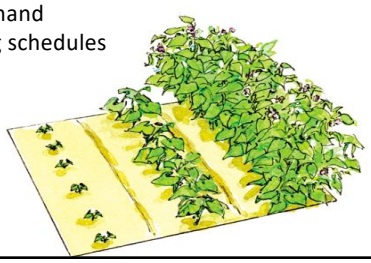
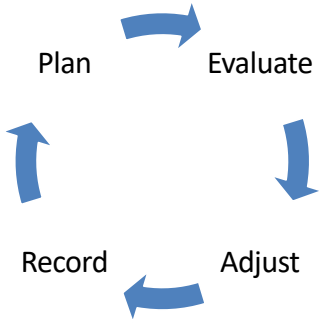
Succession Planning and Maturation Forecasting

Challenges:
- variable weather conditions during growing period
- variable market demand
- interrupted planting schedules
- poor stands



1

Succession Planning and Maturation Forecasting



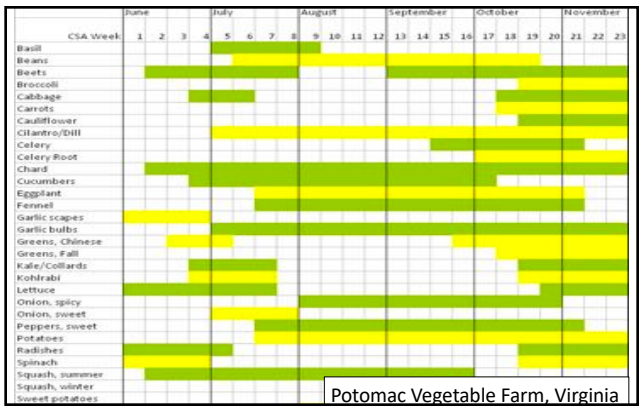
2

Understand Your Market Yield Needed And Timing

Wedge totals	2007 $	VOLUME	2006 $	VOLUME	2005	VOLUME	2004 $	VOLUME	2003 $	VOLUME	2002 $	Volume
Gr. Kale	4400	160	3547	129	3081	130	2640	110	2424	101	2568	107
R. Kale	2062	75	1980	72	1872	78	1656	69	1200	50	1104	46
Lacinato	6105	222	5307	193	4700	196	3096	129	1608	67	1728	72
Kale total	12567	457	10835	394	9653	404	7392	308	5232	218	5400	225
Gr. Cabbage	2706	123	2649	117	3036	138	3278	149	2904	132	1386	63
Red Cabbage	2295	85	2241	83	2403	89	2768	104	2403	89	1269	47
Gr Savoy							527	21	344	14	653	27
Red Savoy							500	20	325	13	no untreated seed	
Cabbage Total	5001	208	4890	200	5439	227	7073	294	5976	248	3308	137
Cucumbers					10235	243	7615	194	8315	220	2340	59
Sweet Corn	7151	341	8813	383	6097	273	6100	305	3720	186	3960	220
Green Peppers	3906	126	3534	114	4340	140	4174	142	2805	90	3968	128
Red Peppers	2676	101	3969	72	6020	121	3343	68	1300	26	3050	61
Tomatoes	12370	312	16024	409	11662	335	10410	280	13775	417	8430	287
Italian Saladette	5960	149	6560	164	3535	101	1080	27				
Sunshine	1400	2400#		735	1260#	1788	4260#	1630	3480#	1362	3000#	1386	2820#
NEW ORCHID	1645	2820#		770	1320#	1434	3540#	1116	2460#	1146	2520#	870	1740#

3

4



Potomac Vegetable Farm, Virginia

5

Vegetable Crops & Their Succession-Planting Intervals

7 days	10 days	14 days	21 days	30 days
Baby leaf lettuce	Full-size (FS) head lettuce	Beets	Carrots	Summer Squash
Baby leaf greens	FS Asian Greens, Pac Choi	Escarole	Cucumber	Swiss Chard
Radishes	Kohlrabi	Endive	FS Mustard Greens	
Spinach	Peas	Arugula	Melons	
	Bush Beans	Turnips		
	Sweet Corn			

http://www.johnnyseeds.com/growers-library/vegetables/succession-planting-interval-chart-vegetables.html

6

Year Round Lettuce – Pam Dawling, Twin Oaks, VA

Lettuce Sowing

- Lettuce germination temperatures 40° F - 80° F
- Optimum 75° F germinates in two days
- Max germination temperature is 85°
- In hot weather, sown late afternoon or at nightfall has better emergence than morning.

