**Vote:** If you are eligible, vote in every single election and on every single local race and issue. This is the lowest bar for being committed to the place and community where you live, and this is also where your vote will have the most influence because of the relatively smaller number of voters casting ballots in local races. In our county, important races have been decided by single-digit margins. **Time commitment:** Approximately one to two hours per year (you can do that).

**Keep up with local news:** Of course, being informed about local issues and candidates is very helpful when voting, so the next minimum bar I recommend is keeping up with your local news. Our rural community is blessed still to have two local newspapers with local reporters who do their best to cover everything from political decisions to upcoming concerts to scholastic sports.

If you have a local paper, I highly recommend subscribing and reading every issue (local newspapers tend to be short, so this is often a quick task). Not only will you educate yourself and stay connected, you will help financially support local journalism. If you don't have a local paper, or if you want more engagement, many communities also have social media community groups that can sometimes provide insight into what's happening.

With the often divisive nature of social media, however, be cautious with this choice — you might be exposed to misinformation or more arguments than is pleasant. So, I recommend the local news outlet if it exists even if you don't always agree with the way they cover the issues. **Time commitment:** One to two hours per week. Do it while you drink your coffee.

**Connect with local political groups:** Does your community have a chapter of your preferred political party? Even if you don't like partisan politics, party designations can still

be helpful for finding information. Or, are there other advocacy groups in your area that might gather people with similar values? Find one of these groups and get involved by signing up for their newsletters and attending meetings. These groups can be a great way to learn more about the issues and local positions, often from a values perspective that is more consistent with your own. There may be simple opportunities to volunteer or help them coordinate for local candidates or issues. **Time commitment:** One to five hours per month. This is still relatively easy.

**Support candidates' campaigns:** There are many local elected offices: mayors, city councilors, county commissioners, school board members, conservation district directors, and more. Who fills all our local elected offices matters a lot. They don't just vote on specific issues as they come up, they often set the agendas as well, meaning that their values will determine the direction of your community.

Let me tell you from experience, it can take a lot of people to run even a small, but effective campaign. If there are candidates who you think will do a good job in even a seemingly minor local office, reach out and offer your support. At the very least, you could offer your endorsement or write a letter to the editor.

As a farmer with land, you could offer to host a large campaign sign leading up to the election. If you don't want to be as visible, you could donate money to the campaign. Keep in mind that a donation will still likely be visible depending on the campaign finance laws in your region. **Time and money commitment:** Varies widely on your investment in the process.

**Organize your community around key issues:** Our big entrance into politics was around a local issue we cared about deeply. If there is a such an issue in your community, you can offer your support or organizational help: emailing people who you think should know about it, writing letters to the editor, holding meetings with stakeholders, working with a lawyer and so on. An issue might be a land-use decision in your area or a proposed new ordinance or law.

**Time commitment:** Varies widely. If you choose to take a lead role, this could be a big time commitment.

**Offer testimony before a vote:** Issues that come before decision-makers also often have opportunities for residents to provide written or oral testimony. These can be critical ways for your elected officials to know their constituents' views on an upcoming vote. So, I recommend always offering testimony on issues you care about, even if it is very simple. You'll need to learn what the process is, as the timeline and processes vary depending on the issue and the forum.

I have testified before our county commissioners and state legislators many, many times, mostly on issues related to farmland preservation. It can feel very awkward at first — I often felt I didn't even have appropriate clothes to wear — but it gets easier, and it's the only way our voices will be heard on specific issues. Remember to identify yourself as a farmer and explain your stake in the vote. **Time commitment:** One to three hours per year. This depends how often you feel called to write or speak. Your influence is significant from a relatively small time investment.

**Serve on appointed advisory boards or councils:** Here in Yamhill



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**Left:** The author and her husband Casey first jumped into local politics in 2010 when an application was made to convert nearby farmland into a gravel quarry. They helped organize neighbors and community members in an effort to protect the land. As part of that work, they built a website with information and a neighbor painted hundreds of signs to spread the word. Some of these signs are still in people's yards over a decade later. **Right:** When the author's husband Casey ran for local office in 2018, he reached out to farmer neighbors about hosting campaign signs on their property, including at this organic dairy on a major road. Casey pounded every t-post himself, being very experienced in such work already.

County, we have many advisory boards and councils that are not elected positions. Instead, local residents are appointed or volunteer to attend meetings on specific topics, such as water issues, roads, planning and public safety. There are similar statewide boards. Often these groups generate ideas and set values for their topics.

