

ZipGrow™

Best Crops For Hydroponics

A Reference Guide For Modern  
Farmers

**ZIP** GROW™



## Purpose

The decline of the family farm and the advent of hydroponics has changed the shape of farming. Hydroponic techniques often require different crop conditions, and when conditions are different, management is different.

This guide is written to help you optimize your growing conditions and practice to grow crops better than ever before.

Use this guide to build a crops list; compare the ideal pH and EC ranges, imagine the labor involved in planting and harvesting; and always feel free to pick up the phone and give us a ring.

You can reach the ZipGrow™ Inc Team Monday - Friday 9-5pm EST at: 1.855.947.4769.



## Difference Between Crops

### Environmental Needs

Growers benefit from new technology and resources by being able to grow almost anything, anywhere. All they need to do is choose crops that can grow together in the environment they choose.

There are some tricks for growing dissimilar crops in the same environment.

FOR EXAMPLE; Differences in irrigation needs can be solved by plumbing your system with valves on each section to control irrigation, timing, and pressure for independent sections. A grower with rosemary in one section can turn the valve onto that sector for a few hours a day, but still water fennel or lettuce on a constant drop by controlling the valves on those crops' respective sections.

### NPK Ratios

Greens	8-15-36	Lettuce, Chard
Herbs	2-3-8	Rosemary, Basil
Flowering and Fruiting	2-9-19	Strawberries, Tomatoes

## Reproductive Cycles

The reproductive stage of a plant's life cycle is cued by age and environmental values like heat and light. You can steer your crops to or away from these life cycles by pruning, and by adjusting light ratios, and temperature.

For most greens and herbs, reproductive growth means bolting. During this stage vegetative growth slows down and the leaves become bitter and tough.

For other crops such as strawberries, cucumbers, squash, melons ETC., reproductive growth is the desired outcome.

Pollination can be an issue for indoor fruiting crops - Growers have several options:

- \* Find varieties that are self pollinating
- \* Introduce pollinators (bees)
- \* Hand pollinate using a paintbrush, toothbrush, etc.

## Reproductive Cycles

Differing crop varieties and techniques require different harvesting methods. Some crops (like lettuce) are only harvested once before being torn out and replanted. Other crops, such as kale, mustard, chives, chard, and some herbs can be harvested multiple times.

**HARVEST AND PRUNE CAREFULLY TO MAXIMIZE THE NEXT PRODUCTION CYCLE OF THE PLANT.**

On woody plants like basil, a main stem grows upward and dominates production. There is a pair of lateral buds on the stem which do not grow into branches unless the main (apical) stem is cut. If you cut the apical stem, you can trigger growth from the lateral buds, replacing the one branch with two branches, increasing production with bushier growth. This is one way to increase production of a basil plant. Other growers prune to favor a center stem, which is harvested more frequently and has a more consistent length.

## Glossary

### Apical Growth

Growth which grows upward from the apical bud of the plant; usually results in the "main" branch of the plant.

### Bolting

A shift from vegetative to reproductive growth, usually resulting in a tall inedible flower stalk and bitter to taste.

### Cole Crops (Brassicas)

Varieties of the species Brassicas Oleracea, including mustard, cabbage, kale, broccoli, and kohlrabi, among others.

### IPM

(Integrated Pest Management) A pest management strategy which utilizes multiple types of control and precise timing to control pest populations for the best economic outcome in the long term.

### Lateral Buds

The set of undeveloped buds situated on the side of the stem of a plant which grow if the apical branch is badly damaged or removed.

### Lateral Buds

The time it takes for a plant to grow from transplant to harvest-able crops.



As you can see from the elongated stem & the leaves which are starting to turn inward, this lettuce plant is beginning to BOLT, and will soon become bitter.

## Greens

Greens are considered low-dollar crops, fetching \$3.50-5.00 per pound.

Though they bring in less per pound than most herbs, greens can be a benefit to farmers because they satisfy a consistent need in most communities.

Greens can also be a liability-reducer for farmers, who can rest assured knowing that it will only take four to six weeks (a typical turn for greens) to return to full production.



## Swiss Chard

### About Swiss Chard:

Chard is a French green, popular in greenhouses and kitchens around the world. The tender leaves add freshness and a mild buttery flavor to dishes like soup, the bacon-friendly southern dish "greens and beans", and even in salads or on BCG (beet, chard, and goat cheese) sandwiches.

Chard leaves grow on elegant stems which range in color from red, yellow or white - you can get Swiss Chard larger than a dinner plate. Chard is a good crop for BEGINNERS.

The cool weather crop is not only tasty and easy to cook, but easy to grow in almost any hydroponic or aquaponic system. A multitude of varieties can be found from seed companies; our favorite is SWISS "RAINBOW" CHARD.

Chard is a fairly tough crop; pests include the occasional aphids and (very) occasional powdery mildew outbreak. Although high or low temperatures will affect the taste, the crop is overall very tolerant of stressful conditions.

Chard is bi-annual, so it will not bolt for the first year.

pH Range: 6.6-7.0

EC/PPM: 1.8-2.3 / 900-1150

Light: 4-8 hours

Temp: 55-75° F; frost tolerant

Planting: Easy to grow from seed

Harvesting: Only harvest 30-35% of the plant, leaving the rest of the plant to support another harvest.

Yield: .5 lbs./ Tower/ 6 Week Turn

Pests & Diseases: Minimal; very rarely, aphids & powdery mildew.

# Swiss Chard

## Harvesting & Storage

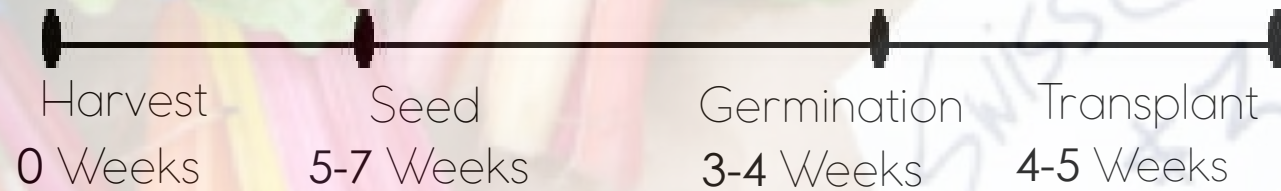
Chard can be harvest four to five weeks after being transplanted, and yields well.

IN OUR ZIPGROW™ TOWERS, HEALTHY SYSTEMS PRODUCE FOUR POUNDS PER 5-FOOT TOWER PER 4-WEEK TURN, AND 5.5 IBS PER FIVE WEEK TURN.