January	Twice
February	Twice
March	Every 10 days
April	Every 9 days
May	Every 8 days
June & July	Every 6-7 days
August	Every 5 days
Late August	Every 3 days
Until Sept 21	Every other day
Until end of Sept	Every 3rd day
Last plants feed us through winter	

7

No Paperwork Method: Challenges

Based on Crop Growth

- **Sweet Corn:** When the previous planting is 1- 2" (emerging in 5-7 days is norm, adjust for temperature)
- **Lettuce:** When the previous sowing germinates (I want plantings to come in every 10 days in general)
- **Beans:** When the plants straighten up from hooked stage

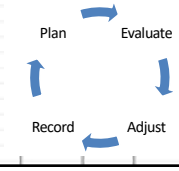
8

PLAN AND RECORD One Document

Earliest unprotected planting date:
Last unprotected harvest date:

Market Dates Goal:
General Harvest Window:

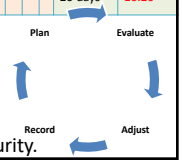
Variety Expectations				Planting					
Variety	Days to Maturity / Seed or Plant	Expected Maturation Date	Expected Harvest Window	General Succession Interval	Transplant Seed Date	Target Field Planting Date	Target # To Plant & Type (seed or	Actual Field Planting Date	Actual # Planted and Type (seed or	Weather Protection / Season Extension



9

	Variety	Days	Planting				Yield		Harvest Length	Expect Mature
			Plan		Actual		Plan	Actual		
			Date	#	Date	#		Date & #		
1	Gypsy	63	4.19	4000			250/wk		7 days	6.20
2	Gypsy	60	4.29	4000			250/wk		7 days	6.27
3	Gypsy	58	5.7	4000			250/wk		7 days	7.4
15	Gypsy	64	7.29	10,000			450/wk		12 days	10.1
16	Gypsy	70	8.1	12,000			500/wk		16 days	10.10
17	Gypsy	77	8.4	16,000			500/wk		20 days	10.20

- Earliest plant date, last harvest date
- Temperature and Day Length and Rain
- Consumer Demand
- Reevaluate next planting based on development.
- Can plant varieties that have different days to maturity.



10

Broccoli 1994, Eureka Township, Dakota County, MN.

We had a cooler and wetter season than normal from April through August. September was unseasonably warm with sufficient rainfall. No irrigation was necessary for broccoli production.

Variety	days to maturity	catalog description
Packman	48 day	early fall good for heat
Gypsy	60 day	heat tolerant
ATX - 3040	68 day	Landmark replacement
Arcadia	70 day	stress tolerant big heads - resistance to hol
Marathon	80 day	highly tolerant to cold

BROCCOLI 2004	Amount	Date Planted	Expected Harvest	Actual Harvest
Packman	3000	7/8	9/1	8/19 - 9/2
Gypsy	2600	6/29	9/1	8/27 - 9/9
Packman	3000	7/15	9/8	8/21 - 90% unshippable d
Gypsy	3000	7/5	9/8	9/2 - 9/17
Gypsy	3000	7/14	9/15	9/9 - 9/20
ATX - 3040	1800	7/5	9/15	9/7 - 9/22
Arcadia	1200	7/5	9/15	8/30 - 9/13
Arcadia	1300	7/13	9/22	9/9 - 9/24
ATX - 3040	3000	7/13	9/22	9/9 - 9/29

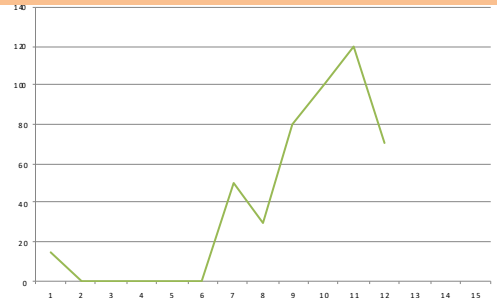
11

Last Planting: Count back from the typical "damaged by weather date"

- The number of days from seeding or transplanting to harvest
- Add the average length of the harvest period
- Add days to allow for the slowing rate of growth in fall (10-20)
- Planting 2-3 days later can mean 2-3 weeks later in fall harvest.
- What is your risk tolerance? If low, add days for chance of early cold
- Row cover – crop protection (Often warm weather follows cold snap)

12

Adjust for crops with uneven yields - Cucumber

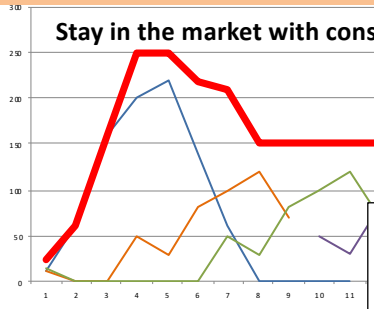


Stay in the market with consistent volume.

