1

Why Small Scale, Small Fruits?

The fruits of Paradise dangling down from green leafy bowers, so heavily laden they nearly touch the ground; flowers humming with honeybees and ripe fruit dripping sweet nectar in the sun.… There is something about *fruit* that conjures up these archetypal images, in ways that kale and radishes simply do not. Ancient Vedic and other histories tell us the Earth used to hand us Her bounty in much, much greater generosity, with little to no labor on our part, and no doubt we accepted it much more gracefully.[1] Today we must toil and sweat to beg Her fruits from those somewhat laden branches.[2]

Why small fruit growing?

Organic fruit is delicious, healthy, and *fruit sells*! Through a modest planting of small fruits such as berries, figs, and tomatoes, you can not only feed yourself but, if you're a market grower, you can stack your existing market table with piles of high-value colorful fruit. This alone can provide a strong customer draw and set you apart from other market growers. Strategically adding a small fruit planting to your market operation will increase your overall labor very little but will bring many benefits.

Likewise, converting your backyard from grass into fruit production is also a very rewarding process. As well as harvesting household fruit, there is also the viable possibility of marketing excess fruit—as well as the seeds, cuttings, and fruit plants themselves. These products are high value and in demand and can often be harvested from the same planting.

Although, in the first quarter of the 21st Century, widespread availability of USDA Certified Organic fruit in supermarkets is now fairly common, the quality is just not the same as locally grown and yet the price tag is still very high. Demand for high quality, ripe, hand-picked, local organic fruit is rising exponentially. This wide-open niche is there for the skilled, strategic market grower to fulfill.

However, I must advise some caution. Fruit farming is not something I would recommend most people take on as a full-time occupation. This book is not about becoming a full-time fruit farmer, nor is it about farming organic fruit on 50 acres. It's about equipping yourself with practical knowledge so you can understand how adding small fruits or berries to your market farming operation, starting a micro-growing operation on an acre or less, or just growing in your backyard for fun and profit can be done successfully. I have placed home and market growing recommendations in Part 2, after each individual fruit is detailed. The techniques and fruits described will work just as well in a backyard setting as on the small farm and will have you set up for success no matter your scale or purpose with growing small fruits.

How and where to start?

You can start growing small fruits just about anywhere there is good sunlight and a little land. Even containers on a sunny balcony can be used for tomatoes, passionfruit, raspberries, and more. The average backyard can produce an amazing abundance of fruit, with enough extra to sell for a side income. It's up to you to take the initiative and get started. If you have a small unused parcel on an existing market farm, you can start there.

I'll share a small fruit marketing story from 2014–2017, when my wife and I were vegetable market farming in Appalachian Kentucky. In March we planted about 150' (46 m) of row of fall (everbearing) Caroline red raspberries, divided into six 25' rows. Six months later we started bringing ½ pint clamshells of raspberries to our quiet, small-town farmers market with decent organic food demand, in Berea, KY. We marketed

them for $5 each, which was the current grocery store price. We could not bring enough. Every week we sold about $150–200 in berries, which at the time was a substantial boost to our overall weekly income. We also propagated and sold the plants, bringing in additional income. Picking the berries only took about 4–5 hours a week, which we did on the two days leading up to Saturday market (Thursday, Friday, and also Saturday morning). We carefully graded the berries by hand and chilled them immediately after harvest. We only took to market the A+ and some B+ grade berries (based on size and appearance). Picking earlier than three days before market would have been too long of a storage time and could have risked the berries molding. The other days of the week (Sunday–Wednesday) we picked the berries and sold those through other outlets (a health food store and our home delivery service). This brought in even more income. Also, note that the raspberries were *not yet even close to their peak production*; this was only season one and they were being grown on marginal ground. Had they been on fertile soil in their peak production, the yields would have been 2–4 times heavier.

Overall, it was a tiny expenditure of land (150' of row), capital (about $150 in T-posts and plants), and labor (4–5 hours a week picking and packing). And yet, during berry season (July–September) the raspberries boosted our income by some $600–800 per month. Not bad! There's no way a large commercial farm could get numbers like that on 150' of berries. A small planting like this could easily fit in many backyards and, I'm sure, a lot of you out there would enjoy eating homegrown raspberries and earning $800 a month in additional income throughout much of the summer, while providing organic fruit for your local community. Before we move into how to do it, we first should understand a few challenges to growing fruit and why small fruits make big sense.

Understanding current climate challenges

With climate change, you can be certain of one thing: uncertainty. Continually altering weather patterns make it necessary to be ready to deal with unexpected occurrences. These include lack of (or too much) rain,

colder (or hotter) than average temperatures, as well as altered spring warm-up times (often earlier). Below are some detailed accounts of how climate change events have affected our plantings.

In the winter of 2015–16 we experienced what some refer to as a "polar vortex" event, wherein our winter lows were about 10°F (6°C) colder than the extreme low for USDA zone 6: –10°F (–23°C) extreme low. Wind chill took it below –10°F. This affected marginally cold-hardy plants and some growers lost trees and plants.

In the autumn of 2019 to spring of 2020, we witnessed unprecedented climatic things happen in our local area. First, we had a severe late summer to early autumn drought wherein there was very little to no rain for about 8 or 9 weeks, with temperatures in the 90s (32–37 in °C) almost the entire time, and intense sun. That is not common for KY, although it had been recorded previously. Many half-century-old pine trees turned permanently brown, and many small tree saplings in front yards died also. By late September rains returned and then we had an unusually warm autumn. This delayed the hardening off (lignification or production of wood/bark) of many of our fruit shrubs and trees, which stayed very green into October. Then, all of a sudden, it dropped to 20°F (–7°C) one night in mid-October. This shocked and damaged these plants as they had not begun the process of hibernation, nor lignified their wood, in preparation for freezing weather. Winter set in shortly after.

