

# Intensive Vegetable Production on a Small Scale

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## Planning is Circular, Just Like Farming

1. How much money do you need to earn?
2. Which markets to sell at
3. Which crops to grow
4. How much of what to harvest when: Harvest Schedule
5. How much to grow to achieve your harvest goals
6. Calculate sowing dates to meet harvest dates: Field Planting Schedule
7. When to sow for transplants: Seedlings Schedule
8. Where to plant each sowing of each crop: Maps
9. Packing more in: succession plantings, intercropping, relay planting, double cropping
10. Tweak to make your best possible plan
11. What to do if something goes wrong: Plan B
12. Record results for next year's Better Plan

## Steps to Creating a Permanent Crop Rotation

1. Figure out how much area is needed for each major crop (the ones needing the largest amount of space).
2. Measure and map the land available
3. Divide into equal plots
4. Group compatible crops together to fill each plot
5. Determine a good sequence
6. Include cover crops
7. Include no-till crops
8. Try it for one year, then make improvements



## Direct Seeding Pros and Cons

### Pros

- Less work than transplanting
- Less money compared to buying starts
- No need for a greenhouse and equipment
- Better drought tolerance – roots grow without damage
- Some crops don't transplant easily
- Some crops have millions of plants! (Carrots)

### Cons

- Uses more seed
- Uses more time thinning
- Occupies the land longer
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- Maybe harder to get started in cold (or hot) conditions

## Transplanting Pros and Cons

### Pros

- Start earlier than outside, get earlier harvests
- Start seed in more ideal conditions in greenhouse, better germination, more fun!
- Easier to care for new seedlings in a greenhouse
- Protected plants grow quicker
- Select sturdiest plants, compost the rest
- More flexibility if weather turns bad. Plants still grow!
- Fit more crops into the season
- Use time windows for quick cover crops
- Save on seed costs

### Cons

- Extra time caring for the starts
- Transplant shock can delay harvest
- More attention needed to watering new plants

## Transplant age and size

Vegetable	Notes	Ideal Age at Transplanting
Cucumbers/Melon/Squash	2 true leaves max (maybe less)	3-4 weeks
Watermelon	(older is OK)	3-4 weeks
Sweet Corn		3-4 weeks
Tomatoes	age is less important	4-8 weeks
Lettuce		4-7 weeks
Brassicas	5 true leaves is ideal	6-8 weeks spring/3-4 weeks summer
Peppers, Eggplant	4 or 5 true leaves. Not yet flowering.	6-8 weeks
Onions (spring sown), Leeks		10-12 weeks
Celery		10-12 weeks

## Optimal Plant Spacing for Vegetable Crops for Various Goals

Crop	Row Spacing	In-Row Spacing	Notes
Beets	7" (18 cm)	4" (10 cm)	For early harvest
	12" (30 cm)	1" (2.5 cm)	For max total yield (small). 2" (5 cm) in-row for bigger beets
Beans, fava	18" (45 cm)	4.5" (11 cm)	For tall varieties.
Beans, green	18" (45 cm)	2" (5 cm)	12" (30cm) x 3" (7.5 cm) gives the same area/plant
Broccoli (calabrese)	12" (30cm)	6" (15 cm)	For equal amounts of heads and side shoots
Cabbage	14" (35 cm)	14" (35 cm)	For small heads
	18" (45 cm)	18" (45 cm)	For large heads
Carrots	6" (15 cm)	4" (10 cm)	For early crops, limiting competition
	6" (15 cm)	1.5" (4 cm)	For maincrop, medium size roots