13

Cucumber Overlap Plantings to Balance Peak

Stay in the market with consistent volume.



Harvest lasts 21 days
Planting every 10 days
First Planting Doubled
7 plantings
First planting row cover

14

Weather and the condition of the plant can interfere with pollination and fruit set.

- Honeybees are less active when it is hot and dry.
- Pesticide applications or residues can kill or deter bees.
- Fruit already developing on the plant hinder successful fruit set in younger flowers, especially those on the same branch or stem.

15

Gypsy Broccoli

Heat tolerant broccoli variety:
- Handles warm conditions better than others
- Also is good in cool conditions
- Holds well in the field for extended harvest.

Johnnys Seed: 58 days from transplanting add 20 days if direct seeding.

Veseys Seed: 62 days.

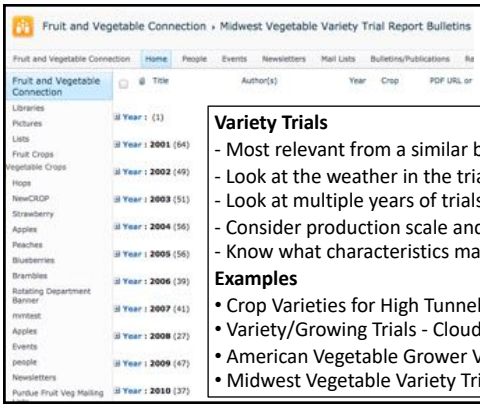
Fedco Seed: 91 days

Harris Seed: 68 Days

16

Sweet Corn Plantings		Time In Days		
Planting	**Variety**	**To Maturity**	**From First PL**	**To Next PL**
1st	Early	68	68	
	Second Early	72	72	
	Midseason	76	76	
	Mainseason	80	80	
	Late	84	84	
				8
2nd	Mainseason	80	88	
	Late	84	92	
				12
3rd	Midseason	76	96	
	Mainseason	80	100	Source:
	Late	84	104	Knott's Handbook

17

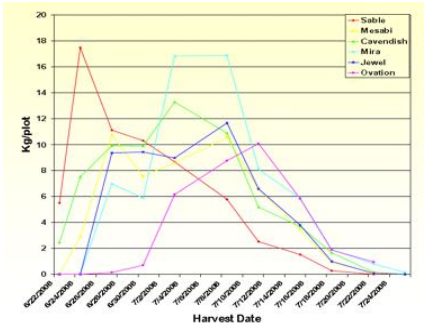


Variety Trials
- Most relevant from a similar bioregion
- Look at the weather in the trial year
- Look at multiple years of trials
- Consider production scale and method
- Know what characteristics matter to you

Examples
- Crop Varieties for High Tunnel Production
- Variety/Growing Trials - Cloud Mountain Farm
- American Vegetable Grower Variety Trials
- Midwest Vegetable Variety Trial

18

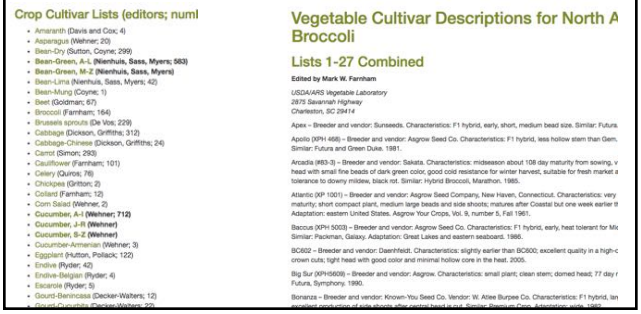
What Makes a Good Strawberry Variety?
Total Yield is a Narrow Lens



- Yield
- Harvest season
- Fruit quality
- Size
- Color
- Firmness
- Flavor
- Durability
- Winter hardiness
- Disease resistance
- Longevity
- Customer Appeal

19

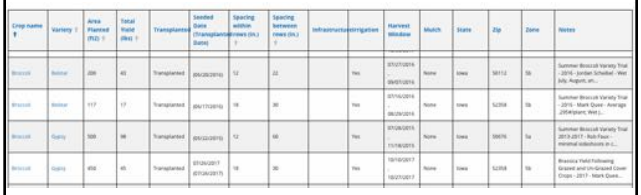
NC STATE Vegetable
Cultivar Descriptions for North America



20

Practical Farmers Of Iowa
Vegetable Yield and Production Data

- Submit or view data.
- Filter by crop, variety, harvest date, production zone, state, and infrastructure used.



https://data.practicalfarmers.org/

21

VARIETY SELECTION

Spring plantings

1. Use varieties that are adapted to mature in cooler temperatures. Consider:
   - Pests and disease
   - Market demands
2. Can plant varieties of the same crop that have different days to maturity. (Timing challenge)
   - Advantages of one variety
   - Disadvantages of one variety

Summer and Fall

1. Use heat and cold tolerant varieties as needed.

22

Phenological Observations As A Prediction Tool

Maturation Forecasting and Decision Making

23

Phenology is the study of the timing of plant and animal life cycle events.