Winter that year was mild, never going below about 10°F (–12°C: USDA zone 8 conditions, whereas it's normally Zone 6) with daytime temps around 40–50°F (4–10°C). Spring came on very early, with early March warming up to 70°F (21°C). Very pleasant, but far too early for it to be that warm every day in our region. With the early warm up, fruit trees and bushes woke up early. Our mulberries, jujubes, grapes, peaches, pawpaws, pears, apples, and most everything else sprouted leaves and flowered a month early. Then…BAM. Spring freeze down to 26°F (–3°C) in late March. Everything melted. The pears, peaches, and apples lost all their fruit, pawpaw flowers were fried, mulberries and jujubes were toast. After that, the plants started to *slowly* recover and more blooms came

out on the pawpaws, and fresh green leaves began sprouting again on the fruit trees and shrubs. Then, BAM. A late mid-April freeze down to 28°F (–2°C). Everything got fried *yet again*.

This second time, it proved too much. The deep stress of it all to the plants led to our first-ever infestation of Asian ambrosia beetles (*Xylosandrus crassiusculus*). This opportunistic little beetle takes the life out of struggling and unhealthy trees and shrubs of many kinds, including pawpaws. It senses ethanol,[3] which is a byproduct of trees that are stressed out. It's as if the stressed trees were waving a bright white flag saying "I'm weak and vulnerable and ill-adapted," and the ambrosia beetle is death's scythe as a response. Many fruit trees died in our local region, and on our farm we lost dozens of specimens. This devastating weather pattern affected much of the southeast, but Kentucky was hit especially hard.

Small fruits to the rescue

However, we noted which fruiting plants were *essentially unaffected* by all of this climatic irregularity: the blackberries, red and black raspberries, strawberries, *aronia*, figs, gooseberries, juneberries, blueberries, passionfruit, honeyberries; *all the small fruits were totally fine! Hmm…*

We observed all season that despite the late freezes, even during the time of full bloom for many of them, all the small fruit plants succeeded despite the extreme, unstable weather. We had amazing harvests of perfect blackberries, strawberries, raspberries, *aronia*, passionfruit, gooseberries, and more. As a positive side effect, we also had drastically reduced populations of stinkbugs, June beetles (*Cotinis nitida*), and Japanese beetles, all typically major fruit pests.

Around this time, I contacted a local fruit orchard about an 80-minute drive north of us, and I inquired as to the status of their crops. I was informed there would be *no apples, no pears, and no peaches in* 2020. Those fruits are their main crops and income drivers. What would they have available? Blackberries, raspberries, blueberries, and squash: *small fruits, to the rescue. Hmm…*

All of this gave me an opportunity to observe the resiliency of all these plants, and collect data. Everything in farming and gardening can be seen as feedback, if you're listening and observant. Remember that.

Once again in 2021, we experienced a similar yet much milder version of 2020 spring weather. Early warm temperatures and then late freezes once again destroyed most of our tree crops. No pears, almost zero apples and pawpaws. Thankfully our other tree fruits stayed dormant longer this time and were unaffected (persimmons, jujube). However, once again the small fruits did great and were apparently completely unaffected.

Why micro fruit farming?

There are different ways to approach this question. Are you already a market farmer or do you currently work 9–5 in an office, possibly under fluorescent lights? If you're already a farmer and you're asking this question, you're likely looking at how to make your operation more efficient, reducing costs and increasing yields, while introducing new products. Or, you could be an organic farmer who is (possibly) overwhelmed and looking to downsize your operation to a more human scale. You may be facing the potential of losing your land or a land lease will soon be ending. Maybe you're inheriting the conventional family farm and you want to make it work organically. You may be exploring transitioning to organic farming, or taking on organic farming as a career choice (or career shift). Maybe you just want to transition your suburban lawn into organic food and cash.

If you're new to farming (maybe you're that office worker mentioned earlier) and the sunshine, soil, and sky are calling you home, then micro farming is a great place to start (and maybe stay). Basically, micro farming is farming on a plot that is $\frac{1}{16}$ of an acre up to a few acres. For perspective, most modern US suburban lots range from $\frac{1}{16}$ acre to about $\frac{1}{4}$ acre. Older suburban lots in larger cities, divided in the 1950s–1970s were often much larger, often around $\frac{1}{2}$ an acre to 1 acre in size.

I remember those large suburban lots from when I was growing up in Louisville, KY. Specifically, I very fondly remember the abundance of

elderly World War II veterans who intensively cropped their large backyards for household self-sufficiency, having turned them into productive mini-homesteads. Although not usually or completely organic, they were growing their own fruits and vegetables. They often sold or generously gave away the excess, they saved their own seeds, and their wives canned enough for winter, all from their ¼–½ acre suburban back lot. Yet now, with the recent disappearance of nearly all of those quiet, humble heroes, so too have their abundant urban homesteads quietly reverted back to lawns.

Producing on this small scale is sometimes called *market farming* or even just *gardening*, but *micro farming* or, when in the city, *urban farming* better describes the intent of this kind of small, yet often highly effective operation and defines that you're selling product. It's the *human scale farm* that worked effectively for millenium after millenium before the advent of industrial-era mechanized farming and agricultural chemicals. Beginning in the late 1800s farming was able to displace people power, going beyond human scale to an artificial industrial scale. Entire books have been written on this tragic turn of events with its profound implications and global repercussions.

