

Sustainable Farming Practices

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Part 1 – Planning and Record-keeping

Tools for crop planning: Create Your Own Field Manual. *The Fundamental Four*

1. Descriptive month-by-month Calendar
2. Maps of the layout of the crops
3. Field planting schedule

2014		OUTDOOR PLANTING		SCHEDULE		Check against last year's OPS in Shed, Manual, Seedlings Schedule, Seed Order, Rotation Plan, Maps, Succession Crops Plan, Onion Plan, Lettuce Log, FBS, Hphs Schedule					
Revised 11 January 2014 by Brittany and Lori Further work 17 Jan 2014 by Pam											
#AREASIGardenPlanningOutdoorPlantingSchedule.xls											
Transpl or Sow	Actual Transpl. or Sow	Vegetable	Variety	RowFt	Pl/100ft	Inrow space	space btwn rows	Location	Plants	Suc-cess?	Notes
25-Jan		Shallots	Ambition	90	220	5		0E?	238		plant all the bulbs we have
25-Jan		Shallots	Armador	6	220	5		0E?	16		plant all the bulbs we have
10-Feb		Spinach_spr	Tyee	filler	200	6					If not enuf t/p for 2/21, direct sow now
14-Feb		Carrots #1	Danvers	450			8		0		5 rows/bed Germ ~day 15-28

4. Seedling schedule for greenhouse production of transplants

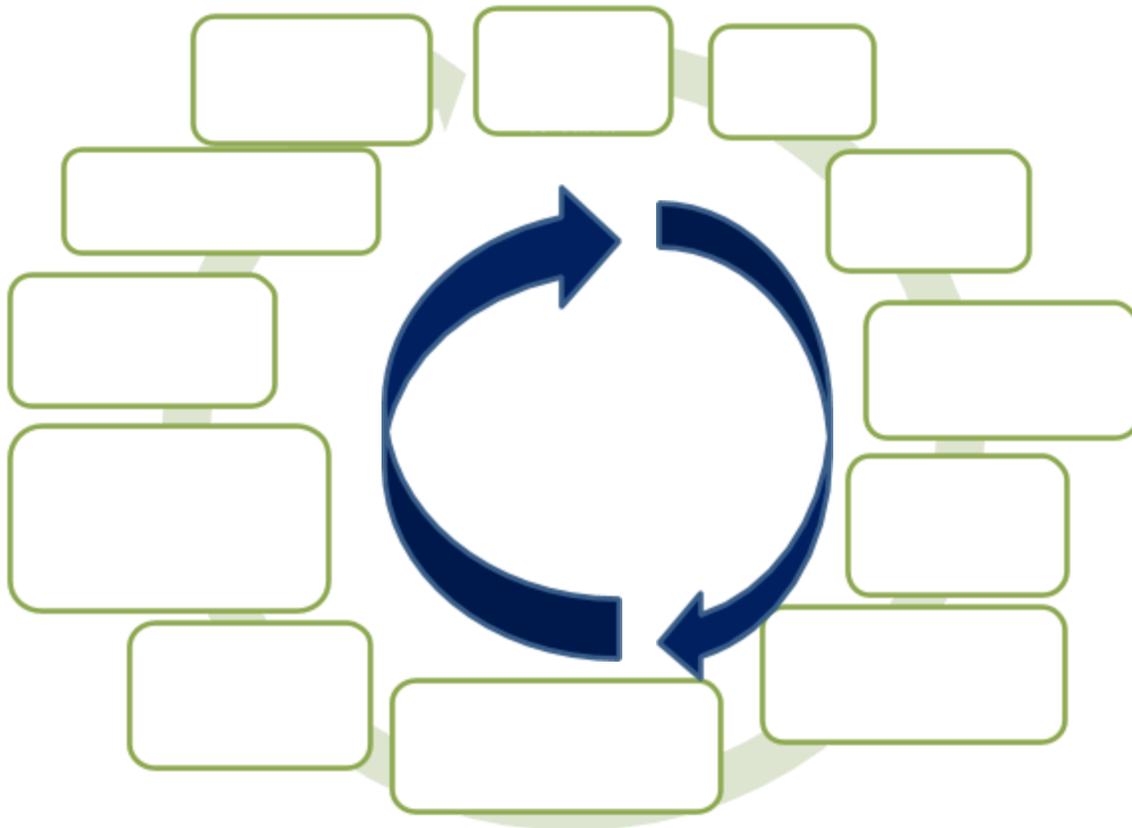
SEEDLINGS SCHEDULE		2014		Max 27 Spdngs, 24 flats at a time. Row Ft? Varieties? Dates? OPS & Lettuce Log?									
#AreaofGardenPlanningSeedlingschedule.xls													
Revised 11 Jan 2014 by Lori and Pam, and 1/17/14 by Pam													
Sown	Sow Date	Vegetable	Variety	RowFt	Pl/100ft	Plants	Sow	Unit	Germ.	Spot	Actual	Transplan	Notes
	17-Jan	Cabbage #1	Early Jersey Wakefield	90	67	72	0.3	flat		1.8		10-Mar	1/2 raised bed, set mouse traps
	17-Jan	Cabbage #1	Farao 60d	90	67	72	0.3	flat		1.8		10-Mar	1/2 raised bed
	17-Jan	Lettuce #1		120	100	144	0.6	flat		3.6		10-Mar	Sow cold hardy spring varieties
	17-Jan	Onions - mini	Red Marble 95d	80	200	176	1.0	spd				21-Mar	3-4 plants/cell. Grow as small bulb onions
	24-Jan	Tomatoes #1	Amy's Apricot ind 75d	4	50	2	3	cells				15-Mar	Hphs Other. Use deep 9-packs/4-packs
	24-Jan	Tomatoes #1	Amy's Sugar Gem 75d ind	6	50	4	4	cells				15-Mar	Hphs Other. Use deep 9-packs/4-packs
	24-Jan	Tomatoes #1	Black Cherry ind	4	50	2	3	cells				15-Mar	Hphs Other. Use deep 9-packs/4-packs