Meeting frequency varies, as infrequent as quarterly or yearly, but ideas expressed in those meetings can have a big impact on how elected officials and administrators set goals and start projects. If you're interested in serving in this way, contact your local elected officials and find out what boards exist in your region and which one might benefit from a farmer's voice.

Time commitment: Varies widely, depending on the board or council.

Run for office: This is The Big One! Ready to really throw your entire self into your community? Run for local elected office. There are many positions available, but you'll need to see which ones you are eligible for based on where you live. Generally speaking, the positions you can vote on are the ones you can also run for (exceptions being positions that might have degree or licensure requirements).

Obviously, running for office is an enormous commitment. Unless you run unopposed (which can happen in local races), campaigning will take more time, money, energy, and emotional work than you could ever imagine. It will also (as I said) take a team of people. Running for office is a process that requires major intention and focus. Have you ever tried to catch a chicken that did not want to be caught? Those birds sure can be fast and tricky. Casey and I used to tell our newer employees that when trying to catch a chicken, "You have to want to catch the chicken." We say the same thing now about running for office: "You have to want to catch that chicken."

I would only recommend running for office if you are already well-experienced in all the other categories of political involvement I listed above and are ready for a bigger commitment. Communities deserve elected officials who are knowledgeable both in their local issues and in

the processes of governing. That being said, communities also benefit from diverse perspectives and backgrounds, so don't rule yourself out just because you don't wear a tie all day.

Your decision-making perspective as a farmer might be critically relevant for your community. And, remember that if you know how to market and operate a farm (and

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catch chickens), you already have a surprising number of skills that can transfer to campaigning and governing. Time commitment: Potentially infinite.

### Will my political actions affect my business?

Perhaps at this point, you are convinced that you should get involved in local politics, and understand how, but are worried that looking political might affect your farm's reputation or customer base. This is a legitimate question to ponder and something Casey and I considered every step of the way. For us, we also wanted our farm community to be welcoming to all, and we didn't want potential customers to feel unwelcome if they didn't agree with us on an issue or candidate that we'd publicly supported.

To that end, in the beginning we mostly engaged in issues that were extremely important to our farm and were consistent with our farm's stated values and messaging. So, for example, publicly opposing an extractive quarry felt consistent with our values of organic farming and sustainability. Whether our customers agreed exactly with us on this issue, we didn't think they'd be surprised by our stance given all that we put on our website and in our newsletters about our values.

As time went on, the values that mattered to us grew and grew. It was still a difficult dance, wanting to use our voice to support candidates and issues that we thought would be positive for our community, yet not wanting to do it in a way that alienated customers. Ultimately, we decided that choosing positive forms of support and language was key.

Even now that Casey is an elected official, we still both



The minimum bar for local political engagement? Voting in every election! You might even get a cool sticker! (In Oregon, where the author lives, voting is all done by mail and there are usually no stickers involved, but she and her husband bought these to share with supporters when he ran for local elected office in 2018.)

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engage everyone in our community (in person and online) respectfully and use careful, intentional language about our values. Being respectful feels like an important part of our overall value system. Even when politics get rough we maintain that. It's important to us as humans, but we also think it goes a long way toward maintaining our positive reputation as a farm business. Ultimately, we can't stop being invested in our community, so perhaps a lost customer or two is worth the larger gains of being involved.

### Do what you can, when you can

Please remember that if you get involved in local politics, it likely will feel messy. You will inevitably feel frustrated and perhaps as though you've wasted valuable time and effort on something much less tangible than weeding your fields. I understand that farmers working to make a living for our families is a tough business; it can be very challenging to give our time and energy to so complicated an activity as politics.

So, perhaps there are periods in your farm journey when you can only engage in the most basic levels of political engagement (voting and reading the local news, for example). But I encourage you to keep an open mind and consider what you might be able to offer your community. As a farmer, you have a unique stake in your community's future, and your voice matters. In whatever way you can, use your voice to further the idealistic goals that first drew you to farming.

*Katie Kulla lives and farms with her family in Yamhill County, Oregon. You can find Katie at [KatieKulla.com](http://KatieKulla.com) and on Instagram: [@katiekulla](https://www.instagram.com/katiekulla).*



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# Plan for alliums all year-round

## *Different members of the onion family for different seasons*

By Liz Martin

It is the heart of allium appreciation season here on our farm. Those cute little buggers start out looking like blades of grass and end up filling crates in the storage rooms and walk-in coolers, giving meals all winter a savory delicious flavor. No dish would be as good in the kitchen without some alliums. I think perhaps no farm is as good as it could be without them either.