A major draw of micro farming is that, depending on the type of operation, it's reasonable that one physically fit, youthful person can farm fresh produce on ¼–½ acre of land, sometimes more, by themselves, given proper tools, training, strategies, and experience—and without a riding tractor. Any size more than that rapidly starts to become overwhelming and unproductive, unless more hands are brought in. Two fit, trained people could handle about 1 acre of produce by hand, and maybe more if we're talking about growing fruit trees, berries, and shrubs.

This may not sound like much, but it's been showcased by many modern growers such as Elliot Coleman and, more recently, Curtis Stone and Jean-Martin Fortier, that this is not only efficient and highly productive, but also potentially highly lucrative. There are reports of $20–100k+ *per acre* being earned doing skilled micro vegetable farming, when combined with strategic marketing and a receptive, middle class or wealthy customer base. Compare that to the conventional farming forecast of

$500–2000 per acre for industrial monoculture crop returns (soy, corn, hay, etc.)

It's important to emphasize that a diversified organic farm (polyculture) does not necessarily have to be "micro" in size—they'll work on virtually any scale. But this book is focused on small scale, human powered, micro agriculture with minimal machines and inputs.

I've thus far mostly been referring to micro *vegetable farming*, which has quick yields (several months) and rapid returns, and high net profit potential. *Fruit growing* is different because yields take longer to come back. Berries and other small fruits take anywhere from 6 months to 2 years to produce profitable yields, fruit trees take 5+ years. However, the labor requirement for fruit is also much less intensive than vegetable farming. For instance, vegetable farming requires near constant replanting, maintenance, and harvesting in order to stay sufficiently productive and highly profitable. Also, weeding, marketing, strategizing, checking crop progress, pest control, etc. are all very time-consuming and laborious work. There is all of that involved in small fruit growing but in general it is much less intensive, and is concentrated into certain events, mostly as the fruit ripens.

Fruit often ripens all at once or within a few weeks, requiring only a brief harvest period, unlike greens or cucumbers which must be picked several times per week for months at a time, or entire seasons. *This aspect makes micro farming with fruit attractive to people looking to farm part-time* while keeping a part-time (or full-time) job, or retired people looking to stay occupied but not slammed with intensive vegetable farming and bustling, demanding farmer's markets. Fruit plantings can also be added into an existing micro farming produce operation to add diversity, interest, and income.

Micro farming is suitable for people on a low or fixed income, as it does not necessitate the purchase of large acreages of land on which to farm, or expensive farm machinery such as tractors, or huge investments like barns. Micro farming can be done in a large sunny backyard, on other people's land, leased land, etc. You will need to invest a modest amount of upfront capital to get started: quality tools, plant material, fertilizers,

and some basic, very affordable equipment (such as trellis posts, bird nets, or irrigation lines), as will be covered in detail later on. But it's reasonable to say, if land is already in possession (or leased, etc.) than one could get into micro farming fruit for a few hundred to a thousand dollars, depending on scale, and maybe much less if you have more time than money and plenty of patience. We'll be exploring this in detail.

Limitations of small fruit growing

It's important to understand the limitations of growing small fruit versus vegetables, for profit. Intensive vegetable production, per acre, is likely always going to become profitable faster and, in general, will be more profitable than growing small fruits. Vegetables produce more sellable mass than small fruits and mature rapidly. Vegetables can be rotated and grown year-round, or at least most of the year, while small fruits are usually only harvested once per year or at most six months of the year. Vegetables are also easier to harvest, process for market, and transport. People and restaurants spend more of their food budget on vegetables than fruit.

This being said, small fruits are still a high-value crop and can *enhance your existing market operation* by adding interest and diversity, and could serve as a niche crop for an enterprising grower as well. Even in your own backyard, you could potentially make thousands per year converting your lawn (or neighbors' lawns) into high value berries, figs, or tomatoes, etc.

The labor to establish a small fruit planting is a one-time, yet long-term proposition, whereas annual vegetables must be continually replaced and replanted every few months. Small fruits are less ongoing labor, are perennially productive, are less common and higher value (per pound) than vegetables in most local marketplaces.

Maximize profits by being the workforce

One of the factors that makes micro and small farming potentially so profitable is that it's "human scale"—powered by people. That allows you, as the owner/operator, to perform most (or even all) of the labor

yourself. Therefore, you don't have to pay anybody for labor, which is typically the largest annual small business expense by far.

University publications on crop profit potentials always seem to assume you're hiring all the labor out. Why? Hiring labor out is sometimes necessary, but can really eat away at any farm profits pretty fast. It's best to size the operation, at least when starting out, so that you (or you and your family/partner/etc.) can do 90–100% of the labor yourselves. This can be tough, sometimes extremely demanding, but is better than working a 9–5 job you don't like with a boss and coworkers you'd rather not work with. As a bit of personal advice, I can tell you it's usually not the best idea to enlist your girlfriend or boyfriend into your small business as free labor, and only slightly better to do this with your spouse. It may be fun and enlivening at first, but in the long run it's a great way to cause a lot of deep stress on the relationship. A family dedicated to farming or running a family business, however, is a different story, yet not very easy either.

The future of small and micro farming

Micro farming is not a passing fad or something "real" farmers don't do. It will absolutely be a major part of the future of global food production and farming. Micro farming will gradually take precedence as the insurmountable burdens of unpayable farm debts, exorbitant mega-equipment costs, increasing age of the average farmer, fluctuating and unstable global markets, soil erosion, water shortages, super weeds and super insects/diseases/viruses gradually bankrupts and cripples the Industrial model of extreme input, mega-sized, mono-crop farming. Micro and small farming is the model many in third-world countries and less affluent areas are taking on, reverting to (or modernizing to), as they see the Industrial mega-farm model already failing them and their neighbors. Take part in the future of farming while feeding local people and earning a right-livelihood—right where you are.