Growers should only harvest chard partially, leaving 65-70% of the foliage for the plant to photosynthesize to the next turn. To harvest, clip the largest leaves from the plant, as close to the base of the plant as possible. Harvesting in the morning or evening can help keep chard fresh. When harvested this way, chard plants can yield for several turns in a row.

Chard can keep over a week without beginning to wilt if treated correctly. Chard lasts longest when stored without washing and sealed in containers or bags at cool temperatures, which dramatically reduce respiration and decay incidence.

## Timeline



Chard is easiest to grow from seed, and germinates within 1-2 weeks. Plant Chard seedlings at 8-10 inches apart in most techniques including ZipGrow™ Towers. The plants grow quite large and can shade each other out if too close.



# Mustard Greens

## About Mustard Greens:

Brassica Juncea, or mustard greens, is another member of the brassicas family (a relative of kale and cabbage). Although its precise origins are unknown, there's support to assume that mustard is native to Eastern Europe and Asia, as is reflected by its common names - India mustard and China mustard.

The ruffled leaves of mustard taste similar to radishes and can add a spicy bite to a salad, sandwich, or can be eaten by themselves (often steamed). Mustard is often cultivated for it's seed, which is used in brown mustard (the condiment) and has been used for centuries in folk remedies for aches, arthritis, and even promote cow milk production in some areas of the world. A grower favorite is the Southern Giant Curled variety; however many varieties have been bred with different flavors and colors ranging from green to dark purple.

Although mustard greens aren't the first thing that come to mind when creating a weekly menu, they are a great addition to spruce up a dish that is lacking flavor. Selling mustard greens in large quantities will prove difficult.

pH Range: 6.0-7.5

EC/PPM: 1.2 to 2.4 / 60-1200

Light: 2-18 hours

Temp: 50-75° F

Planting: Easy to grow from seed

Harvesting: For partial harvest, only take 30% of the plant, leaving the rest of the plant to support another harvest.

Yield: 3.1 lbs./ Tower/ 5 Week Turn

Pests & Diseases: Few; Cabbage Loopers, Flea Beetles, Cabbage Worms, and Clubroot possible if grown in soil.

# Mustard Greens

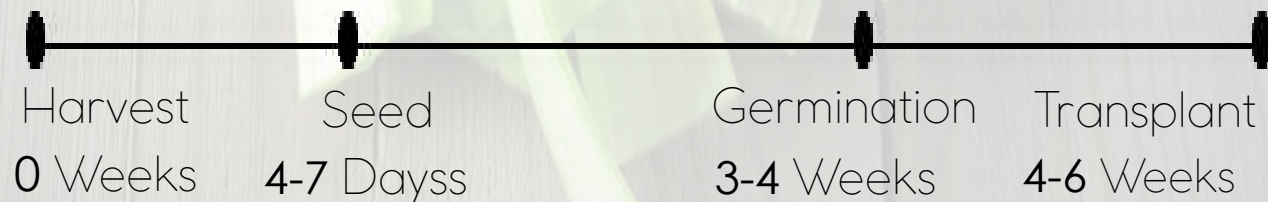
## Harvesting & Pricing

Mustard is another crop which is easy to grow, and a favorite with UpStart Farmers. Mustard will grow almost anywhere using any technique, and although it will survive down to 35° F, it's not as frost tolerant as some of it's cousins.

When grown outside and or in the soil, mustard greens can have issues with cabbage loopers, flea beetles, cabbage worms, and clubroot. Grown vertically and or in healthy hydroponics systems - this is not likely.

Mustard greens can be managed similar to kale - grown from seeds, which take four to seven days to germinate, the seedlings will be ready to transplant at 2-3 weeks later. (at 3-4 weeks from the seed planting). After 4-6 weeks growing, growers can harvest the greens partially (recommended), taking only 30% of the plant and leaving the rest to continue to grow. We've experienced yields of 3.1 lbs per 5-foot ZipGrow™ Tower this way, although light and nutrients impact that number.

Pricing for mustard greens varies widely by market, quality, and value points, but most UpStart Farmers are getting pricing at \$5.00-6.00 per pound.



# Kale

## About Kale:

Kale has been hailed as a super food and has found it's way into home and restaurant menus alike. Crop varieties from the scaly-looking Dinosaur Kale (also called Tuscan Kale) and Curly Kale grace our soups, smoothies, salads, and more.

Some varieties display shades of red and purple, like Russian Red Kale.

pH Range: 6.0-7.5  
EC/PPM: 1.8 to 3.0  
Light: 2-18 hours  
Temp: 45-85° F

Planting: Easy to grow from seed

Harvesting: For partial harvest, only take 30% of the pant, leaving the rest of the plant to support another harvest.

Yield: 4 lbs./ Tower/ 6 Week Turn

Pests & Diseases: Rare; aphids and powdery mildew most likely indoors.



# Kale

## Harvesting & Pricing

For farmers growing kale with hydroponics can be a simple and profitable option. Kale's popularity can bring in good profit for farmers. The crop grows relatively quickly with a six week turn from transplant to harvest, or can be harvested partially to regrow (no more than about 30% for quick regrowth).

Growers using ZipGrow™ Towers can expect to see four pounds of produce per tower for a full harvest when conditions are favorable.

Kale is a cool weather crop, and many growers even apply cooler temperatures (down to 40° F) on purpose to draw out a smoother, improved flavor in the green.

Fortunately, kale is another crop which - when grown indoors - is targeted by only a few pests such as aphids and some powdery mildew.



# Arugula

## About Arugula:

Arugula is a Brassica, like mustard or kale. It carries a spicy punch in a tender leaf, making it a great addition to salads, pizzas, and sandwiches. Some varieties are spicier than others, with the Rocket variety being considered the spiciest of the three most popular (Astro, Rocket, and Sylvetta).