### Garlic

Here is a peek into the world of alliums and how we grow them at Muddy Fingers Farm. Let us start our stroll with the garlic. Lovely, spicy, steady garlic. It's already planted when things wind down for the fall and pops up in the spring when the daffodils do, helping to remind us that the season is on its way.

In our zone 5 Upstate New York farm we plant garlic in mid-October. Scapes are harvested in mid-June and are nice additions to the early season CSA share. Bulbs are harvested in mid-July. We lay them in our barn on slatted greenhouse tables to cure. We trim them once dry or whenever we need the space or find the time.

We plant three rows per bed on 42-inch beds. Years ago we drove by a neighbor's farm and saw they had planted garlic on black plastic. We tried it and were impressed that the scapes come up a little earlier and liked how the dark color warms the soil in the spring.

We have tried both black plastic and landscape fabric; we prefer the landscape fabric since we can reuse it. We use 4-foot-wide landscape fabric with holes cut about every ten inches. We plant three cloves in each hole. Planting so densely reduces the size of the bulbs but increases overall yield. We've been able to reuse this landscape fabric for many years and thus far haven't had any disease problems. We protect the garlic with row cover before the ground freezes and then pull the covers off when the plants start to grow in the spring.

### Scallions

Next in the allium family for us are scallions. We've grown the small green onions used for bunching in two different ways. A friend's farm turned us onto planting onion sets as close together as possible, mulching deeply and harvesting the greens in the spring as scallions. This system was fun, but we've had trouble sourcing certified organic sets. And though we hoped to thin the sets and sell some as scallions and some as bulbed onions, the onions just bolted before they bulbed.

So, for the last few years, we've planted scallions from seed in small

plantings in 2-inch chain paper pot trays (264 cells per tray) and transplanted six plantings with seven rows per bed over the course of the season. We find that four trays in each planting is enough for our small farm. Too many more and their quality decreases before we can sell them. So we try to have another bed ready to go when that happens. We've only used "Evergreen Hardy White" as the seeds are inexpensive and they make fine scallions for us.

Next we come to our red whale — shallots. We generally sell onions for about \$2.20 per pound, leeks for about \$3.25 per pound, but we can easily charge \$6 per pound for shal-



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**Left:** Multiple onions per hole may decrease the size of the individual onion but increase overall yield due to increased planting density. **Center:** Alliums on rope lights for bottom heat. **Right:** A basket full of tall Lincoln leeks. And, yes, the author is kneeling they're not THAT tall. All images courtesy of the author.

lots, so we're hungry to produce those gourmet little onions.

We've grown them from sets both planted in the fall and in the spring without much success. We have bunched the plants that were fall planted and sold them as shallot-scallions. But they often bolt before they are even big enough to do that. (See the article "Shallions, bulbs, and edible flowers: Three crops from one fall planting of Dutch shallots" from the January 2021 GFM for more on shallions.)

In general, we like to start all of our alliums (excepting garlic) from seed in mid-March. But boy, shallots are plagued with such poor germination. The ones that come up seem inclined to easily get diseases and die in the tray. They tend to grow slowly and be very susceptible to getting water logged in the trays and the plants can suddenly turn yellow and experience tip die-off.

We also realize that our somewhat poorly drained clay loam is not ideal for shallot growing. But the price per pound and the flavor, oh baby, keep us on the hunt to conquer our yellow or red (we're not picky, we just want shallots) whale. We will try growing them on raised beds next year.

## Onions

Now we're into our main crops in the family field: The onions. We grow three types- early fancy types for bunching, sweet, and storage. Be-

cause onions aren't good competitors with weeds, we grow them on large swaths of wide landscape fabric covering several beds and their permanent paths. This keeps the crabgrass out of our normally weedy pathways.

We found that we didn't like to grow them on biodegradable plastic. The number of holes in the plastic made it degrade too quickly and weeds became an issue before the plants were ready to harvest.

We plant three plants per hole (except for sweet onions) and now use three rows per bed with holes about 10 inches apart. We have also planted onions at four rows per bed and two plants per hole. We are fitting slightly fewer plants per 100-foot bed (1,200 in the four-row system versus 1,080 in the three-row system), but it is much easier to plant and maintain. And the onions get larger at a slightly lower density. This has been an extremely positive change on our farm.

## Leeks

The last stop on the allium express for us is the best stop. We love our leeks; we tend to sell them for about nine months of the year and they fill us with such joy.

Our first true love is the early season or bunching leeks and this is where my deepest fondness lies. We grow tall light green (rather than blue green) leaved leeks for most of the season until it gets too cold for them (temps in the mid 20s). Then we

switch to the hardier winter leeks.