2

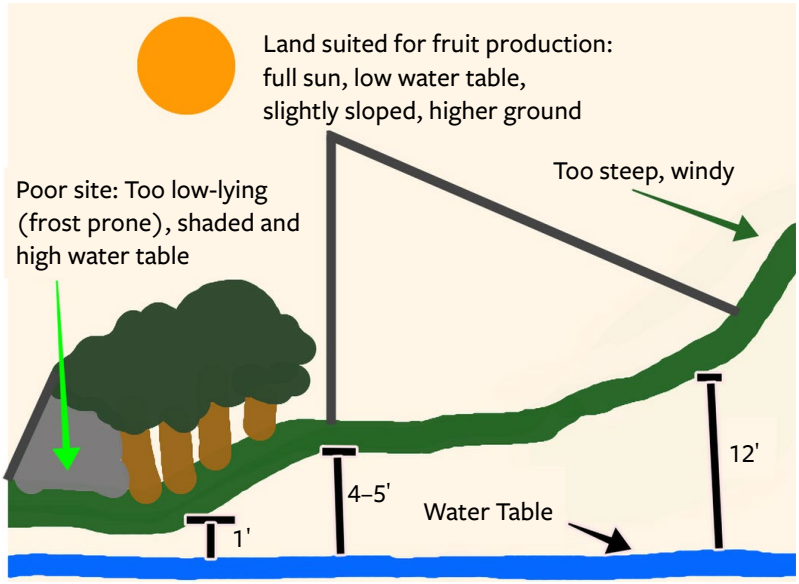
21st Century Strategic Planning

Planning it out

To start, you will need to have a conducive, suitable site for growing fruit. It needs to have the following basic parameters:

1. Full sun (strong, direct sun exposure) for 8 hours minimum; 10+ hours a day is best. It must be direct sun and not filtered or obstructed by trees, etc.
2. Good drainage of water and cold air (ascertained through observation).
3. Low enough water table (at least 18–24" (46–61 cm) below ground for small fruits, 3–4' (0.9–1.2 m) for grapes and trees). Test this by digging a hole on the site at least a few days after a rain (digging with a post hole digger is ideal). If you hit water, you are likely encountering the water table. Measure how far down it is. If you dig down 2 ft. (0.6 m) and do not encounter water, the water table is likely low enough for small fruits.
4. Some protection from wind and access to irrigation water.
5. Nearly level or sloping ground is best but slightly steeper slopes can also sometimes work.

If these parameters are not met on your site you need to find another more suitable site, or you could grow in large raised beds or containers. Raised beds are described in Chapter 4.



Start planning your fruit planting about six months to a year before you want to start. This way you can thoroughly research it for a few months, plan it out on paper, consult with regional authorities, perhaps visit other growers, and survey your customer base and local markets. It may take some time to do this, so do not rush it. It's best to have an order for plants ready and placed by autumn or early winter before nurseries start selling out for the following spring. Spring is the best time to plant most small fruits.

Although this can be an exciting endeavor, *never rush it*. I used to rush things. Through rushing and being impatient and overly passionate I met with lots and lots of unnecessary, expensive failures and very frustrating lessons. If you're *all of a sudden* inspired to plant strawberries and it's June, it's likely *just too late*. You don't want to get off to a bad start and have to dig up dead plants, wasting your time and resources, including emotional resources. Just wait till next year or next season and do it right, in the proper timing for your local area.

Species selection

The first step in the strategic planning process is to create a list of what you'd like to grow. Write down every small fruit you'd consider growing and why. Example: blackberries for the You-Pick, figs for side income, tomatoes as your main cash crop. What you're essentially doing here is contemplating what *species* you're interested in and why.

After that, you'll have to make sure the species you're interested in will not only *grow* but survive long term *and* produce adequate crops in your area. Just because you live in a compatible cold hardiness zone (say USDA zone 6) and blackberries "thrive in a zone 6 climate" does not mean you can grow blackberries successfully in your area.

For instance, here in Kentucky, cherries are fully cold hardy and *grow* just fine; the *trees* that is. However, in KY it's too wet, humid, and frosty in the spring for reliable, marketable cherry production and many years the whole crop rots on the tree. If you failed to do your research and planted "zone 6 compatible" sweet cherry trees in KY, you'd be facing eventual crop failure and be out of resources, time, space, etc.

So, *species selection is crucial* and is the first criteria to carefully research to see what is possible in your area. Also of vital importance is what species are *marketable and in demand* in your area. Let's look at how to best find answers to these questions.

How to research

In today's world, what passes for "research" often means googling and reading a few online articles from random sources and then coming to a speculative conclusion based on the culmination of that minimally sourced, questionably factual, and often highly biased information. That's not really research or, at least, not effective research. Recently there are many online articles about growing fruit that are actually a form of disguised advertising created simply to sell nursery plants or products and are often full of gross inaccuracies, false hopes, and oversimplifications.

If you want to be effective in your research you have to utilize a diversity of reliable sources of information, far beyond reading a few online articles. That means studying articles published by university agricultural departments, consulting with authorities on the topic, visiting people actually doing it, and studying quality books written by experts on the topic. Also, your local agricultural extension office is often a goldmine of information, which we will discuss in a moment. Through this holistic process of research you can most effectively be educated on what you're wanting to do.