Part 2 – Feed the Soil

Cover crop opportunities

- Undersowing at last cultivation (oats and soybeans in corn shown here.)
- After vegetable crops in summer or fall, for the winter
- Frost-seeding of small seeds such as clover: Broadcast in the early morning when ground is frozen. As it thaws, the water draws the seeds down into the soil.
- Late winter or early spring, if the area will not be planted with vegetable crop until late spring. We use oats.
- In spring, between an early vegetable crop and a later one
- To replace a crop failure.

Planning is Circular, Just like Farming



Compost making

1. Hot (aerobic) compost combines 1 to 3 parts high-C materials with 1 part high-N materials in a 25:1 to 40:1 C:N ratio, and enough water to make the piles damp, enough air to keep the bacteria alive.
2. The first 2-3 days: Mesophilic bacteria active at 90°F–110°F (32°C– 43°C) begin to break down the sugars, fats, starches and proteins.
3. The next several weeks: Thermophilic bacteria increase, and keep working as long as decomposable materials remain available and the oxygen supply is adequate. Temperatures in the middle of the pile can reach 120°F–150°F (48°C–66°C). Pathogens, weed seeds and fly larvae are destroyed. Whenever the pile starts to cool, turn it because more oxygen or more water is needed. This remixes the material – ensuring all gets composted. Turning prevents the pile from overheating – above 150°F (66°C), thermophilic bacteria can die
4. When the compost stops heating, even if you turn it, the compost materials have all been consumed by bacteria and the N is converted to nitrates. The pile cools to around 100°F (37.7°C) The C is now resistant to further breakdown, and the N slowly becomes available for crops
5. Leave it to cure for about 30 days, so beneficial microorganisms can move back in. It is then ready to be used.
6. Finished compost ideally has a C:N (carbon:nitrogen) ratio of 10:1. If the C:N ratio is greater than about 25:1, almost no N is available from the compost and it is unable to mineralize. Between 16 and 20:1, about 10% of the N is available. Even at a C:N ratio of 10:1, only 50% of the N is available in the near term

Crop rotations

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, Include no-till crops
7. Try it for one year, then make improvements



Organic mulches – straw, hay, sawdust, woodchips, tree leaves, newspaper and cardboard all add organic matter