For the early season leeks we love both "Lincoln" and "Bulgarian Giant." We start them in open 10x20 trays in March with about 300 plants in 10 rows. We normally have leeks on the table top in our greenhouse that is only heated with rope lights, giving them bottom heat. Each night we cover them with row cover. If it's very cold, plastic, too. On extremely cold nights we will put a small space heater under the tables to help bring the temperature up a little more.

We transplant out into landscape fabric in a dense planting of four rows with holes about every 8 to 10 inches. We plant four plants into each hole — three in a clump and one separately, making sure the one separate leek's roots aren't intertwined with the others. As we harvest, we thin for baby leeks by pulling the three planted together and leaving one single leek in each hole.

It is slower transplanting in this way, but we are basically double-cropping the bed, one bed of baby leeks and one bed of big leeks all planted at once. By the time we've finished thinning out the beds, the first leeks are large enough to sell as single leeks by the pound.

These early leeks are fantastic and we're so sad to see them go when they are done. We've grown "Lincolns" as tall as myself (5 foot 4 inches) when the greens are stood up to measure. And they've weighed in at as much



**Left:** Leek flowers. **Right:** Allium leaf miners and their damage.

as two pounds in the past (at \$3 per pound that's a \$6 leek).

So, when we heard a rumor that "Lincoln" might be dropped by the trade, we were scared. "Bulgarian Giant" is quite similar and is open-pollinated. So, we started growing that variety and producing our own seeds, just in case.

### Growing leek seeds

Growing our own leek seeds has been a really fun new layer in our love of leeks. We leave 100 to 150 nice leeks in the bed at the end of the season. We row cover them and leave them out in the weather. The plants lie down over the winter, and when we uncover them in the spring, they look like a bunch of slimy, silver snakes on the landscape fabric.

The first year our hearts sank and we figured we had messed up and should have brought them into the cooler for the winter and replanted them in the spring. But as the days get longer, those plants will stand back up and start growing. Out of those disgusting snakes emerge the most lovely white and purple cluster of flowers that are irresistible to all sorts of insects.

It's not unusual to walk by and see three or four different types of flying insects (bumbees, native bees, mason bees, wasps, and yellow jackets) on each blossom. Even people find them fascinating. We had a new pond built this year and they caught the eye of the operator driving by on equipment. They stopped to ask what those big balls on stalks were.

They flower for a very long time and it takes ages for the seeds to mature. The first year we grew them, "harvest leek seeds" was on our to do list for about 10 weeks before it was actually time to do it. Once the seeds seem mature (have turned black), we harvest the whole head and put them in a bin or bag. We shake the seed heads into a bag and then plant in open trays in the spring.

### Allium leaf miner

Our love affair with leeks used to be a pure unsoiled thing, but in the last few years, it has started to be sullied. There is (sigh) a new pest, and it has arrived to ruin our blissful union. The allium leaf miner is here and it does some real damage to the perfect aesthetic we're used to from our tall slender friends.

In the old days, leeks came out of the field sometimes looking gross, but we'd peel off an outer layer or two and they'd be pristine, glistening up to two feet of clear, clean light green shafts with the faint white hue underneath. But since the arrival of allium leaf miner that old trick of peeling anything bad away has been replaced with a terrible new reality: the leaf miner damage gets worse the deeper you go. So now instead of peeling a layer off being the most amazing joy, it is the most depressing revelation — only more and more grubs inside.

The first year we had a population that reduced our ability to market the leeks was 2020. The early leeks were okay but as the season went on, the damage was bad enough that in December 2020 we just stopped selling leeks and abandoned the rest in the field.



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Leeks covered with insect netting to exclude allium leaf miner.

In an effort to get a head of this new bug(ger), we tried both non-spraying organic solutions that we had read about: silver reflective mulch and insect exclusion cloth. Due to heavy swede midge pressure, we were already very familiar with using insect exclusion cloth. We use ProtekNet. This year we got the 47 gram which has a longer life expectancy. We've also used the 25 gram and it lasted several years, but we wanted to try the 47 gram for its longer life.

We transplanted the plants into reflective silver mulch.

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I guess the glare discourages the adults from landing on the leeks, and at the right angle you could just about blind yourself. Several weeks later, we weeded the leeks and covered the plants with hoops and insect exclusion cloth.

It was our hope that this year with these precautions we wouldn't have any allium leaf miner damage. The early season leeks were very clean. But the winter leeks had damage. Less than last year but as of this writing in early December, they are about to be abandoned in the field again. Even if it's only one or two larvae rather than six to 10, it's still more larvae than most people want in their food.