Nest Building


Leaf Out


Flowers Blooming


Migration

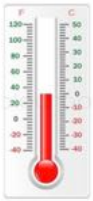

Emergence

Will help you adapt to changing climate

24

Factors in the environment can cause the timing of life cycle events to change.

Temperature



Precipitation

25

Phenology happens everywhere.

26

Plants Are Primarily Ectothermic

- Metabolism and rate of development is strongly influenced by temperature
- Temperature & time (degree days) are useful for predicting development

27

TABLE 8.7. APPROXIMATE TIME FROM POLLINATION OF VEGETABLES TO MARKET MATURITY UNDER WARM GROWING CONDITIONS

Vegetable	Time to Market Maturity[1] (days)
Bean	7–10
Cantaloupe	42–46
Corn,[2] market	18–23
Corn,[2] processing	21–27
Cucumber, pickling (¾–1¼ in. in diameter)	4–5
Cucumber, slicing	15–18
Eggplant (⅔ maximum size)	25–40
Okra	4–6
Pepper, green stage (about maximum size)	45–55
Pepper, red stage	60–70
Pumpkin, Connecticut Field	80–90
Pumpkin, Dickinson	90–110
Pumpkin, Small Sugar	65–75
Squash, summer, crookneck	6–7[3]
Squash, summer, straightneck	5–6[3]
Squash, summer, scallop	4–5[3]
Squash, summer, zucchini	3–4[3]
Squash, winter, banana	70–80
Squash, winter, Boston Marrow	60–70
Squash, winter, buttercup	60–70
Squash, winter, butternut	60–70
Squash, winter, Golden Delicious	60–70
Squash, winter, hubbard	80–90
Squash, winter, Table Queen or acorn	55–60
Strawberry	25–42
Tomato, mature green stage	35–45
Tomato, red ripe stage	45–60

https://iavs.info//wp-content/uploads/2017/04/KnottsHandbook2012.pdf

28

Figure 17. Length of flowering to mature fruit interval (days) by field and harvest period - 2012 Season.

29

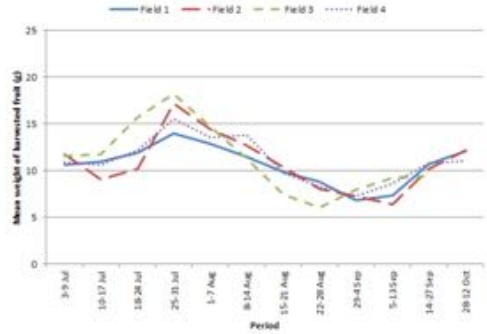


Figure 19. Mean fresh weight of harvested fruit (g) by field and by period - 2012 season.

30

TABLE 3.6. DAYS REQUIRED FOR SEEDLING EMERGENCE AT VARIOUS SOIL TEMPERATURES FROM SEED PLANTED ½ IN. DEEP (Continued)

Vegetable	Soil Temperature (°F) 32	41	50	59	68	77	86	95	104
Lettuce	49	15	7	4	3	2	3	NG	NG
Okra	NG	NG	NG	27	17	13	7	6	7
Onion	136	31	13	7	5	4	4	13	NG
Parsley	—	—	29	17	14	13	12	—	—
Parsnip	172	57	27	19	14	15	32	NG	NG
Pea	—	36	14	9	8	6	6	—	—
Pepper	NG	NG	NG	25	13	8	8	9	NG
Radish	NG	29	11	6	4	4	3	—	—
Spinach	63	23	12	7	6	5	6	NG	NG
Tomato	NG	NG	43	14	8	6	6	9	NG
Turnip	NG	NG	5	3	2	1	1	1	3
Watermelon	—	NG	—	—	12	5	4	3	—

Adapted from F. F. Huntington and P. A. Minges, "Vegetable Seed Germination," California Agricultural Extension Mimeo Leaflet (1964).
NG = No germination; — = not tested

KNOTT'S HANDBOOK

31

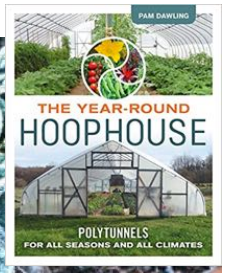
Growing degree days (GDD): A measure of heat accumulation. Used to predict plant and insect growth and development rates.