Celery	11" (28 cm)	11" (28 cm)	For high yields and mutual blanching
Cucumber (pickling)	20" (51 cm)	3" (8 cm)	
Leeks	12" (30 cm)	6" (15 cm)	Maximum yield of hilled up leeks, average size
Lettuce	9" (23 cm)	8" (20 cm)	Early crops under cover
	12" (30 cm)	12" (30 cm)	Head lettuce
	5" (13 cm)	1" (2.5 cm)	Baby lettuce mix
Onions	12" (30 cm)	1.5" (4 cm)	For medium size bulbs
	12" (30 cm)	0.5" (1 cm)	For boiling, pickling, kebabs
Parsnips	12" (30 cm)	6" (15 cm)	For high yields of large roots
	7.5" (19 cm)	3" (8 cm)	For smaller roots
Peas, shelling	18" (46 cm)	4.5" (11.5 cm)	Can sow in double or triple bands, 4.5" (11.5 cm) apart
Potatoes	30" (76 cm)	9-16" (23-41 cm)	Depends on size of seed pieces. Small pieces closer
Sweet Corn	30-36" (76-90 cm)	8" (20 cm)	Closer than 8" (20 cm) the plants shade each other.
Tomatoes, bush types	19" (48 cm)	19" (48 cm)	For early crops
Watermelon	66" (168 cm)	12-24" (30-60 cm)	For small varieties. 5-10 ft <sup>2</sup> (0.5-1 m <sup>2</sup> ) each
	66" (168 cm)	30-84" (76-215 cm)	For large varieties. 13-40 ft <sup>2</sup> (1.2-3.7 m <sup>2</sup> ) each

### Season Extension

- Advantages and disadvantages in time and money
- **Growing earlier crops in spring:** Use fast-maturing hardy varieties; find warm microclimates; use transplants; use rowcovers, low tunnels, Quick Hoops, high tunnels (hoopouses).
- **Extending the growth of cool-weather crops into summer:** learn how to germinate seeds in hot weather; use shadecloth, ProtekNet to keep bugs off; practice succession planting and intercropping,
- **Extending the survival of frost-tender crops beyond the first fall frosts:** rowcover returns to the fields; minimize frost damage
- **Cold-hardy winter vegetables**

### Formula to determine last sowing dates for frost-tender crops

- Count back from the expected first frost date, adding:
- the number of days from seeding to harvest,
- the average length of the harvest period,
- 14 days to allow for the slowing rate of growth in the fall, and
- 14 days to allow for an early frost (unless you have rowcover).

**Bean Beetle Parasite** (*Pediobius foveolatus*) NJ Department of Agriculture Beneficial insect rearing laboratory contact: Tom Dorsey at (609) 530-4192. See [www.state.nj.us/agriculture/divisions/pi/prog/beneficialinsect.html](http://www.state.nj.us/agriculture/divisions/pi/prog/beneficialinsect.html)

**Biointensive Integrated Pest Management:** See [www.sustainablemarketfarming.com](http://www.sustainablemarketfarming.com) Search for Biointensive Integrated Pest Management

### Resources

- The Market Gardener*, Jean-Martin Fortier, New Society Publishers
- The Complete Know and Grow Vegetables*, J K A Bleasdale, P J Salter et al.
- Knott's Handbook for Vegetable Growers*, Maynard and Hochmuth
- The New Seed Starter's Handbook*, Nancy Bubel, Rodale Books
- The Organic Farmer's Business Handbook*, Richard Wiswall, Chelsea Green
- Sustainable Vegetable Production from Start-up to Market*, Vern Grubinger,
- The New Organic Grower*, Eliot Coleman, Chelsea Green
- Extending the Season: Six Strategies for Improving Cash Flow Year-Round on the Market Farm* a free e-book for online subscribers to Growing for Market magazine
- Sharing the Harvest*, Elizabeth Henderson and Robyn Van En
- Gardening When it Counts*, Steve Solomon
- Grow a Sustainable Diet: Planning and Growing to Feed Ourselves and the Earth*, Cindy Conner, New Society Publishers, (worksheet based). DVD/CD set *Develop a Sustainable Vegetable Garden Plan*
- Crop Planning for Organic Vegetable Growers*, Daniel Brisebois and Frédéric Thériault ([www.cog.ca](http://www.cog.ca))
- Nature and Properties of Soils*, fourteenth edition, Nyle Brady and Ray Weil
- Garden Insects of North America*, Whitney Cranshaw
- Managing Weeds on your Farm: A Guide to Ecological Strategies*. Charles Mohler, Antonio DiTommaso. SARE.