Let's say you read online that 'Bluecrop' blueberries are "good for organic growing and high quality" and you're considering planting 100 of them. First, you must ascertain: is 'Bluecrop' recommended by your local agriculture extension office? Is it grown and marketed locally? Does the local You-Pick grow this cultivar? Does your local university say anything about it in their blueberry research papers? When is its approximate ripening date? Does it bloom too early for your local climate? Is it susceptible to local diseases and insects? Is it cold hardy enough for your area? You have to carefully research ALL these things from accurate, reliable sources, not nursery catalogs or random online articles making claims. Otherwise, you may invest a lot in something that does not pan out in your local area.

Begin with your local agricultural extension office

People make the big mistake of trusting their conclusion based on a rapid *google search* and not utilizing their own tax dollars by contacting their local agricultural extension office, the one that they did not even know existed nor know that they were financing. If you want to google, google your local ag extension office first! Most, if not all counties in the US and many areas of Canada, Australia, and Europe all have useful agricultural government departments open to the public.

Your local ag extension office can provide crucial and accurate answers to questions like, "*Will strawberries grow in my local area*?" and

"*What is the soil type on my site?*"[1] They will usually have available resources such as: locally based growing guides, marketing information, and lists of scientifically tested, proven productive cultivars for your specific area. Nice! This is far, far, better than googling "how to grow strawberries" and "best strawberry varieties for Texas" and trusting that some random article is totally accurate—*risky business!*

So, start your research with the ag extension office and generally you should trust their information. If they tell you "Strawberries will not grow in this county or are not able to be grown here profitably" then maybe forget about it, or do a very small trial of some promising cultivars and see what happens. They are basing that information on years of scientific field trials and research. Don't go into an endeavor thinking you're going to prove them all wrong or prevail against all the odds. I've seen a number of people attempt that sort of thing, and it usually fails. That's not the point. You're not out to do the impossible or beat the system. The point here is to produce healthy, local organic food and make right livelihood income, and your ag extension office is there to assist, not hold you down. In addition, they can provide soil testing and also applications and assistance with applying for *agricultural grants* that could be extremely helpful for you.

Seek out local growers and experts

Remember, just because you've "seen it growing" does not mean that a product is *marketable or in demand*, or will produce marketable yields in your area. You have to research all of this carefully and also talk to knowledgeable local people.

If the local office does not have pertinent information about what you're wanting to grow, the next best approach is to seek out local growers and try to consult with them, or visit their operation (perhaps posing as a curious customer) and try to get as much info as possible on what and how they do things, especially the cultivar names of their fruit species. Do an online search for local fruit farms, You-Picks, and growers,

and talk to local co-ops and health food stores to see who they're buying from locally. They don't have to be organic growers to provide useful local info.

Also check into local grower seminars, grower associations, and workshops. These can be excellent places to meet other growers, network, and learn crucial information for growing in your local region. If no one in the local area is growing (or has even heard of) what you are considering, that is a "red flag" that you might be trying to swim upstream. Perhaps what you're thinking about is nearly impossible to grow locally or your local community has little to no interest in the product itself. This is useful feedback, especially for market growers, and should be carefully considered.

Local or regional botanical gardens are also great places to explore, as they very often have locally adapted fruits growing and usually have cultivar labels so you can see yourself what's thriving and how it's being grown. Contact them and inquire.

Survey your customers and observe the local market

If you are already a market farmer, survey your customers in person or online: "*What fruits would you be most likely to buy from us: strawberries, blueberries, blackberries, figs…*" Their feedback can help you target what would be most in demand, or just go with what is obviously in high demand. Also check local saturation levels at your market. If five other growers at your market are already bringing strawberries, you might want to bring something no one else has. If they are all conventional producers, you may be able to fulfill the demand for organic strawberries.

Investigate what small fruits the local health food stores or co-ops sell that are being imported from out of state. Could you grow that and provide it locally? Would they be interested in local organic product? Inquire.

Evaluating agricultural profit forecasts

Over years of studying many university and extension office documents on growing and marketing various crops, I've noted the dismally low and even somewhat pessimistic profit estimates they often calculate.

For instance, the University of Kentucky forecasted in 2017 that a 96' × 20' high tunnel growing tomatoes could annually earn you about $850 after expenses, including labor.[2] This abysmal number suggests a few things. First, the profit forecast is assuming the tomatoes are being sold for only $2 per pound, which is on the low side for direct marketing. Second, this number is not considering organic production and pricing. Third, for some reason these publications always seem to assume you're hiring all the labor out. If you're doing most or all of it yourself or within your family, then that profit estimate just got a lot bigger.

A local Amish family farm out here in central KY have a high tunnel nearly the same size and, according to what they told me, they're making about $3000–4000 annually on the conventional (non-organic) tomatoes produced in it, and that's selling wholesale for about $2/lb. on average. They perform all the labor themselves and sell at the local Amish-operated produce auction. They spray with organic fungicides. And, their numbers are far better than $850 per season per tunnel, almost 5× as high.

To be quite frank, it's wise to always estimate on the low side for profit margins when making calculations and estimating yields of crops. But do not let the terribly low profit forecasts of the conventional methods scare you away. Through organic production, doing most of the labor yourself (at least to start), engaging in strategic direct marketing, and making a name for your operation, you can easily smash these numbers and do much, much better.