Development will only occur if the temperature exceeds the minimum development threshold, or base temperature (TBASE).

32

Overwintering Spring Hardy Crops

9/20-9/30 sowings over winter small and make harvest in early spring. It grows every time air temperature reaches 39° F. (Pam Dawling - Virginia)



33

Temperature Base (Tbase)

The base temperature is that temperature below which plant growth is zero.

OSU's Integrated Plant Protection Center http://uspest.org/wea/ http://ipm.ucanr.edu/MODELS/index.html

Crop	Lower Development Threshold (°F)
Asparagus	40
Bean, snap	50
Beet	40
Broccoli	40
Carrot	38
Collards	40
Cucumber	55
Eggplant	60
Lettuce	40
Muskmelon	50
Onion	35
Okra	60
Pea	40
Pepper	50
Potato	40

34

Approx. Monthly Temperature for Best Growth and Growing Degree Day Base Temperature

Plant Family	Crop	Opt	Min °F	Max °F	GDD Base
Carrot	Carrot	60-65	45	75	38
Carrot	Celery	60-65	45	75	
Carrot	Parsley	60-65	45	75	
Carrot	Parsnip	60-65	40	75	
Goosefoot	Beet	60-65	40	75	40
Goosefoot	Chard	60-65	40	75	
Goosefoot	Spinach	60-65	40	75	
Onion	Chives	55-75	45	85	
Onion	Garlic	55-75	45	85	
Onion	Leek	55-75	45	85	
Onion	Onion	55-75	45	85	35
Pea	Broad beans	60-65	40	75	
Pea	Peas	60-65	45	75	40
Sunflower	Chicory	55-75	45	85	
Sunflower	Endive	60-65	45	75	
Sunflower	Lettuce	60-65	45	75	40

Source: Maynard, D.N. and Hochmuth, G.J. 2007. Knott's Handbook for Vegetable Growers, 5 ed. John Wiley and Sons, New York.

35

$$\frac{\text{Tmax} + \text{T min}}{2} = \text{MT} - \text{Tbase} = \text{GDD}$$

$$\frac{70 + 50}{2} = 60 - 40 = 20 \text{ GDD}$$

$$= 60 - 60 = 0 \text{ GDD}$$

Daily maximum temperature = 70°
Daily minimum temperature = 50°
Mean temperature = 70° + 50° / 2 = 60°
Tbase for broccoli is 40°
Tbase for okra is 60°

36

Golden Jubilee Sweet Corn

Date 2011	Date 2010	Date 2009	DDs	Event
5-19	5-16	5-16	104	First emergence from soil
6-12	6-12	5-31	308	5 leaf stage
6-25	6-25	6-9	445	7 leaf stage
7-25	7-24	7-9	883	5 inch tassels
7-30	7-27	7-14	960	10 inch tassels
8-1	7-30	7-17	1005	5% silk emergence
8-4	8-3	7-19	1062	50% silk emergence
8-9	8-7	7-24	1145	95% silk emergence
8-18	8-15	7-29	1288	50% brown silks develop
8-24	8-23	8-4	1412	95% brown silks develop
8-31	9-1	8-12	1539	Fresh market harvest
9-4	9-4	8-16	1597	Processing market harvest

37

Modified Growing Degree Days:

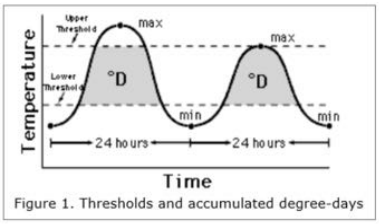


Figure 1. Thresholds and accumulated degree-days

Corn: Development is limited over 86° F.

If the high for the day was 92° F and the low 68° F, the modified GDD calculation would be 86 + 68 = 154 / 2 = 77.

38

Thermal time to maturity (2013-14 data)

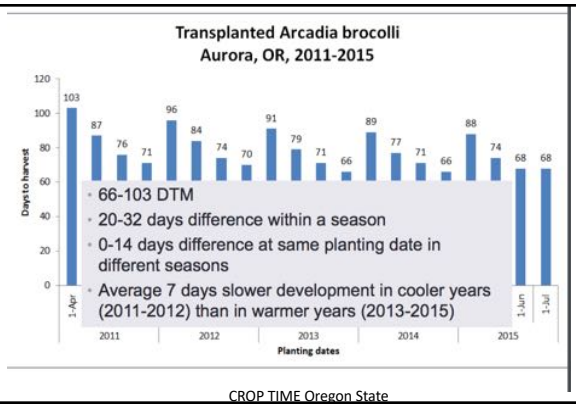
Cucumber 50/80F, SSICO	First flower	First harvest	Accuracy (± days)
Cobra (DS)	561	870	2.88
Marketmore (TP)	358	682	4.0
Marketmore (DS)	654	952	2.5

~11days diff.