Though Arugula grows like lettuce (some varieties are ready for harvest in just three weeks), it's often considered a herb. Farmers can typically get slightly higher prices on arugula than lettuce, with some sellers achieving the extreme about 50-60 cents per ounce. A more realistic price range would be \$3-5 per pound.

pH Range: 6.0-6.8

EC/PPM: .8 to 1.2 / 400-600

Light: 2-10 hours

Temp: 50-65° F

Planting: Easy to grow from seed

Harvesting: Full Harvest

Yield: 2-3 lbs./ Tower/ 5 Week Turn



# Cabbage

## About Cabbage:

Cabbage is one of the Cole Crops. (cabbage is Brassica oleracea var. capitata)

Hydroponic cabbage is a fairly hands-off crop to grow. General pest control measures (use an IPM plan) usually keeps pests at bay, and cabbage needs no extra pruning or training. The heads grow large (eight pounds is not uncommon), so farmers can get a fairly large crop from a small space. From one 5-foot ZipGrow™ Tower, for example; a farmer could get 4-6 heads totaling 3050 lbs if grown correctly.

pH Range: 6.5-7.0

EC/PPM: 2.5 to 3.0 / 1250-2100

Light: 6-12 hours

Temp: 40-70° F

Planting: Easy to grow from seed

Harvesting: When head is Firm - one time

Yield: 4 heads/2.8 lbs./ Tower/ 5 Week Turn

Pests & Diseases: Rare; Slugs, Aphids, Flea Beetles; Diseases include Blackleg, Black Rot, Fusarium



# Cabbage

## Harvesting & Pricing

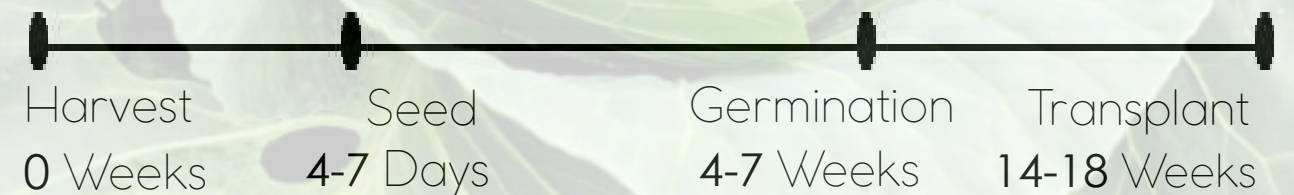
Overgrown cabbage heads crack and split. Splitting is caused when the heads grow large and firm, then resources (such as water or fertilizer) are increased. Keep growing conditions consistent, and don't wait too long to harvest.

Cabbage is vulnerable to common pests such as aphids, and fusarium, as well as fungal diseases like blackleg and lack rot. The latter are usually due to the crown of the plant being kept moist. Watch out for leaks or high water levels that could do this.

In our ZipGrow™ Towers, cabbage can be planted 4-6 plants to a tower.

Consumers might find prices for grocery store cabbage near \$.60/lb. Prices climb for organic cabbage or local cabbage, which goes for \$1.25 to \$2.00 per pound.

At a piece of \$1.25/lb a farmer could sell a 5-lb head of cabbage for \$6.25 or an 8-lb head for \$10. If he/she is growing in towers, they might make \$25-40 off of one tower.



## Timeline

For best germination rates, keep seedlings a little warmer than mature crops (65-70°F). Scarification of seeds can also increase germination rate. After being planted, seeds will germinate in 4-7 days, and ready to transplant 4-6 weeks later or when the first true leaves arrive. Depending on the type of cabbage and the size of head desired, the crop will be ready for harvest 9-11 weeks later.

**HARVEST WHEN THE HEAD IS FIRM AND BIG ENOUGH FOR YOUR MARKETS.**



# Bok Choy (Pak Choy)

## About Bok Choy:

Bok Choy comes in a range of sizes, including large varieties like Joi Choi and smaller varieties like Shanghai Green Pak Choy, which offer more compact, tender heads with delicate flavor.

**BOC CHOY (BRASSICA CHINENSIS L.)** – Belongs to a genus in the mustard family called the brassicas. Members of brassica include Kale, Cabbage, Broccoli, Cauliflower, and dozens of other important food crops, Perhaps the most similar member of brassica - in terms of appearance and taste, anyway - is Tatsoi.

**TATSOI (BRASSICA NARINOSA, ALSO CALLED BROADBEAK MUSTARD)** - Displays the same thick leaves and light veins as bok Choy and tastes just as good. Tatsoi can be grown in similar conditions.

**NAPA CABBAGE (BRASSICA RAPA PEKINENSIS)** - is another brassica member which, while it looks different than Bok Choy and Tatsoi, has the same sweet flavor and crispness. It can be used in many of the same recipes (Napa Cabbage is often used for the Korean dish, Kimchi), Napa cabbage prefers the pH and EC range of Bok Choy as well, and tastes better when grown in cooler temperatures.

pH Range: 6.0-7.5

EC/PPM: 1.5 to 2.5 / 750-1250

Light: 12-18 hours

Temp: 55-75° F

Planting: Easy to grow from seed

Harvesting: Full harvest

Yield: 7.3 lbs./ Tower/ 5 Week Turn

Pests & Diseases: Rare; Aphids, Powdery Mildew

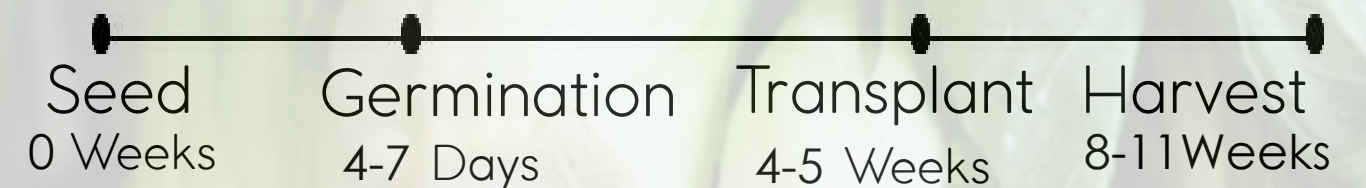
# Bok Choy (Pak Choy)

## Harvesting & Storage Tips:

Bok Choy has thick but fragile veins and ribs, take care when handling not to break leaves. Store Bok Choy in containers with good air circulation and high relative humidity, at temperatures in the 30's (°F), or just above freezing.

## Timeline:

Plant Bok Choy from seed and transplant as soon as there are true leaves on the plant; this will typically occur in about four weeks. Though highest yields occur at six weeks from transplant, Bok Choy may be grown on shorter turns down to four weeks,



# Lettuce

## About Lettuce:

Lettuce is one of the most popular crops in the world. The cool-weather crop grows sweet and tender, a perfect addition to any fresh dish.

Lettuce grows well in almost any gardening system, whether hydroponic, aquaponic or traditional soil gardens. It takes up relatively little space, has a short (5-6 weeks from transplant or 9-11 weeks from seed) growing cycle when it's healthy, and there is always high market demand.

Hundreds of lettuce varieties are grown around the world. The common varieties, like red and green Romaines, Iceberg, Oak leaves, Green Leaf, and Mesclun mixes, can be found in almost any grocery store.