- ❑ SARE *Crop Rotations on Organic Farms A Planning Manual*, Charles Mohler and Sue Ellen Johnson, editors.
- ❑ ATTRA [attra.ncat.org](http://attra.ncat.org) *Market Farming: A Start-up Guide; Plugs and Transplant Production for Organic Systems; Scheduling Vegetable Plantings for a Continuous Harvest; Intercropping Principles and Production Practices* (mostly field crops, but the same principles apply to vegetable crops); *Season Extension Techniques for Market Farmers*, and many other great publications.
- ❑ SARE [sare.org](http://sare.org) -A searchable database of research findings and publications free to download.
- ❑ [extension.org/organic\\_production](http://extension.org/organic_production) [http://www. eOrganic.info](http://www.eOrganic.info). The organic agriculture community with eXtension. Publications, webinars, videos, trainings and support. An accessible source of reliable information.
- ❑ Center for Environmental Farming Systems at North Carolina State University. *Composting on Organic Farms*.
- ❑ Compost recipe software is available from Cornell University [www.cfe.cornell.edu/compost/science.html](http://www.cfe.cornell.edu/compost/science.html)
- ❑ Southwest Florida Research and Education Center, <http://www.imok.ufl.edu/programs/vegetable-hort/research-extension-ozores/veg-transplant/> . (Detailed information on age of transplants, container size, biological control for pests, diseases, hardening off, plant size, planting depth and temperature.)
- ❑ Cornell Extension: [www.vegetablemendonline.ppath.cornell.edu/NewsArticles/All\\_BactSeed.htm](http://www.vegetablemendonline.ppath.cornell.edu/NewsArticles/All_BactSeed.htm) seed treatments.
- ❑ The Twin Oaks Harvest Calendar by Starting Date and by Crop are available as pdfs on my website [sustainablemarketfarming.com/2013/11/07/growing-for-market-articles-2/](http://sustainablemarketfarming.com/2013/11/07/growing-for-market-articles-2/)
- ❑ AgSquared online planning software: [agsquared.com](http://agsquared.com)
- ❑ COG-Pro record-keeping software for Certified Organic Farms: [cog-pro.com](http://cog-pro.com)
- ❑ Free open-source database crop planning software [code.google.com/p/cropplanning](http://code.google.com/p/cropplanning).
- ❑ Mother Earth News interactive [Vegetable Garden Planner](http://www.motherearthnews.com/garden-planner), free for 30 days: [motherearthnews.com/garden-planner](http://www.motherearthnews.com/garden-planner).
- ❑ Target Harvest Date Calculator: (Excel spreadsheet) [johnnyseeds.com/t-InteractiveTools.aspx](http://johnnyseeds.com/t-InteractiveTools.aspx)
- ❑ Growing Small Farms: [growingsmallfarms.ces.ncsu.edu](http://growingsmallfarms.ces.ncsu.edu) Click Farmer Resources, Farm Planning and Recordkeeping, to download Joel Gruver's spreadsheets. Debbie Roos keeps this site up to the minute.
- ❑ Mark Cain [www.drippingspringsgarden.com](http://www.drippingspringsgarden.com) under the CSA tab, you can download their Harvest Schedule. Notebook-based system.
- ❑ Tables of likely crop yields [johnnyseeds.com/assets/information/vegetablecharts.pdf](http://johnnyseeds.com/assets/information/vegetablecharts.pdf).
- ❑ [gardensofeden.org/04%20Crop%20Yield%20Verification.htm](http://gardensofeden.org/04%20Crop%20Yield%20Verification.htm) two charts on crop yields, one of organic crops from The Owner-Built Homestead by Ken & Barbara Kern, one from California.
- ❑ Determining Prices for CSA Share Boxes Iowa State U [extension.iastate.edu/agdm/wholefarm/pdf/c5-19.pdf](http://extension.iastate.edu/agdm/wholefarm/pdf/c5-19.pdf)
- ❑ New England Vegetable Management Guide Crop Budgets [nevegetable.org/cultural-practices/crop-budgets](http://nevegetable.org/cultural-practices/crop-budgets)
- ❑ Clif Slade's 43560 Project: Virginia Association for Biological Farming newsletter [vabf.files.wordpress.com/2013/08/clif-slade-43560-demo-project.pdf](http://vabf.files.wordpress.com/2013/08/clif-slade-43560-demo-project.pdf).
- ❑ USDA annual vegetable consumption [www.usda.gov/factbook/chapter2.pdf](http://www.usda.gov/factbook/chapter2.pdf)
- ❑ John Jeavons *How to Grow More Vegetables* has charts: Pounds Consumed per Year by the Average Person in the US and Average US Yield in Pounds per 100 Square Feet.
- ❑ The Center for Agroecology and Sustainable Food Systems at the UC Santa Cruz Crop Plan for a Hundred-Member CSA, for a range of 36 crops in its Unit 4.5 CSA Crop Planning: [casfs.ucsc.edu/education/instructional-resources/downloadable-pdf-files2](http://casfs.ucsc.edu/education/instructional-resources/downloadable-pdf-files2) or [63.249.122.224/wp-content/uploads/2010/05/4.5\\_CSA\\_crop\\_plan.pdf](http://63.249.122.224/wp-content/uploads/2010/05/4.5_CSA_crop_plan.pdf)
- ❑ Jean-Paul Courtens , Roxbury Farm [www.roxburyfarm.com](http://www.roxburyfarm.com). Information for Farmers tab, 100 Member CSA Plan, including a Weekly Share Plan, Greenhouse Schedule, and Field Planting and Seeding Schedule (with charts of possible crop yields). Courtens is also willing to send you their 1,100-member schedule.