Direct seeded sweet corn 50/86, corn DD	5 true leaves	100% silk	Fresh market harvest	Processed market harvest	Accuracy (± days)
Kokanee	306	1112	1522	1635	2.6
Luscious	277	1004	1134	--	3.75

~16 days diff.

39



40

Degree Days for Common Fruit & Vegetable Insect Pests

Colorado Potato Beetle, 1st generation
Base temperature = 50°F
Begin counting when first eggs appear
1st instar larva at 185 DD50
2nd instar larva at 240 DD50
3rd instar larva at 300 DD50
4th instar larva at 400 DD50
Pupa at 675 DD50

Common Asparagus Beetle
Base temperature = 50°F
Egg laying at 150 – 240 DD50
(Amelanchier full bloom, redbud early to full bloom, Black Hills spruce bud caps splitting)

http://uspest.org/wea/

MyPest Page - IPM Pest and Plant Disease Models and Forecasting

USPEST.ORG

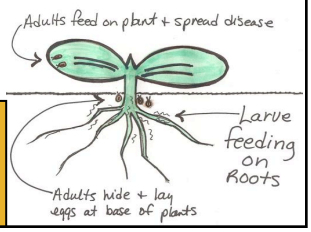
for Agricultural, Pest Management, and Plant Biosecurity Decision Support in the US

Introduction | Quick Start | Map Index | Shortcut Links | Degree-day Maps

41

Striped Cucumber Beetles

• **Overwinter** - As unmated adults in crop and weed debris, bordering vegetation, woodlots and fence rows.
• **Emerge** - In spring when temperatures reach 55 to 65°
• In spring before migrating to cucurbits, **over-wintering adults** feed on - pollen, petals and leaves of early blooming plants, especially flowering plants in the rose family.
• **Larval Stage EAT** – only roots of cucurbit plants.



Delay Planting – Plant after June 10

42

Hairy nightshade time to maturity

Hairy Nightshade			
Cotyledon to First Flower (DD)	Cotyledon to First Flower (Days)	First Flower to First viable seed (DD)	First Flower to First viable seed (Days)
778	34	1085	36

43

FLORIDA, NEW MEXICO

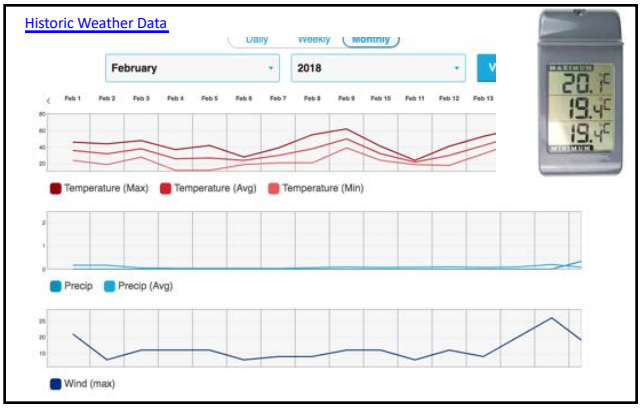
Period of Record General Climate Summary - Growing Degree Days

Station:(293225) FLORIDA												
From Year=1929 To Year=1992												
Growing Degree Days for Selected Base Temperature (F)												
Base	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
40 M	80	149	303	519	793	1057	1210	1136	918	630	263	93	7153
40 S	80	230	533	1052	1845	2902	4112	5249	6167	6797	7060	7153	7153
45 M	21	62	169	372	638	907	1055	981	768	476	138	28	5615
45 S	21	83	251	623	1261	2169	3224	4205	4973	5449	5587	5615	5615
50 M	3	18	72	231	483	757	900	826	618	325	48	5	4286
50 S	3	20	92	323	807	1564	2464	3290	3908	4233	4282	4286	4286
55 M	0	3	22	112	332	607	745	671	468	186	9	1	3155
55 S	0	3	24	136	468	1075	1820	2491	2959	3145	3154	3155	3155
60 M	0	0	3	35	190	457	590	516	320	78	1	0	2190
60 S	0	0	3	39	228	685	1276	1792	2112	2189	2190	2190	2190
Corn Growing Degree Days													
50 M	122	182	291	407	533	635	754	723	582	445	252	137	5064
50 S	122	305	596	1003	1536	2171	2925	3648	4230	4676	4927	5064	5064