Don't forget about unique heirloom varieties. Seed companies like Baker Creek Heirloom Seeds offer great varieties like Deer Tongue, Bronze Beauty, Brune D'Hiver, Cimmaron, and Devil's Ear Lettuce.

pH Range: 5.6-6.2

EC/PPM: .8 to 1.2 / 400-600

Light: 10-18 hours

Temp: 45-70° F

Planting: Easy to grow from seed

Harvesting: Harvest whole head or (full plant) and store at 32-35° F.

Yield: 7.3 lbs./ Tower/ 5 Week Turn

Pests & Diseases: Rare; Aphids, Powdery Mildew, Leaf Miners

# Lettuce

## Harvesting & Storage:

Harvesting techniques can affect shelf life if the lettuce is handled roughly, bruised or crushed during the process. This makes produce much more vulnerable to post-harvest decay and diseases, as well as impacting the scalability of the produce.

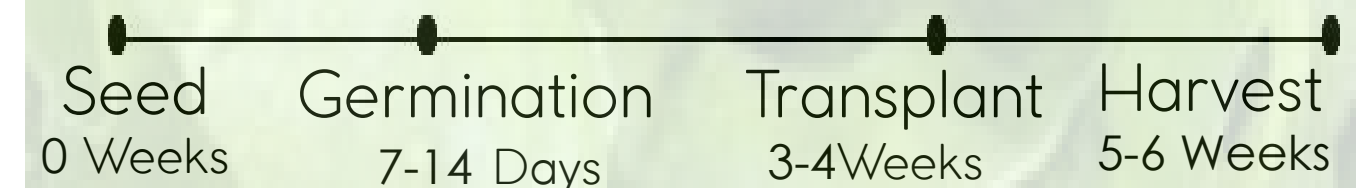
### QUICK TIPS FOR HARVESTING AND STORING:

- \* Harvest the whole head.
- \* Store at 32-35°F and keep temperatures consistent.
- \* Don't let the lettuce freeze.
- \* Process the lettuce minimally.

Lettuce can be harvested quickly as a batch by taking the whole head. (Many growers harvest the entire plant, including the roots, which can extend shelf life if the growing technique facilitates it.) For growers using our ZipGrow™ Towers, a harvesting knife used to cut each head where it meets the face of the Tower is best. Horizontal growers should harvest close to the surface of the soil or other growing apparatus.

Lettuce, with so much transpiration and moisture, can be tricky to store for more than a few days before it starts wilting, or worse - get's slimy.

Lettuce needs cold temperatures to extend shelf life. Just above freezing (35° F, or just above 0°) is ideal, and lettuce can stay fresh for up to three weeks this way. Don't let the lettuce freeze! If frozen, the leaf epidermis will separate from the other tissues, and the leaf will decay rapidly. Lettuce requires humidity to keep from drying out, but condensation or heavy moisture on the leaves is detrimental. The best thing that producers can do to avoid condensation is to keep temperatures very consistent.



# Herbs

## About Herbs:

Herbs are high value crops with a continuous yield.

Herbs can be easier to grow than greens, but take a longer time to reach maturity. This longer maturation time can cause problems. In case of an emergency, it takes longer for a grower to reach full production again; however, most herbs can be harvested multiple times.

Herbs regularly bring \$1.00/oz.-\$2.99/oz



# Oregano

## About Oregano:

Oregano (*Origanum* spp.) is a small, bushy herb with a strong unique flavor that's especially pungent when the herb is fresh. The leaves are used fresh and dried in most types of cuisine, but especially Italian and French. There are three main kinds of oregano used for culinary purposes: Greek (*Origanum vulgare hirtum*), Mexican (*Lippia graveolens*, which actually isn't oregano at all), and Italian (*Origanum x majoricum*).

Oregano has small, rounded leaves that are fuzzy in some species - this makes it harder for them to deal with high humidity.

You can buy oregano in bulk for \$60-65/lb, which ends up being about \$4/oz. Dried oregano is \$3.50-4/oz, and dried organic oregano comes in higher at \$5-5.50/oz. Fresh oregano pricing varies by market and grower, but UpStart Farmers can consistently receive at least \$2-3/oz. for herbs.

Because oregano is a popular herb, demand isn't difficult to secure. Be sure to check in with your local markets. Your crop choices should heavily depend on real-life feedback that is specific to your situation.

Oregano can bring in a lot of profit, but be aware that the growing timeline is much longer. Oregano is a slow grower - the first harvest is eight weeks after transplant. Once established, the tips can be harvested every 3 or 4 weeks.

Oregano needs dry periods in irrigation and thoughtful pruning.

Oregano suffers from typical greenhouse pests like thrips, white flies, and sometimes aphids. Be especially aware of over watering: like rosemary, oregano prefers low watering and is susceptible to root rot and other diseases if over-watered.

**Planting:** Propagation by cutting is best

**Harvesting:** Multiple harvest; pruned similar to rosemary

**Yield:** 2.5 lbs./ Tower/ 8 Week Turn

# Oregano

pH Range: 6.0-8.0  
EC/PPM: 1.5 to 2.0 / 750-1000  
Light: 12 hours  
Temp: 55-70° F

Pests & Diseases: Rare; Thrips, white flies, spider mites etc.

## Harvesting & Storage:

Once harvested, fresh oregano sprigs have a shelf-life of 1-3 weeks.

BE CAREFUL OF OVER-CHILLING OR EXCESSIVE MOISTURE ON THE FOLIAGE



# Mint

## About Mint:

There are dozens of types of mint, but the main varieties are spearmint (*Mentha Spicata*), peppermint (*Mentha x Piperita*), and pennyroyal mint (*Mentha Pulegium*); some of the other mints like lemon mint (*Monarda Citriodora*) are actually not mint at all. When mint is used in the kitchen, it's usually spearmint.

Mint's bright leaves grow lush, making full gardens or ZipGrow™ Towers that look beautiful wherever they are. This makes them superb candidates for live sales and displays. Because it grows so fresh and viable, easy solutions and have proven to be well received by clients.

Mint is tolerant of low EC and some temperature variation, although it doesn't do well when heat spikes above 80°F. It struggles less with pests than many of the herbs, although verticillium wilt and powdery mildew can become problems. Keep your greenhouse dry and stay on top of pest control.

Mint can be grown from seed, but using cutting or rootstock is much quicker, especially on a commercial scale. From mint cuttings, or "clones", mint roots out and grows to maturity within a few weeks.

For stem cutting, you can select healthy green sprigs and simply cut them in water. We've also used cotton or loose soil to set cuttings. Haydn Christensen, owner of Bayberry Fresh, takes it one step further, and drops his mint cuttings in the gutter that runs below the towers.