We'll try again next year. It's possible that our dog, who jumped back and forth over the low hoops and cut open a few tears in the netting, might be responsible for this infestation. Or it's possible that the insect exclusion netting just went on too late. It was late in arriving and then we were too busy to get it on for a while. Perhaps earlier application next year in combination with the reflective mulch will completely exclude the leaf miners.

### Winter leeks

Winter leeks end our tour of the allium family. Once it gets down to the mid-20s, the early season leeks get too damaged. They become unsaleable and on their way to slimy snake status. We generally aim to just finish harvesting before the weather reaches this point.

For our latest leeks of the year, we switch to a blue-green leaved variety and leave them in the field for as long as possible. We've grown lots of winter hardy varieties and haven't found any that wow us like "Lincoln" does.

Winter leeks tend to be much better rooted and can be hard to pull and they always seem to be smaller with much less shaft area than the early season leeks. We have grown "King Richard," "Siegfried," "King Sieg," "Lancelot," "Blue de Solaise," "Tadorna," "Bandit," "Megaton," and this year "Jumper."

If truly cold weather is approaching, we have pulled winter leeks and stored them in the walk-in cooler as well, but not very often. We've also just left them in the field under row covers. We manage to have a pretty good supply of leeks for most of the year. And with onions, shallots and garlic in storage, there's always some magical allium to go to market and make the start of a great meal. Thank goodness.

Good news, those leeks we abandoned in December 2020, we harvested in June 2021, totally having forgotten why we left so many leeks in the field. Somehow, they were immaculate inside. The leaf miner larvae were gone and the damage was healed up as well, giving us some quite early leeks. We'll see if the same holds true this year, fingers crossed. Maybe 2022 is the year we don't have to abandon any leeks in the field.

*Liz Martin is half of the team at Muddy Fingers Farm together with her husband Matthew Glenn they grow two acres of certified organic vegetables for CSA, farmers market and fine local restaurants. They use a permanent bed system and 2022 will be their 20th growing season! You can find them on Facebook and Instagram if you'd like to connect.*



# The 3-point pallet fork: How did we ever get along without it?



Harvesting butternut squash with 3-point hitch forks. All images courtesy of the author.

By Emily Oakley and Mike Appel

There are amazingly diverse uses for a very cheap tractor implement for those without front-end-loaders or forklifts.

You know those moments when you look at a piece of equipment and wonder why you ever went without it? In just a little over a year, the 3-point pallet fork has become that tool for us. You don't need a large farm to reap the benefits. We cultivate three acres of vegetables, and this has served our needs and more. If you've got a tractor, all you need to make this tool worth the purchase are some used pallets.

When we started our farm, we

were in our mid-20s. Eighteen seasons later, we're in our mid-40s, getting older, and realizing physical limitations. Although it seems obvious now, it has taken us time to realize we can't always rely on strength to power through difficult tasks. And, even if we can, it's not healthy for our bodies.

Friends and customers often assume that farming keeps you fit. While it does keep us moving, flexible, and using our bodies, farming is just as likely to wear you out as work you out. Like all farmers, we are constantly in search of the universal goal of working smarter, not harder. As we age, we think more seriously about how to accomplish physically demanding tasks over extended periods

of time without exhausting ourselves.

Equipment often has been the answer. The right tool allows us to work longer on a job than might otherwise be possible by shifting a significant portion of the workload and effort onto a machine. This is especially important for us as a two-person farm. Without employees or interns to offset our no-longer-25 bodies, equipment can step in to perform tasks we used to push through. And really, there's never a reason to make your body do something a \$300 tool can do instead.

We've made a number of changes over our farming careers that have increased efficiency and lessened physical demands, from better layout and ergonomics in our wash and pack station to harvest and marketing vehicles that minimize lifting and stooping. The 3-point pallet fork is one of the most recent and one of the most versatile.

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lay out and pick up staking T-posts, lay out and pick up sandbags for row cover, unload pallets from our truck, harvest storage crops from the field directly into crates on the forks, spread square bales of mulch, move silage tarps between hoopouses, and general hauling.

I'm sure there are other uses we will figure out with time. In fact, just writing this article helped us come up with another use: carrying our firewood from the shed to the house.

### Staking t-posts

Instead of picking up T-posts from the barn, placing them in the truck bed, driving to the field, and carrying them down each row, instead, we can pick up a pallet of T-posts in the field and drive directly down the rows while one of us lays them out. The driver adjusts the height of the pallet to make it easy for the person laying them out to reach. No more bending, no more walking down rows with armfuls of T-posts.