M = Monthly Data
S - Sum of monthly data

44

Historic Weather Data



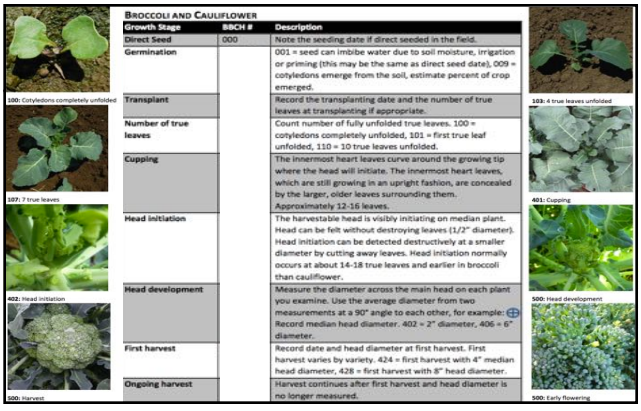
45

Smallfarms.oregonstate.edu/croptime

Oregon State University Extension Service

Date		Temp/Precip			DD	Day length		Cum DD	Crop events
Month	Day	Max	Min	Precip	DDs Today	Day length (hr)	QA + Notes	Starting 4-1 Cumu. DDs	Model Events
4	1	53.0	40.1	0.10	14.6	13.1		15	transplanted - 2-4 leaves
5	1	73.8	45.6	0.00	27.5	14.6		612	
6	1	62.5	53.9	0.21	26.2	15.8		1458	
6	11	81.4	49.9	0.00	31.4	16.0		1780	50% head initiation
6	28	83.6	66.3	0.00	38.6	16.0		2351	first harvest
7	1	95.4	57.9	0.00	36.2	16.0		2461	
7	9	85.2	59.8	0.00	36.2	15.9		2751	early flowering
7	14	83.4	57.6	0.00	35.1	15.8		2930	
7	22	72.1	53.1	0.00	30.6	15.5		3205	

46

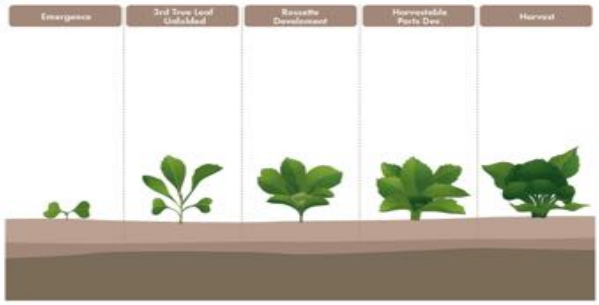


Broccoli and Cauliflower

Growth Stage	BBCH #	Description
Direct Seed	000	Note the seeding date if direct seeded in the field.
Germination		001 = seed can imbibe water due to soil moisture, irrigation or priming (this may be the same as direct seed date), 009 = cotyledons emerge from the soil, estimate percent of crop emerged.
Transplant		Record the transplanting date and the number of true leaves at transplanting if appropriate.
Number of true leaves		Count number of fully unfolded true leaves. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 110 = 10 true leaves unfolded.
Cupping		The innermost heart leaves curve around the growing tip where the head will initiate. The innermost heart leaves, which are still growing in an upright fashion, are concealed by the larger, older leaves surrounding them. Approximately 12-16 leaves.
Head initiation		The harvestable head is visibly initiating on median plant. Head can be felt without destroying leaves (1/2" diameter). Head initiation can be detected destructively at a smaller diameter by cutting away leaves. Head initiation normally occurs at about 14-18 true leaves and earlier in broccoli than cauliflower.
Head development		Measure the diameter across the main head on each plant you examine. Use the average diameter from two measurements at a 90° angle to each other, for example: ⊕ Record median head diameter. 402 = 2" diameter, 406 = 6" diameter.
First harvest		Record date and head diameter at first harvest. First harvest varies by variety. 424 = first harvest with 4" median head diameter, 428 = first harvest with 8" head diameter.
Ongoing harvest		Harvest continues after first harvest and head diameter is no longer measured.

47

Plant Development Stages



48

DETAILED RECORDS ARE CRUCIAL FOR SUCCESSFUL PLANNING

Developmental Stages: Germination, true leaf, vegetative stage, leaf count, flower, fruit development, rosette, beginning head, etc.