For rootstock, you can pull out the media when a mature tower becomes overgrown, remove some root material to populate a new tower, and simply tuck the root material in the new media. Then replant both towers - one with old and one with new root material - and voila! You have two towers of mint.

Since mint grows quickly, we run mint on a three-week turn, harvesting it completely between each new turn. It's a lightweight herb but still produces about 3-4 lbs per tower. Depending on local markets, growers can expect anywhere from \$2-4 per ounce. Specialty markets sometimes sell mint for even higher prices! Check with local consumers, stores, and markets to see if there's demand for mint in your area,

# Mint

## About Mint:

pH Range: 6.5 - 7.0

EC/PPM: 2.2 to 2.6 / 1100-1300

Light: Full Sun - 14-18 hours

Temp: 55-70° F

Planting: Propagation by cutting or rootstock

Harvesting: Complete, Multiple

Yield: 3-4 lbs./ Tower/ 3 Week Turn

Pests & Diseases: Occasional verticillium wilt and powdery mildew.

## Harvesting & Storage:

Mint is ready to be harvested when it is 8+ inches tall. To harvest mint, shear across the face of the growing plane with a knife, leaving 1-2 inches of plant to regrow and harvested again in only 2-3 weeks. (Mint can be harvested the same as chives)

Some growers prefer to harvest sprigs with shears so that they can pick and choose the young tender shoots as a premium product.



# Chives

## About Chives:

Common chives are the variety most used. A few other varieties, like garlic chives and Chinese chives are also available.

Chives are a tough crop that will survive a wide range of temperatures and can even go without water for a while without it impacting the quality of the plant. Chives are also fairly pest-resistant, rarely infected with diseases, and rarely are targeted by insect pests.

Chives propagate rapidly from roots, and can be planted by division. Growers using ZipGrow™ Towers can simply tear apart the roots of a plant from another ZipGrow™ Tower and use it to plant multiple others.

Rarely will growers need to use seeds to grow chive seedlings, unless mature chive plants are nowhere to be found.

pH Range: 6.1 - 6.8

EC/PPM: 1.8 to 2.2 / 900-1100

Light: Full Sun - 12 hour minimum

Temp: 65-80° F

Planting: Seed or by root

Harvesting: Every 2-3 weeks by cutting the plant to 1-2 inches from the crown

Yield: 3-5 lbs./ Tower/ 4 Week Turn

Pests & Diseases: Rare; most common in hydroponic systems are viruses and fungus gnats.

# Chives

## Harvesting & Storage:

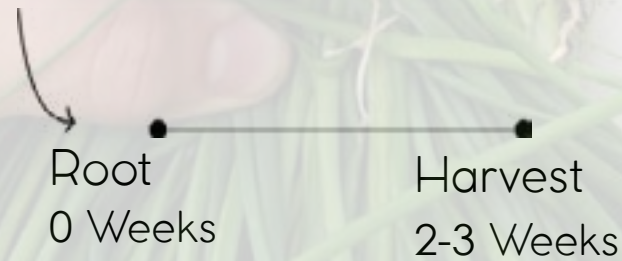
If chives are grown from seed, seedlings will be ready to transplant about four weeks later, and ready to harvest 3-4 weeks later. When planted from root, chives will be established within 2-3 weeks and will grow thicker with every harvest. Eventually, chive plants will inhabit every inch that you let them.

Chives should be trimmed back to about 1-2 inches above the crown every two weeks (three at the most). This will give growers a nice harvest and will keep the chives looking lush and green.

Chives are very easy to harvest with a pair of shears or a harvest knife. Hold the top of the plant in one hand (carefully) cut through the greens near the base. You'll be left with a handful of the tasty herb.



\*\* OR \*\*



# Fennel

## About Fennel:

A mildly sweet herb with a taste reminiscent of anise, fennel is edible both as bulbs and greens. The greens may be harvested once before a full-plant harvest a few weeks later.

While most grocery stores carrying fennel sell it between \$1-1.50 per bulb, some On-line sellers can sell a bulb for \$5.75.

Most UpStart Farmers will be somewhere between these two price points. Growers should do a survey of local markets to determine potential pricing. Fennel prefers a lower EC and moderate pH. Though fennel often proves drought tolerant, heat tolerant, and cold tolerant, it is not frost tolerant. Fennel rarely struggles with pests if it's kept healthy, although aphid infestations could affect the crop.

Fennel has a wider range of germination rates, from about 60%-90%. Be sure to get good seeds (Baker Creek and Johnny Seeds are both great places to start). Seeds take 1-2 weeks to germinate and are typically ready to plant 3-5 weeks later. The bulbs can be harvested as soon as the grower wants, but .5-1 lb bulbs are standard at most markets. From seedlings it takes most plants 6-8 weeks to reach harvesting size.



# Fennel

## Harvesting & Storage:

Fennel may be harvested twice (once for the greens, one for the bulb and greens together) if you have a market hungry for the greens. As with chard and kale, only 70% of the greens should be harvested at first. In a healthy system, fennel can yield 5-8 lbs per ZipGrow™ Tower in an eight-week turn.



# Basil

## About Basil:

There are dozens of basil varieties, from spicy bush basil, to lemon basil, to Thai basil. Favorites are the only classic sweet basil, Genovese basil, and dwarf basil. Basil grows better in ZipGrow™ Towers than in any other growing technique in the world and yields 3-4 lbs./Tower/5-week turn.

Basil prefers warmer temperatures (65-95°F) with a lot of light (14-18 hrs of good light), a pH range of 5.6-6.6, and EC between 1.4-2.3.

**pH Range: 6.2 - 6.8**

**EC/PPM: 1.6 - 2.2 / 800-1100**

**Light: Full Sun - 14-18 hour minimum**

**Temp: 65-95° F**

**Planting: Seed or clone**

**Harvesting: Prune apical meristem to cue lateral growth**

**Yield: 3-5 lbs./ Tower/ 5 Week Turn**

**Pests & Diseases: Nematodes, aphids, thrips, flea beetles, whiteflies, snails, slugs. Diseases include damping off, root rot, leaf spot diseases, fusarium wilt, and powdery mildew.**

# Basil

## Harvesting & Storage:

Basil has been bred to be a single-stemmed plant growing upward. For ZipGrowers, a bushier multi-stemmed plant is better. A pruned tower looks better, makes your towers balanced and it's much easier to carry around. The bushier the plant the more it yields.