The same is true when it's time to remove the T-posts at the end of the season. Someone drives the tractor with an empty pallet between two rows while the other person takes the T-posts out of the ground and lays them directly on the pallet. No more pulling out T-posts, laying them on the ground, driving down with the truck, bending down to pick them up again, and laying them in the truck bed. The time and energy to do this job have been reduced by at least 75 percent. Since we stake all of our tomatoes, peppers, and eggplant (which adds up to hundreds of T-posts a season), this tool made an immediate difference.

### Sandbags for row cover

We use sandbags to hold down row cover over hoops in our beds. Typically, we only use row cover when the threat of frost or freeze is more than the crops can handle; it's not something we apply as a regular part of spring crop maintenance. So, when we need to get out row cover, it's usually pretty hurried. Keeping the sandbags stacked on pallets makes quick work of getting them out to the beds when it counts.

### Unloading pallets

Without a forklift, we've struggled with deliveries of palletized orders in the past. Since delivery trucks find

it hard to deliver to our property for logistical reasons, we often pick up shipments from a local terminal and have the pallets loaded onto our box truck, cargo van, or pick-up truck. At the farm, we then back up the fork to our vehicle and unload the pallet. For example, the pallet fork lets us purchase totes of potting soil and easily remove the pallet from the truck with the tractor rather than unloading bags by hand. Same goes for pallets of cover crop seed or soybean meal. This saves both labor and money for bulk orders.

### Harvesting storage crops

When it's time to harvest storage crops like beets, potatoes, onions, carrots, and winter squash, we put a pallet on the forks, lay out a row of empty crates on the pallet, straddle the tractor over the bed, and harvest directly into the crates on the pallet. When the bottom row of crates is full, we layer more empty boxes on top, and repeat the process until the pallet is full. We drive the pallet to our barn, unload it in the shade, and clean the veggies when we're ready. Alternatively, you can buy plastic, wooden,

or cardboard pallet crates in varying sizes and capacities that fit directly on the forks.

### General hauling

Our tractor doesn't have a front-end loader, so hauling has always been a challenge. Now, the pallet fork makes quick work of moving and spreading square bales of mulch on asparagus and other beds. It also facilitates moving silage tarps between hoopouses. Anything that can be stacked on a pallet is a perfect candidate. Loading unruly items directly onto the forks is also an option. We've used it to move big logs that have come down during storms.

We purchased our 3-point pallet fork from Agri Supply for \$290 plus shipping last year. A range of prices and options exist. Ours has a lifting capacity of 2,000 pounds and two-inch thick forks. Our biggest weight limitation is our tractor's hydraulic pump.

The next upgrade is purchasing a \$200 hydraulic top link to adjust the angle of the forks by tilting them up or down, instead of being limited to the range of motion permitted by the





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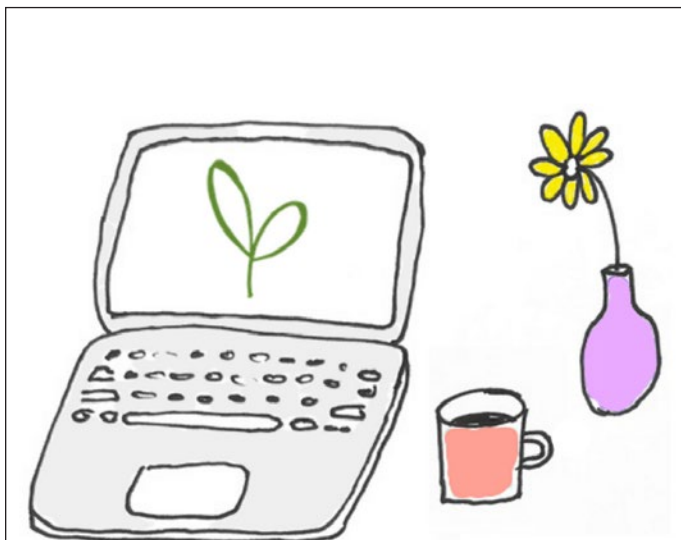


Staking eggplant without bending over for t-posts.

3-point hitch. Its uses wouldn't be limited to the pallet fork and could be applied to other implements.

Sometimes the simplest tools are the most useful. The 3-point pallet fork reduces lifting and saves time, making dreaded jobs easy and fast. It has already paid for itself many times over and is one of those tools we don't know why we didn't buy sooner.