Part 3 – Year Round Production

Direct sowing

- **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
- **Cons**
 - Some crops have millions of plants! (Carrots)
 - Uses more seed
 - Uses more time thinning
 - Occupies the land longer
 - Maybe harder to get started in cold (or hot) conditions

Transplanting

- **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!
- **Cons**
 - Fit more crops into the season
 - Use time windows for quick cover crops
 - Save on seed costs
 - Extra time caring for the starts
 - Transplant shock can delay harvest
 - More attention needed to watering new plants

Crop spacing

Crop	Row spacing	In-row spacing	Notes
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Beets	7" (18 cm)	4" (10 cm)	For early harvest
	12" (30 cm)	1" (2.5 cm)	For max total yield (small).
Beans, fava	18" (45 cm)	2" (5 cm)	For bigger beets
	18" (45 cm)	4.5" (11 cm)	For tall varieties.
Beans, green	18" (45 cm)	2" (5 cm)	12" (30cm)×3" (7.5 cm) gives 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)	Max 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
Onions	5" (13 cm)	1" (2.5 cm)	Baby lettuce mix
	12" (30 cm)	1.5" (4 cm)	For medium size bulbs
Parsnips	12" (30 cm)	0.5" (1 cm)	For boiling, pickling, kebabs
	12" (30 cm)	6" (15 cm)	For high yields of large roots
Peas, shelling	7.5" (19 cm)	3" (8 cm)	For smaller roots
	18" (46 cm)	4.5" (11.5 cm)	Can sow dbl or trpl bands 4.5" (11.5 cm) apart
Potatoes	30" (76 cm)	9–16" (23–41 cm)	Depends on size; small pieces closer
Sweet Corn	30–36" (76–90 cm)	8" (20 cm)	< 8" (20 cm) plants shade each other.
Tomatoes, bush	19" (48 cm)	19" (48 cm)	For early crops
Watermelon	66" (168 cm)	12–24" (30–60 cm)	For small varieties. 5–10 ft ² (0.5–1 m ²) each
	66" (168 cm)	30–84" (76–215 cm)	For large varieties. 13–40 ft ² (1.2–3.7 m ²) each

Sustainable Pest Management

4 steps of Integrated Pest Management:

1. prevention (reduce chance of problems)
2. avoidance,
3. monitoring (is action needed?)
4. suppression (using least toxic solution)

Sustainable Disease Management

Diseases need

- a susceptible host,
- the presence of a pathogen,
- suitable environmental conditions