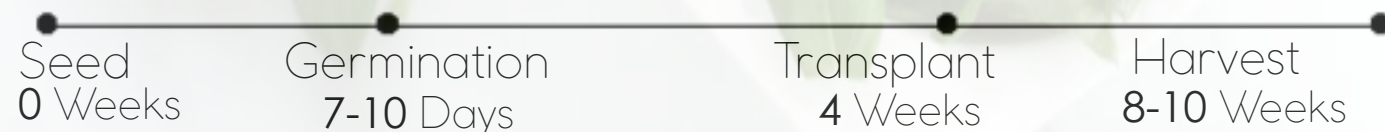
To change the way that basil grows, growers can trigger a secondary type of growth that moves outward and up instead of straight up. This is called lateral growth. A young basil plant (say 5-10 inches tall), has places on the stem with buds on the side of the stem that haven't grown out yet. Those are the lateral buds; they're like back-ups that will only grow if the main stalk gets badly damaged or removed.

This means that if growers clip the stem right above those lateral buds, they will be triggered to grow out. There are two instead of one, growers increase the production of that branch. When pruning, snip the stem right above the lateral buds. (Not at the base of the plant.) If you prune a basil plant correctly, you'll see an increase in yield each time you harvest for the first three harvests at about weeks 5, 8, and 11.

To extend the shelf life of basil, store it above 55° F (preferably at a temperature of 60°) where it can attain a shelf life of 12 days. Instead of cooling the basil, keep it in a higher-temperature cooler, or on a counter in a cool room.

If growers package basil in bags or cartons that reduce moisture loss (plastic with little or no air exchange), be sure to keep storage temperatures steady to avoid condensation.

Handle basil gently, as bruising can increase the rate of deterioration. Many Upstart Farmers have found that selling basil packaged in clamshells is helpful for preserving the herb.



# Parsley

## About Parsley:

Parsley is a Mediterranean native used worldwide both as a garnish and as a popular addition to savory dishes. Several varieties of parsley exist, from the more bitter and frilly garnish parsley to the flavorful, tender large leaf varieties.

Though popular mostly as a cooking ingredient, parsley has been used in a variety of ways, from a medicinal ingredient to a symbol in ceremonies like the Seder dinner.

Parsley's tolerance of a wide temperature range and EC range make it an easy crop for farmers to add into a crop set. Large leaf varieties like Italian flat leaf grow abundantly in hydroponics (or aquaponics), and farmers using ZipGrow™ Towers should plan on harvesting a lot of weight from the large plants, which grow 12-18 inches from the face of the Tower or media.

**pH Range:** 6.0 - 7.0

**EC/PPM:** .8 - 1.8 / 400-900

**Light:** Full Sun - 14-18 hour minimum

**Temp:** 60-75° F

**Planting:** Seed

**Harvesting:** Harvest twice before replanting

**Yield:** 3-5 lbs./ Tower/ 5 Week Turn

**Pests & Diseases:** Rare; most common are thrips and aphids.



# Parsley

## Harvesting & Storage:

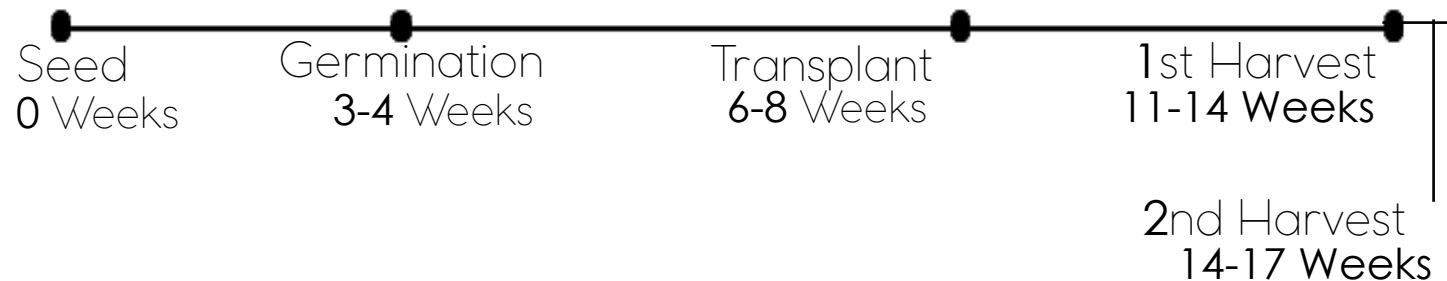
Parsley can be harvested multiple times similarly to chives. Use shears or a harvesting knife to cut the crop down to 2-3 inches from the face of the Tower or the media, and keep it in the system to regrow. Another harvest may be taken about 3 weeks later.

We recommend starting a new cycle for parsley after the second harvest. Parsley yields can be very high in healthy hydroponic systems – one 5-ft ZipGrow™ Tower can yield 3-4 pounds per Tower each harvest.

## Timeline:

Parsley comes as an affordable seed and germinates within 3-4 weeks with good moisture.

Seedlings are ready to transplant a few weeks later when they display their true leaves, and first harvest typically happens 5-6 weeks later.



# Rosemary

## About Rosemary:

*Rosmarinus officinalis* belongs to the family Lamiaceae like many of our culinary herbs. Rosemary is a great fit for indoor farming because it can be very compact. Although rosemary has a longer turn than greens, it can achieve good pricing.

Non-local rosemary can be bought at a typical grocery store for \$2.25-2.50/oz, but local and organic farmers list prices up to \$3.90/oz. Growers should conduct basic local market research and compare different herbs prices. Like its co-members of Lamiaceae, lavender and thyme, rosemary prefers dry feet. This means that growers should give roots a dry period between watering. For example, in our greenhouse, we have ran oregano, thyme, and rosemary on a separate circuit. We ran our drippers through that block of towers twice a day for about 30 minutes each time.

Rosemary is typically pest-free and can even deter many pests, but growers will occasionally see powdery mildew or mite infections. Botrytis and root rot can be an issue if growers over water. Growers raising rosemary in hydroponics should be especially careful about this, as it's easy to over water.

Starting rosemary from seed can be a finicky process – the seeds need consistent moisture and germination rates tend to be around 30-50%. Growers are often better off propagating the plants from cuttings, although some argue that best flavors and aromatics come from seed grown plants.

pH Range: 5.5 - 6.0

EC/PPM: 1.0 - 1.6 / 500-800

Light: 6-8 hours

Temp: 75-85° F

Planting: Clone is fastest

Harvesting: Multiple harvests

Yield: 7.8 Oz./ Tower/ Week

Pests & Diseases: Rare; botrytis or powdery mildew

# Rosemary

## Harvesting & Storage:

Rosemary is a perennial; the plant's natural lifetime can extend for decades. It can be harvested many times by pruning (similar to basil).