*Emily and Mike own Three Springs Farm, a diversified, certified-organic vegetable farm in eastern Oklahoma. They cultivate more than 40 different crops and more than 150 individual varieties on three acres of land and sell primarily through their CSA.*



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# Favorite flowers from 2021



Left to right: lisianthus 'Rosita 3 Champagne,' celosia 'Celway Terracotta,' and ranunculus 'Romance Hydra.'

By Gretel Adams

Last year when we did multiple sets of trials, it was fun to see all the new varieties, but also hard to keep track of all of it. Taking photos through the season helps me to remember along with a Crop Planning note in our Evernote (an app for note-taking and organizing) that I share with our employee Emily who helps me with planning. We also started a

shared album on our phones for easier submitting of photos and data collection.

Let's just work through the season in order. In spring, we had exciting new additions. We used to grow freesia and brought it back last year, which was a nice plant to add back for spring holiday sales. We dedicated even more bed space to them. It's really one of my favorite smells on the farm.

Among other plants that were fun was buying in a lot of hellebore

Ice N' Roses series already in bloom from a wholesale nursery. We cut off of them right away, and then planted the plants for future blooms. If you haven't seen them, maybe that's because Martha Stewart talked about that variety and they are going to be hard to find. They are a nice upright facing flower head rather than other varieties we have that hang their heads down.

A couple of ranunculus varieties we tried that we really liked were 'Success Fragolino' (from Biancheri

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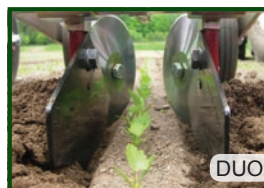
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At left is the author with an armload of celosia 'Red Toreador.' At right is celosia 'Celway Terracotta' drying. All images courtesy of the author.

Creations through Onings Holland), and 'Romance Hydra' (from Green Works through Ben or Ko at Zabo Plant). Both are the more expensive varieties as far as corms go, but the colors can't be beat. A lot of the specialty ranunculus sold out last year and is selling out fast for this year. So be sure to get your orders in ASAP for these spring flowers.

Last year we did an Association of Specialty Cut Flower Growers [ASCFG] trial of different celosias, and there were some real beauties in there. Instead of talking about all the varieties, since there will be a review in the ASCFG Cut Flower Quarterly, I will review the ones we liked best.

The Sunday series 'Bright Pink' Improved was one of our new favor-

ites, a much brighter color than the Sunday series 'Dark Pink' we have grown in the past. Sunday 'Purple' was a nice purple flower head with a green stem with more substantial of a bloom head than the feather types.

Other trial favorites were 'Reprise Velvet' and 'Act Diva' that were nice new red colors that dried into very dark rusty tones. This was a nice addition because we grow a lot of 'Chief Persimmon,' but it doesn't dry well for us or produce seeds. So, we like the celosias that are more multi-purpose.

All the yellow spike celosia varieties always seem to bloom earlier than other colors, so they get too dirty looking by the time we are in that patch harvesting. Although yellow was finally the color of the year, we

won't be adding any of those to the repertoire.

Not a part of the celosia trials, but new to us that we fell in love with were 'Bombay Pink' and 'Celway Terracotta.' They were perfect for those peachy-blushy tone weddings, and the 'Celway Terracotta' dries nicely, too, which has become an added bonus during wreath time. Another big hit with our florists and for dried was Ball's celosia 'Red Toreador,' which we got because in the past we liked 'Tornado Red' from Harris Seeds, but it was unavailable last year. See me in the photo with a large armload of these guys, which are great fresh or dried.

We typically grow some sunflowers for seed companies for the Cultivate show in Columbus each summer (the biggest horticultural show in the U.S. they claim). It's fun to have vendors come through the farm, only six miles from downtown, so they can see their seeds or plugs in action. See the photo for a layout of the Sakata vari-



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Digitalis 'Camelot' showing why it was one of the favorites in 2021.

eties. We really enjoyed the Vincent's 'Fresh DMR' and Vincent's 'Choice Summer DMR' (DMR is Downy Mildew Resistant).

If you haven't experienced downy mildew in your sunflowers, consider yourself lucky and know that it will probably happen if you have a cool or wet period within your sunflower production. Breeders are working on varieties that are downy mildew resistant to help growers with this issue, but some of the colors are a bit different from the parent varieties.

Popular with our bouquet makers were the sunflowers from Takii Seed called 'Ziggy' (a nice bicolor one) and 'Double Sun King' (a nice teddy bear one that didn't get too huge and had a nice stem strength). We were looking to simplify our sunflower selection to make it easier when we are direct seeding, but with these new options, we will be planning on some of these for the 2022 season to keep it interesting.