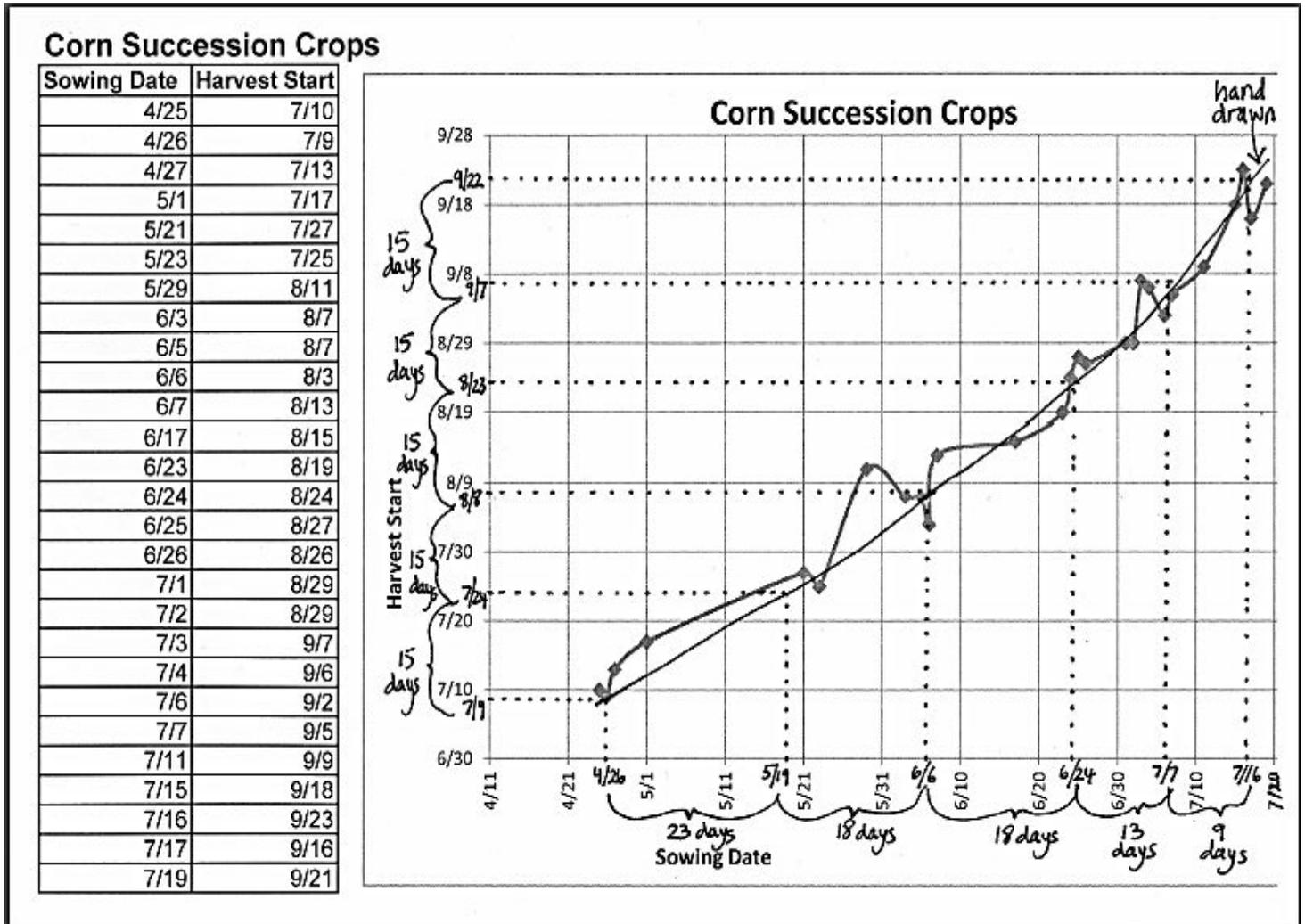
Sustainable Weed Management

- annuals and perennials;
- stationary perennials (docks) and invasive perennials (Bermuda grass);
- cool-weather and warm-weather types;
- quick-maturing and slow-maturing types;
- "Big Bang" types (pigweed) versus "Dribblers"

Succession crop scheduling graphs - 6 Steps

1. Gather sowing and harvest start dates for each planting of each crop
2. Make a graph for each crop: sowing date along the horizontal (x) axis; harvest start date along the vertical (y) axis. Mark in all your data.
3. Mark the first possible sowing date and the harvest start date for that.
4. Decide the last worthwhile harvest start date, mark that.

5. Divide the harvest period into a whole number of segments, according to how often you want a new patch.
6. Figure the sowing dates needed to match your harvest start dates



Season extension

- Growing earlier crops in spring:
 - Choose fast-maturing hardy varieties
 - Warm microclimates
 - Transplants
 - 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
 - Shadecloth
 - ProtekNet to keep bugs off
 - Intercropping allows a new crop to establish in the shade of the old one
- Using spring *and* fall for carrots, beets, broccoli, cabbage, kale, spinach
- Extending the survival of frost-tender crops beyond the first fall frosts
- Growing cold-hardy winter vegetables

Efficient production strategies

1. Plan ahead for success when growing a wide range of different crops and doing many different tasks each day.
2. Plant similar crops together to minimize time-consuming switching of tasks.
3. Plan roads and paths for your truck or carts to haul away the bounty.
4. Break long rows up into manageable chunks. Don't ask anyone to haul a harvest crate more than 100ft. Keep container weight reasonable.