Farmers should never take more than 30% of the plant at once, leaving 70% for the plant to photosynthesize and continue to grow. Like basil, rosemary grows best when pruned just above the apical shoots (the "V" in the stem).

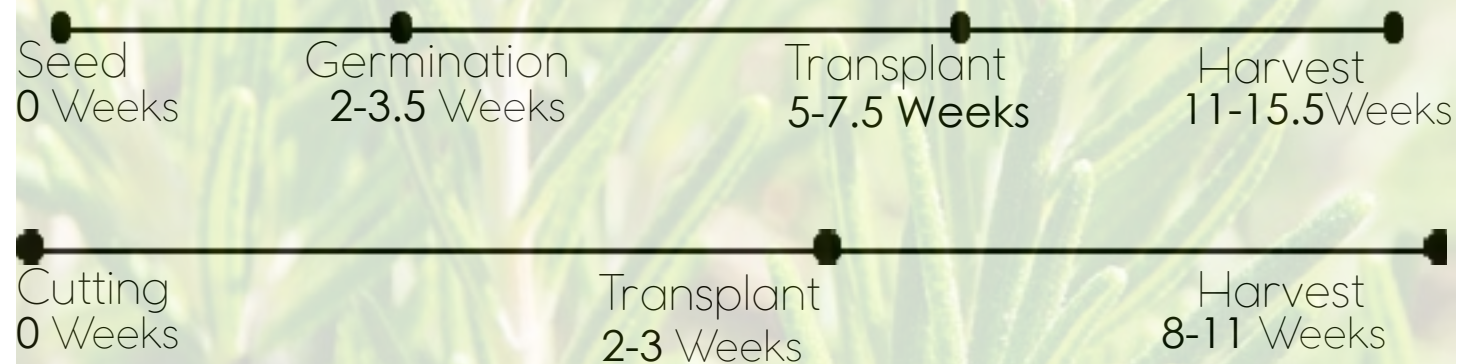
## Timeline:

Seed-grown rosemary takes 2-3.5 weeks to germinate and an additional 3-4 weeks until they are ready to transplant.

Cuttings are ready to plant when roots are established and the spring has grow past a few inches in height. THIS SHOULD HAPPEN IN 2-3 WEEKS.

From transplant to the first harvest, rosemary takes 6-8 weeks.

Growers should expect lower yields for the first few harvests while the plant is growing more mature. In time, mature plants can give over 7 ounces per ZipGrow™ Tower per week.



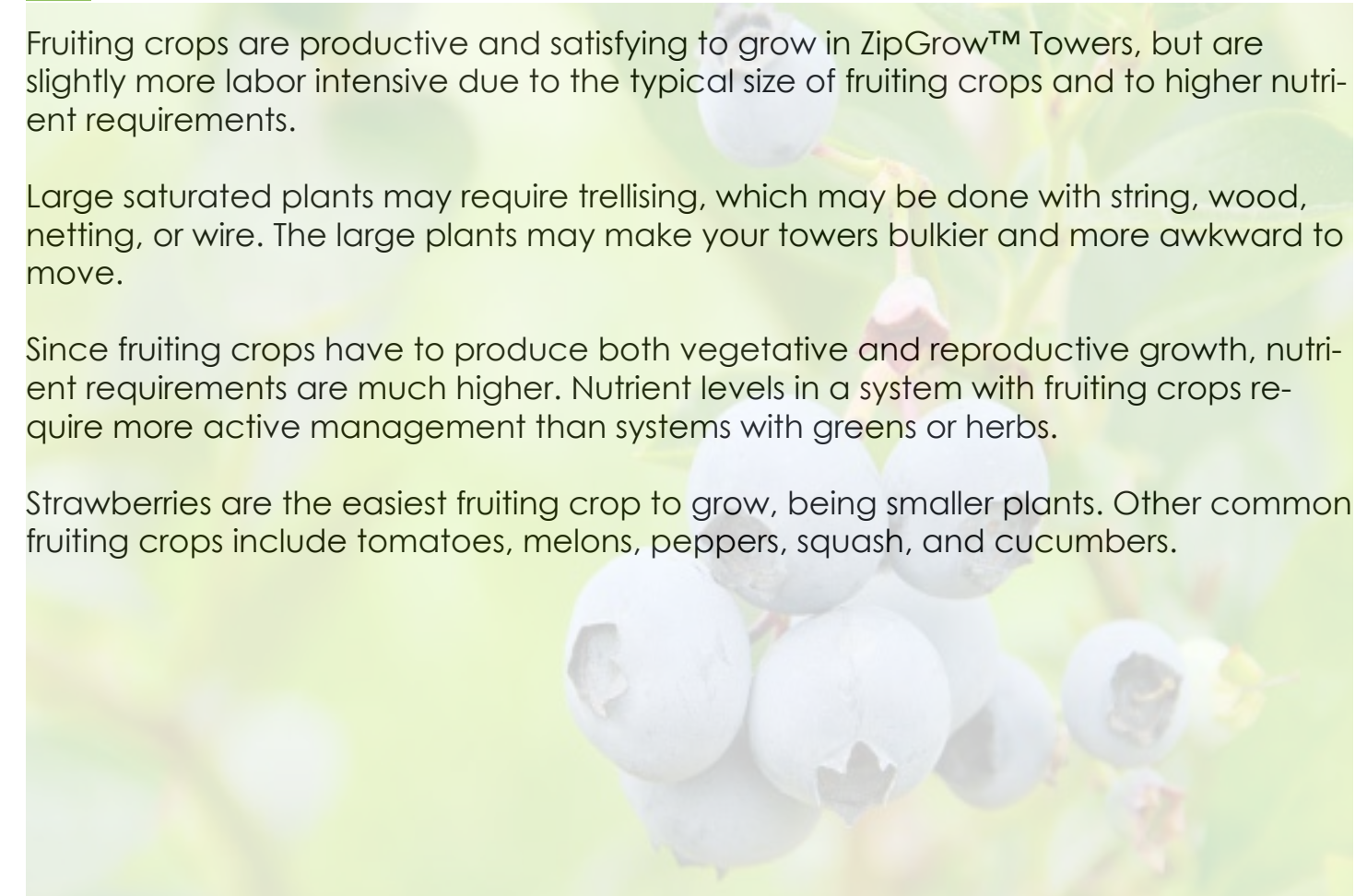
# Fruiting Crops

Fruiting crops are productive and satisfying to grow in ZipGrow™ Towers, but are slightly more labor intensive due to the typical size of fruiting crops and to higher nutrient requirements.