To reevaluate a net profit forecast such as the UK tomato growing profit estimate mentioned above, first look at your own actual expenses. Do you already have a high tunnel? Are you/your family doing all the labor? OK, scratch off those two expenses. How much can you reliably and factually charge for organic tomatoes? Insert that number. Assume

that, if you are a new grower, you'll get 20–50% of the estimated yield. If you are quite skilled, assume 75–90% of what is estimated. Remember, marketable organic yields could be lower, and in this particular example they are assuming you're growing extremely productive hybrid cultivars (such as the ones the universities would recommend). Their estimate is also assuming that you are spraying the crop with fungicides and insecticides. You *can* utilize organic approved spray products *and this is highly recommended, especially in humid climates*. If, instead of productive (non-GMO) hybrids, you're planning to grow lower-yielding open pollinated or heirloom cultivars, you can cut the yield estimate in half right now. Calculate these numbers together (yield estimate multiplied by price per pound, minus expenses) and you can get a close net profit estimate of what you could expect. Be conservative.

This is also an example of why cultivar selection is so important. If done strategically, it can drastically raise your yields and marketability. With the example of tomatoes, cultivar selection can double or triple your yields and also will determine your end product and marketability in general (e.g., cherry tomatoes or large slicer tomatoes). Hybrids almost always yield the most product by far.

To evaluate the gross profits from other crops, you'll need to know how much yield you can expect in your region and how much you can realistically sell it for. Factor in associated costs of nursery stock, labor, supplies, establishment costs (labor, equipment rental, irrigation lines, high tunnel, etc.). Subtract those costs from your gross profit estimate to get your net profit estimate. It will give you an idea of what's possible.

Understanding your bioregion and regional climate

Next, in order to be an effective grower, you'll have to understand the specifics of your geographic/climatic bioregion, *down to the particular microclimate of your site.* If you have not already, you'll need to observe, explore, and get to know it. Learn by association with other local/regional growers, *over the course of many seasons.*

No one can accurately say that in order to grow good blackberries,

you toss them an ounce of 10-10-10 fertilizer every April for great results. Your soil type and micro climate can vary subtly yet crucially from someone even 20 miles away and you'll eventually learn how these small differences can make wide variations on the way species and exact cultivars perform. Temperature variations of 5–10°F (roughly 3–6°C) in winter from one nearby location to the next (even the top of a high hill to the base) can allow certain fruit species and cultivars to be either fruitful or killed outright in winter. Winter warm-ups like we have in the Mid-Atlantic region can spell doom for some cultivars and entire species, such as early-blooming apricots and almonds, and 'Pakistan' mulberry, and yet hardly affect others, such as the cold hardy 'Illinois Everbearing' mulberry and most other small fruits.

"Bioregion" here means the combination of a number of important factors, which include specific soil types, average and seasonal precipitation, local plant and animal life, winter and summer high and low temperatures, and local seasonal weather patterns (e.g., summer droughts, monsoons, mild year-round temps, extreme summers, etc.) Most regions have names. Our general region in Kentucky is the Bluegrass region. This region is noted for especially rich soils, epic pastures, lots of waterways, and hilly, limestone-based terrain. Broadly speaking we are in the Mid-Atlantic/Upper South with a Continental influence. This means we have fairly long, hot, muggy, usually moist summers. Here it's very lush and green and jungle-like; we generally enjoy rich clay-based loamy soils, fairly high precipitation (~40 inches or 100 cm per year spread evenly across the entire year), lots of wildlife, lots of humidity, and also very high insect pressure. The Continental influence makes our winters significantly colder (by about 5–10°F or approx. 3–6°C) than other nearby but more ocean-moderated places like Virginia or Maryland.

It's important to thoroughly understand the implications of your bioregion, especially because many of you will be farming in regions you did not grow up in. For example, most of California experiences a practically rain-free, warm to hot summer growing season with low humidity (basically March–October) and moist, very mild winters that hardly

freeze. Conversely, in Kentucky, summers are usually fairly moist and very humid, and winters are moderately cold with lots of subfreezing, sometimes severe weather and drastic temperature swings. These (drastically different) regional factors exert major influence on your choices of viable species, adapted cultivars, farming techniques, timing of planting and harvest, etc. Your local ag extension office will help you understand and navigate these nuances, as will talking with other local growers and doing lots of in-depth research on your bioregion.

Hardiness zones

All U.S. regions are entirely mapped out according to their average *lowest temperatures*. In the USA this is called the USDA Hardiness Zone Map. There is a similar system in Canada and most other parts of the world. Each area is designated a number. These numbers correspond to the average "lowest possible" temperature for each zone, with a 10 degree difference between zones. For instance, in central Kentucky we are in zone 6, which means that the maximum extreme low temperature possible is –10°F (–23°C). That means that, on occasion, it has been recorded that the temperature in central KY can go down to –10°F. Yet, in extreme winters like we had in 2014, there were a few severe days of wind chill down to –20°F (–29°C), possibly colder. This is important to note. Usually, the extreme low temp is rarely reached but has been recorded.

Understand that your hardiness zone number is a *basic reference point* based only on winter low temperatures and nothing else, and utilize it as such. Other factors such as summer temperatures and conditions, winter chill hours, first and last frost dates, annual precipitation, etc., make a deeply substantial impact on plants and on agriculture in general, and are very important to consider.

For instance, parts of Washington state are in "zone 6," but those areas are more like highland deserts than the moist, humid, verdant pastures of "zone 6" Kentucky. Just because both areas are "zone 6" does not mean that what thrives in zone 6 KY will thrive in zone 6 WA and vice-versa, but many people out there assume this. Likewise, parts of

New York state are "zone 7," yet conditions are *very* different in "zone 7" New York from conditions in "zone 7" Alabama—namely, with respect to summer high temperatures, length of growing season and humidity, as well as local pests and diseases. Thus, there are serious limitations to blindly relying on Hardiness Zone maps to guide your decisions, yet they are an important basic starting point and tool to understanding your area. Research your region thoroughly and discuss it with local growers!