5. Get the tools ready before you start. Make sure there enough knives, scissors, crates, etc. for everyone
6. Set containers along the rows when you arrive. Put full ones near the path

Harvest and Maturity Indicators

- **Size:** Cow Horn okra at 5" (others shorter), green beans a bit thinner than a pencil, carrots at whatever size you like, 7" asparagus, 6" zucchini
- **Color:** Garden Peach tomatoes with a pink flush. The "ground spot" of a watermelon turns from greenish white to buttery yellow at maturity, and the curly tendrils where the stem meets the melon to turn brown and dry. *For market you may harvest "fruit" crops a bit under-ripe*
- **Shape:** cucumbers that are rounded out, not triangular in cross-section, but not blimps. Sugar Ann snap peas completely round
- **Softness or texture:** eggplants that "bounce back" when lightly squeezed, snap beans that are crisp with pliable tips. Harvest most muskmelons when the stem separates easily from the fruit ("Full slip").
- **Skin toughness:** storage potatoes when the skins don't rub off, usually two weeks after the tops die, whether naturally or because of mowing.
- **Sound:** watermelons sound like your chest not your head or your belly when thumped. Try the "Scrunch Test" - press down firmly on the melon

Resources – General

- ❑ ATTRA 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 -A searchable database of research findings. Available to download: *Using Cover Crops Profitably and Crop Rotations on Organic Farms, A Planning Manual*
- ❑ extension.org/organic_production <http://www.eOrganic.info>. The organic agriculture community with eXtension. Publications, webinars, videos, trainings and support. An expanding, source of reliable information.
- ❑ *Growing Small Farms:* growingsmallfarms.ces.ncsu.edu Click *Farmer Resources*. Debbie Roos keeps this site up to the minute. Includes Farm Planning and Recordkeeping
- ❑ The Center for Environmental Farming Systems at North Carolina State University has good information on compost-making, such as *Composting on Organic Farms*.
- ❑ Compost recipe software is available from Cornell University www.cfe.cornell.edu/compost/science.html
- ❑ Southwest Florida Research and Education Center, www.imok.ufl.edu/programs/vegetable-hort/research-extension-ozores/veg-transplant/ (Information on age of transplants, container size, biological control for pests, diseases, hardening off, plant size, planting depth and temperature.)
- ❑ Jean-Paul Courtens , Roxbury Farm www.roxburyfarm.com. Click the *Information for Farmers* tab

Resources – Slideshows

- ❑ Many of my presentations are available at 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*
- ❑ Mark Cain *Planning for Your CSA:* 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
- ❑ *Cover Crop Innovation* by Joel B Gruver www.Slideshare.net ; *Cover crops for vegetable cropping systems*, Joel Gruver, 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
- ❑ *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

Resources – Books

- ❑ *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, (worksheet based). DVD/CD set *Develop a Sustainable Vegetable Garden Plan*
- ❑ *Crop Planning for Organic Vegetable Growers*, Daniel Brisebois and Frédéric Thériault (Canadian Organic Growers 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 and Antonio DiTommaso. SARE. In prep.(not yet published)
- ❑ *SARE Crop Rotations on Organic Farms, A Planning Manual*, Charles Mohler and Sue Ellen Johnson, editors.

Resources – Planning

- ❑ 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/
- ❑ AgSquared online planning software: agsquared.com
- ❑ COG-Pro record-keeping software for Certified Organic Farms: cog-pro.com
- ❑ Free open-source database crop planning software code.google.com/p/cropplanning.
- ❑ Interactive Vegetable Garden Planner, free for 30 days: motherearthnews.com/garden-planner.
- ❑ *Target Harvest Date Calculator*: (Excel spreadsheet) johnnyseeds.com/t-InteractiveTools.aspx
- ❑ *Growing Small Farms*: growingsmallfarms.ces.ncsu.edu click Farmer Resources, Farm Planning and Recordkeeping to download Joel Gruver's spreadsheets.
- ❑ Mark Cain www.drippingspringsgarden.com under the CSA tab, you can download their Harvest Schedule.

Resources – Detailed Planning

- ❑ Tables of likely crop yields johnnyseeds.com/assets/information/vegetablecharts.pdf.
- ❑ gardensofeden.org/04%20Crop%20Yield%20Verification.htm two charts, 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
- ❑ New England Vegetable Management Guide *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.
- ❑ USDA annual vegetable consumption 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 or directly at 63.249.122.224/wp-content/uploads/2010/05/4.5_CSA_crop_plan.pdf
- ❑ Jean-Paul Courtens, Roxbury Farm 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.