Large saturated plants may require trellising, which may be done with string, wood, netting, or wire. The large plants may make your towers bulkier and more awkward to move.

Since fruiting crops have to produce both vegetative and reproductive growth, nutrient requirements are much higher. Nutrient levels in a system with fruiting crops require more active management than systems with greens or herbs.

Strawberries are the easiest fruiting crop to grow, being smaller plants. Other common fruiting crops include tomatoes, melons, peppers, squash, and cucumbers.



# Strawberries

## About Strawberries:

Growers can order strawberries from most big seed companies like Burpees or Johnny's Seeds. Dozens of different varieties are available with different environmental preferences and different bearing timelines. The two main types of strawberries are ever-bearing and June-bearing. We recommend ever-bearing (or "day-neutral") varieties for indoor growers.

Strawberries are best grown from rootstock rather than seed. Vegetative growth (runners) tends to be much faster than sexual reproduction (seeds), so you can cut the time from planting to production by months or years by using rootstock.

Strawberries are prone to pest and diseases like spider mites, pythium, and crown rot. Use miticides to manage mites, a fungicidal dunk before planting to prevent fungal infections, and plant the rootstock correctly to avoid crown rot.

**\*\*REMEMBER: ALWAYS READ THE LABEL BEFORE USING A PESTICIDE. IT IS A LEGAL DOCUMENT, AND STRAYING FROM INSTRUCTIONS IS UNLAWFUL! \*\***

The crown of the plant is the region where the roots become the stem. Keeping the crown dry is key to avoiding crown rot. When you plant your root stock, choose the plants with thicker crowns and talk to the provider about sterilized rootstock or a recommended fungicide dunk for the rootstock. Plant the rootstocks at an angle so that the crown of the plant is angled upward. If the plant is planted at a downward angle, then water can run down the roots and over the crown, creating crown rot problems down the road.

You'll see a woody "stalk" or stump near the crown of the plant that looks different from the other shoots. That is the remains of the runner from which the plant grew. Try to keep the runner on the top side of the plant.

If you don't have the space to plant all of your rootstock, you can store it in a fridge or cooler (depending on the variety, most seed companies will tell you to store the rootstock at about 32° F) for a limited time. Strawberries prefer lower salt levels (an EC of 1.2-1.5 is best), long day length, and a pH range of 5.5 to 6.8.

KEEP THE TEMPERATURE IN THE HIGH 60'S AND KEEP THE GROWING FACILITY DRY.

# Strawberries

## About Strawberries:

For farmers growing a variety of crops, salt content could be an issue in their strawberry-growing efforts. While strawberries flourish in most hydroponic systems, the high EC levels required by some crops can cause depressed yield for strawberries in the same system.

In a healthy system, strawberry rootstock will have new growth sprouting up in less than a week. Pinch back the buds for 4-6 weeks to keep the plant's resources directed towards vegetative growth. This gives the plant the ability for higher yields later on.

If flowers are allowed to develop, fruit forms and ripens in about 2 weeks. Outdoors, producers can rely on natural pollinators like bees, flies, and birds to spread pollen from the male parts to the female parts of the strawberry plants. Indoor growers will either have to hand-pollinate with something like a paintbrush or keep bees.



## Appendix A -Crop Sets

### Crops For Beginners:

Lettuce	Kale	Fennel
Bok Choy	Mint	
Mustard Greens	Arugula	
Chard	Chives	

### Cool Region Crops:

Lettuce	Bok Choy	Fennel
Arugula	Mint	Nasturtiums
Kale	Cilantro (Coriander)	Peppermint
Mustard Greens	Tarragon	

### Warm Region Crops:

Bok Choy	Lemongrass
Oregano	Spearmint
Basil	

### Low Region Crops:

Cilantro	Sage	Nasturtiums
Chives	Oregano	Peppermint
Tarragon	Fennel	

## Appendix B -Growth Rates

HERBS	SEED - GERMINATION	GERMINATION- TRANSPLANT	TRANSPLANT - HARVEST
Genovese Basil	7-10 Days	3-5 Weeks	5 Weeks
Lime Basil	5-15 Days	3-5 Weeks	5 Weeks
Cilantro	7-10 Days	3-5 Weeks	5 Weeks
Oregano	8-14 Days	5-7 Weeks	8-10 Weeks
Fennel	7-14 Days	3-5 weeks	6-7 Weeks
Mint	12-16 Days	4-5 Weeks	6 Weeks
Parsley	21-28 Days	3-4 Weeks	5-6 Weeks
Chives	15-21 Days	4 Weeks	6-8 Weeks
Lemon Thyme	8-20 Days	4 Weeks	6-8 Weeks
Lemongrass	10-90 Days	4-5 Weeks	5-6 Weeks
Nasturtiums	7-14 Days	3-4 Weeks	3-4 Weeks
Tarragon	10-14 Days	5-7 Weeks	8-10 Weeks
Chervil	7-10 Days	4-5 Weeks	3-5 Weeks

## Appendix B -Growth Rates

GREENS	GERMINATION TIME	TIME TO TRANSPLANT	TIME TILL SALE (TURN)
lettuce	7-14 Days	3-4 Weeks	5 Weeks
Chard	5-7 Days	3-4 Weeks	5-6 Weeks
Bok Choy	4-7 Days	3-4 Weeks	4-6 Weeks
Mustard Greens	4-7 Days	3-4 Weeks	4-6 Weeks
Kale	4-7 Days	4-5 Weeks	5-6 Weeks
Arugula	5-7 Days	3-4 Weeks	6-7 Weeks

## Appendix C -pH

CROPS	pH	EC/PPM
Basil	6.2-6.8	6.2-6.8/800-1100
Cilantro	6.5-7.5	.8-1.8/400-900
Oregano	6.0-8.0	1.5-2.0/750-1000
Fennel	6.0-7.5	1.0-1.4/500-700
Mint	6.5-7.0	2.2-2.6/1100-1300
Parsley	6.0-7.0	.8-1.8/400-900
Chives	6.1-7.8	1.8-2.2/900-1100
Rosemary	5.5-6.0	1.0-1.6/500-800
Lettuce	6.2-6.8	0.8-1.2/400-600
Chard	6.0-7.0	1.8-2.3/900-1150
Bok Choy	6.0-7.5	1.5-2.0/750-1250
Mustard Greens	6.0-7.5	1.2-2.4/600-1200
Kale	6.0-7.6	1.8-3.0/900-1500
Arugula	6.0-6.8	1.2-1.5/400-600
Cabbage	6.5-7.0	2.5-3.0/1250-1500

# Contact Us



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