Reading and utilizing weather predictions and data

There are many online weather forecasting services out there these days. You might have a favorite one already. Personally, I utilize Weather Underground (wunderground.com). Many other good and free weather services are out there.

Their forecasts are shockingly accurate and created by bringing in data from thousands of localized mini weather stations across the USA and beyond. You can choose the station you want data from (or even get one installed on your farm!). Chances are there is one not too far away from you. Make sure the station you're drawing your data from is as close as possible—the website may automatically choose one for you that is not as local (and thus applicable) as others.

In general, I have found that our farm seems to get 1–3°F colder in winter than is usually predicted. This can make a substantial difference: 33°F is above freezing, 31°F is not!

Weather Underground, and likely others, also offer a History feature where you can see the temperatures for any day going back decades or longer. So, you can track your weather patterns, see general trends, look for climate change patterns, and see if your local climate is much different than it was in the past. Also, it has very clear and exact data on predicted precipitation, wind speed and direction, etc. As you progress in your fruit growing this data will be important, as it can help you make important decisions, such as when to open or close high tunnels, when to cover plants, when to plant, etc. Also, try to observe other local phenomena to hone your own intuitive sensitivity. For instance, I can hear

distant train whistles when it's going to rain soon. The pressure change associated with incoming rain gives me mild headaches sometimes. Also, the lowest point on our land begins to be blanketed in frost hours before anywhere else, signaling a very cold night ahead.

You should also install accurate digital thermometers, especially ones that record the lowest and warmest temperatures detected. You can also get thermometers that send data to your phone via an app, which can be useful. That way you can track your local conditions and compare that to your forecasting info and see general trends on your land versus what your local weather station reports. Stick to one weather station and website, don't switch around.

Choosing cultivars

Eventually, in your planning process and research, you'll have narrowed down what species are viable in your area and best for your marketing plan. So, what regionally appropriate *cultivars of your chosen species* will grow best? This crucial question can literally *make or break* your operation or planting, of any size.

Cultivar selection is key to success because only specific cultivars of a species will be adapted and thus thrive in any given area. Other cultivars that are not adapted will completely or mostly fail due to vulnerabilities to local conditions such as winter low temps, frost dates, pests, diseases, etc. This is true for virtually every food plant in the world. Additionally, you need to ascertain whether your chosen cultivars are not only adapted but will also produce tasty and marketable fruit in your region.

Importance of cultivar selection

A "cultivar" is a cultivated strain (often erroneously called a "variety") of a plant. 'Golden Delicious' and 'Granny Smith' are two distinct cultivars of the species *Malus domestica* (apple). Cultivars are so *specific to region*, and *vary so widely*, that some will thrive and give bumper crops one place, and fail to yield in another. So very carefully research and decide

what cultivars to plant in your region. You can start this research by contacting your local ag extension office for recommendations. Research what cultivars the local orchards, local fruit growers, and market farmers grow. Check online fruit growing forums and ask questions. Remember, if you are marketing fruit then backyard grower recommendations might be useful but may not be the best choice out there.

To illustrate the importance of this, I once read a book by an organic farmer in Los Angeles that left an impression on me. He said he made the mistake of buying fruit trees based on lovely nursery catalog descriptions such as "the highest quality," "excellent production," etc. He bought a few dozen of these peach trees and planted them out. In a couple of years, the trees matured and began to bear a crop. As the green, immature peaches swelled up with juice his anticipation grew. As the green peaches sweetened, ripened, and matured to the picking stage, and yet stayed *green peaches, never turning orange*, his anticipation turned to horror. He couldn't sell *green peaches*; no one would buy them, regardless of how sweet they tasted. Especially not in a super competitive market like in LA! In his region that *specific cultivar* of peach does not color up due to temperature or some other factor. He ended up selling them all as dried peaches to minimize losses and, disappointed, he tore the trees out. It was a waste. Don't let it happen to you. This is an example of a mostly regionally adapted cultivar but one that is not marketable (in this case due to coloration). Other cultivar issues could involve a tendency towards perishability, splitting, poor taste, etc.

Due to the rising numbers of new, mostly backyard, growers, cultivars are nowadays often designated by nurseries into variations such as: disease-resistant/good for home growers/commercial varieties. As a market farmer, you will often want to focus on the first two categories. Commercial cultivars are often productive but the quality may be lacking and they may be susceptible to disease, as most growers rely on synthetic fungicides, etc., to produce the crop. If a commercial cultivar is reliable *and* disease resistant in your area, then it may be good for your purposes.

But if the quality of the final product is not great, customer interest may be lackluster. Flavor is important and is one of the major draws of localized food production in general.

However, you do not need to focus on heirlooms or old varieties with "supreme flavor," etc. Flavor is important, but so is production, resiliency, and reliability. Many newer cultivars have it all, as many breeding programs (thankfully!) are starting to focus not only on production but also on developing better flavor and some amount of disease resistance. Some older cultivars may produce high quality fruit and be very resilient, however, hybrid cultivars are important and will continue to play a major role in the future of small farming and global agriculture. There is nothing wrong with growing hybrid cultivars or even hybrid species (such as modern strawberries and blueberries). These can often prove super productive and very high quality. Hybrid fruit cultivars are not GMO. A hybrid is, simply stated, the offspring of two open-pollinated cultivars or species. This creates a new cultivar (or species) that often will express high vigor and production. As of this writing, no GMO small fruits even exist,[3] except for a couple of tomato (and pepper) cultivars that you won't have access to anyway. So don't worry on that score.