Cultivate, the horticultural show, also is how we get lucky enough to trial lisianthus for both Takii and Sakata, companies working really hard at breeding lots more lisianthus colors and series. 'Rosita 3 Champagne,' one of our favorites from the trial, is an actual champagne color like a

beautiful ivory, not pink and yellow like some champagnes in the lisianthus world. Sakata says this seed will become available to the general public this year.

Other nice lisianthus that we added last year from Grow'n Sell are 'Little Summer Orange' and 'Espirit Light Pink,' both early bloomers that were great in our earliest heated beds for production. The Madonna series looked like the Voyage series, so the Celeb series we grew was too similar to Voyage 'Pink' to add it.

But really all pink, peach, and blush ones are our best sellers — Voyage 'Champagne' and Mariachi series 'Light Pink' were good to add with the Corelli series 'Light Pink' and 'Arena Apricot.' The plug producers are branching out with their offerings, so it's nice to have more varieties available as plugs since we are still working out our methods of growing our own lisianthus plugs. Check out Petals Farm RI and Farmer Bailey for growers that are offering more options. I also hear Raker-Roberta's is

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Left to right are: dahlia 'Black Magic,' dahlia 'Lilac Time,' and hellebore 'Ice N' Roses."

planning to expand availability.

Some other summer and fall items that were nice additions were dahlias: 'Black Magic,' 'Labyrinth,' 'Robann Regal,' 'Jowey Veronique,' and 'Lilac Time,' which were available from Dutch suppliers. And from specialty growers like us at Sunny Meadows, Summer Dreams, Five Forks, and Arrowhead (among many others), we have added over the past couple of years: 'Valley Tawny,' 'Creamy,' 'Buttercream,' 'Bracken Sarah,' 'Bracken Palomino,' and 'Miss Amara.'

There are other varieties that are great ones if you are selling to designers: 'Peaches N' Cream' (not to be confused with 'Peaches & Cream'), 'Rock Run Ashley,' 'Rose Toscano,' 'Jowey Winnie,' and 'Crichton Honey.'

Last year our focus was to add more purples and pinks because we had a ton of varieties that were shades of oranges and red-burgundy. Each year our dahlia list is growing and changing as our goal as tuber producers at Sunny Meadows Flower Farm is to provide the tubers that are best for cut flowers and most highly sought after by our designers.

Fall flowers were different last year because we did not get frost here until November 3 (the latest it has ever been for us as farmers). This meant even our Hail Mary successions we do at the end of the season just in case were already done blooming before the frost hit. Even our dahlias had produced all they could and completely given up before frost came. So, we were grateful that we pushed some trial flowers into our heated and unheated space to expand

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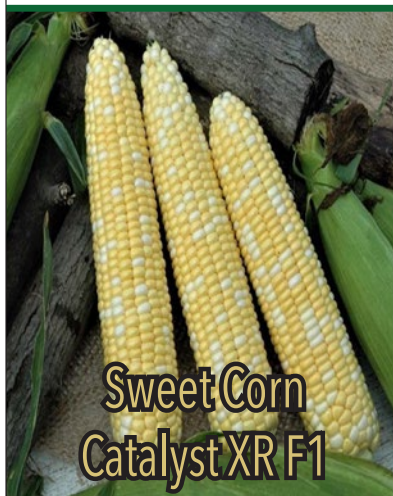
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Thanksgiving flowers.

We really expanded our marigold production last year as we were trying to hit Día de Los Muertos at the beginning of November for our Mexican community. We typically can't have them from outside for that holiday because of frost, so we had a lot of marigolds planted in our covered space. Coco, Babuda, and Jedi are our favorite series, but last year 'White Swan' was a great addition to have a nice cream marigold.

Other late flowers that worked post-frost: celosia, gomphrena and fall snaps. So, if you have space and you are thinking about it, you might as well try. In the fall, we finally hit fall stock for Thanksgiving, made possible by the Iron series of stock from Johnny's Selected Seeds. Also,

the 'Vintage Brown' was another good one from Johnny's, a nice color for holiday arrangements.

Plants that were a bust for us last year: asters, callas, oriental lilies. The flowers produced well but our market wasn't really buying them. So, please know that what I say bloomed great for us all depends on what your market wants. Every year what we are growing changes, that's what keeps it interesting. It's always fun to find a new variety that your customers love.

*Gretel & Steve Adams own Sunny Meadows Flower Farm in Columbus, Ohio. Follow on Instagram for more color and variety details: @sunnymeadowsflowerfarm, @flowerfarmette, and @flowerfarmer.*