**Slideshows are available at [www.Slideshare.net](http://www.Slideshare.net) .**

- ❑ Search for *Pam Dawling*. You'll find Crop Rotations, Cold-hardy Winter Vegetables, Fall Vegetable Production, Succession Planting for Continuous Vegetable Harvests, Crop Planning for Sustainable Vegetable Production, Spring and Summer Hoophouses, Fall and Winter Hoophouses, Growing Great Garlic
- ❑ Mark Cain Planning for Your CSA: [www.Slideshare.net](http://www.Slideshare.net) (search for Crop Planning)
- ❑ Planning the Planting of Cover Crops and Cash Crops, Daniel Parson SSAWG 2012 [www.slideshare.net/parsonproduce/southern-sawg](http://www.slideshare.net/parsonproduce/southern-sawg)
- ❑ Cover Crop Innovation and Cover crops for vegetable cropping systems by Joel B Gruver [www.Slideshare.net](http://www.Slideshare.net) [www.slideshare.net/jbgruver/cover-crops-for-vegetable-crops](http://www.slideshare.net/jbgruver/cover-crops-for-vegetable-crops)
- ❑ Finding the best fit: cover crops in organic farming systems. Joel Gruver, Some overlap with previous slideshow. [www.slideshare.net/jbgruver/cover-crops-decatur](http://www.slideshare.net/jbgruver/cover-crops-decatur)
- ❑ Farm Planning for a Full Market Season Tom Peterson, Appalachian Farmers Market Association and Appalachian Sustainable Development <http://vabf.files.wordpress.com/2013/02/tom-peterson-farm-planning-for-a-full-market-season.pdf>
- ❑ Cultural Practices And Cultivar Selections for Commercial Vegetable Growers. Brad Burgefurd, Wide scope. [www.slideshare.net/guest6e1a8d60/vegetable-cultural-practices-and-variety-selection](http://www.slideshare.net/guest6e1a8d60/vegetable-cultural-practices-and-variety-selection)