Most of all, *regional adaption* is foundational. If a cultivar or species is not adapted to your region, then yields will be zero. You have to do your homework! The ag extension office can help with this. Also, never call a nursery in another state and ask them what will grow in your area. Nursery customer service employees are not nationwide fruit experts and they will usually give you very generic recommendations based on USDA Hardiness zones and this can rapidly steer you in a very wrong direction. You have to do the research yourself and do it well!

How many plants?

So, now we've come to this point in the planning process—narrowing down your bioregion, *check*; viable species, *check*; cultivars that will work, *check*.

Next, you'll need to calculate how many row feet you want to plant to a given fruit and how many plants that will take. Unlike what many

online articles might suggest, it's surprisingly unreliable and difficult to ascertain how much profit can be made based on row feet, or square feet, of a crop. There are simply too many real-life variables. That includes your skill level as a grower, your soil type and health, growing season, regional climate, specific cultivar of plant, price you get for the product locally, seasonal climatic variations, if you're hiring labor out, etc. There are also seasons of average yields, bumper crops, and crop failures.

Again, visit a regional grower of a crop you want to grow and try to get as much info from them as possible, perhaps by posing as a curious customer. You could ask, "How many row feet or acres of (x) do you grow? What are your yields?" Then, with the data on price per pound and their yields, you can calculate an approximate yield/row/price. Or, if you start a small planting of, say, raspberries, you can plant a 100 ft. row and calculate using your own data. If you make a $1000 profit on the 100 ft. row, and could obviously sell much more than you produced, then it's reasonable to think that if the row footage doubled, and everything else stayed the same, the profit likely would double too. This has limits as the Industrial business model has historically shown us. Exponential growth creates a need for exponential labor, resources, and market, and that is impossible because we live in a finite system with limits. But, you're a market farmer (or backyard grower) so you're probably not interested in planting a hundred acres anyway.

If you are consulting with an ag extension office, they will assume you'll be using a tractor to mow or cultivate between rows of plants. So, row spacings (as well as fruit plants per acre calculations) will be based around fitting a tractor comfortably between rows. Your rows can usually be made much closer if you don't plan on using a tractor.

Generally, always run rows of plants North-South so the plants get maximum and even sun exposure on all sides. In some regions such as excessively dry or hot ones, this may differ, so check with local growers.

Don't plant rows or plants too close or they will shade each other out and lead to lower yields or other issues such as diseases. Around the height of the crop itself is a decent approximate measure of row distance if no information can be found. So, if raspberries are on a 5' tall trellis system,

about 5–6' between rows should work. It's better to make rows a little wider apart than necessary than to crowd them together, as mentioned earlier. Crowding reduces sunlight access, airflow, work space (including harvest tubs, crouching farmers, wagons, etc.) and this creates frustration, causes plant diseases like fungal infections, increases populations of fruit flies like Spotted Wing Drosophila (herein referred to as SWD), and lowers yields. Likewise, excessive spacing is a waste of space, requires more maintenance in the form of mowing, results in less efficient workflow and lower yields, etc. Don't guess on this, research exact spacing and note what other growers are doing.

To calculate how many plants you need per row, *count how many row feet* you intend to plant and *divide it by the distance between plants*. For instance, if you're planting a 100' row of red raspberries and planning on 2' between plants, then divide 100 by 2 and you get 50 plants. Simple enough.

Pollination

This is an important topic that warrants your attention. Bees are a hot topic right now, due to their decline (many species, not just honeybees). Whereas in 2022 the honeybee fad is turning around and people are questioning the merits of the "exotic imported" honeybee, the fact is that honeybees are not only extremely important but originally native to North America.[4] However, controversy aside, all bees are important and matter. Especially when you are growing organic small fruits!

Honeybees do a great job pollinating many small fruits (blackberries, raspberries, etc.) However, you may not be able to raise honeybees, and honeybees are not very active in cool, moist weather when some small fruits bloom. Other bees and pollinating insects can do a great job ensuring your yields are high, if you allow them space to exist and some habitat. The best habitat is "shaggy", unmowed, and left alone areas with lots of native wildflowers. Allow the wildflowers to finish their lifecycle and do not tear down the dead plants until late spring (or not at all). They may contain pollinator or beneficial insect eggs! Even just a few "shaggy"

square feet in the corner of your backyard can help if that's all you can spare.

Mason, sweat, carpenter, and bumble bees are all excellent pollinators, as are many types of wasps. We raise plenty of honeybees but also build simple little houses for the native bees. Some bumblebees nest in the ground. Don't kill wasps or carpenter bees. In this way, you can ensure good pollination of your crops. And, if you raise honeybees you'll have other highly valuable and marketable goods: honey, wax, propolis, nucleus colonies, etc.

A repurposed milk powder can, some hollow bamboo canes, a piece of hardware cloth and some old rope have created a sanctuary for wild bees, in minutes, for pennies. All the mud-capped tubes contain native wild bees/eggs. Kept under cover and protected from woodpeckers (via the hardware cloth screen), these houses help attract and keep pollinators around.

Summary

1. Do your research thoroughly. Decide what species you want to grow. Base your decisions on your local climate and region, your intended purpose, what the local market is doing, and what's in demand locally.
2. Consult with your local agricultural extension office to understand if your species will work in your area, and find out what cultivars they recommend. Talk with other local growers. Research university publications on the topic.
3. Understand how to estimate your potential profits and yields before moving forward.
4. Understand your local bioregion and climate. Explore your planting site carefully and understand your soil type, local weather patterns, and growing conditions. Choose cultivars based on this data and local recommendations.
5. Calculate how many plants you're going to need for the planting.
6. Facilitate, protect, and nurture pollinators, including wild bees and wasps by creating and protecting their habitat and nesting areas.