Broccoli

# of true leaves on transplant	Roots leave ball	Leaves color up	Cupping date, # of leaves	10% of heads initiation	50% of head initiation	Flowers open, % of field

Cucumber

Roots leave ball	Leaves color up	Vining	M. Flower	P fruit date, #, location	P fruit date, #, location	P fruit date, #, location

49

Maturation Forecasting: Transplant

Root growth and leaf color

50

Maturation Forecasting: Cupping

150 gdd, typically 15/16 leaves
Innermost heart leaves curl around growing tip

51

Maturation Forecasting: Head Initiation

400 gdd, ½" diameter, 14-18 leaves
head can be felt without destroying leaves

52

Maturation Forecasting: Harvest

424-460 gdd

53

Maturation Forecasting: Early Flowering

501 GDD - branches begin to elongate
550 GDD 50% flowering
590 GDD 90% flowering

54

ASTERACEAE

LETTUCE

Growth Stage	Description
Cotyledon (emergence)	Cotyledonous leaves emerge from the soil.
Number of true leaves	Count number of fully unfolded true leaves.
5-6 true leaves	**5-6 true leaves are fully unfolded. This is the beginning of the period of N uptake.**
Number of true leaves	Count number of fully unfolded true leaves.
Rosette	Distinct circular cluster of leaves.
Cupping	**Tips of inner leaves begin to curl inwards on the edge, two youngest leaves do not unfold. This stage is much less pronounced with leaf lettuce than with head lettuce.**
Heading	Cupped leaves begin to overlap and cover the growing point of the plant. Leaf lettuce does not form a head.
Mature	**The head reaches marketable size for the variety, leaf lettuce is marketable size for that variety and leaves have not started to become bitter.**
Bolting	Main shoot inside head begins to elongate.

55

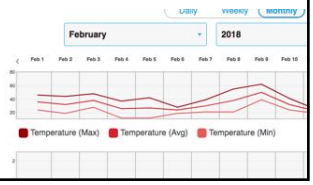
HEAD LETTUCE PLAN AND RECORD

Historic Weather Data

Knott's Handbook
Temperatures for best growth

Optimum	Minimum	Maximum	Freezing point
60-65	40	75	31.7° mature, 25° hardened seedlings

Tbase 40°
Johnnys
Full-Size Head Lettuce
Sow up to 8 weeks before first fall frost
Plant at 10-day intervals



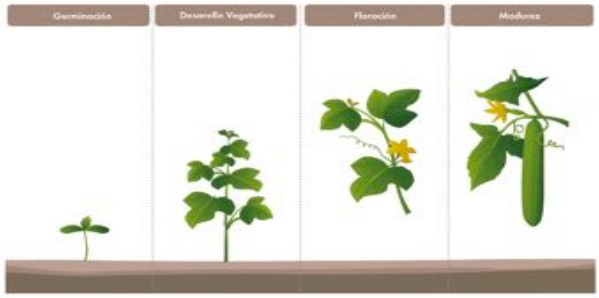
56

What will your field tour schedule be?

Developmental Stages: Germination, true leaf, vegetative stage, leaf count, flower, fruit development, rosette, beginning head, etc.

	Phenology
Broccoli	
# of true leaves on transplant / Roots leave ball / Leaves color up / Cupping date, # of leaves / 10% of heads initiation / 50% of head initiation / Flowers open, % of field	
Cucumber	
Roots leave ball / Leaves color up / Vining / M. Flower / P fruit date, #, location / P fruit date, #, location / P fruit date, #, location	

57



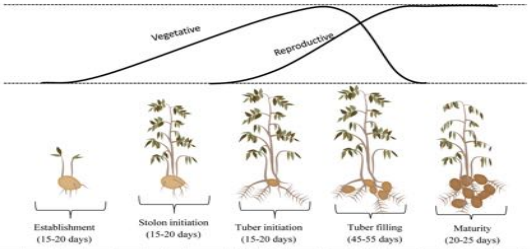
What Development Stages Will I Record?
Consider fertility, pest, water, weeds, harvest

58

Monoecious: Separate male and female flowers
Andromonoecious: Separate male and perfect flowers
Gynoecious: Female flowers only
Hermaphroditic: Perfect flowers
Parthenocarpic: Fruit without fertilization of ovules, which makes the fruit seedless.
Simulative Parthenocarpic: Pollination is required but no fertilization takes place.

59

How do growth stages impact fertility, pest, and water needs?



60

How do growth stages impact fertility, pest, and water needs?

61

62

Seed Versus Transplant

- Germination accuracy
- Clay soils
- Clock reset = increased control
- Pest and disease management
- Weed management

63

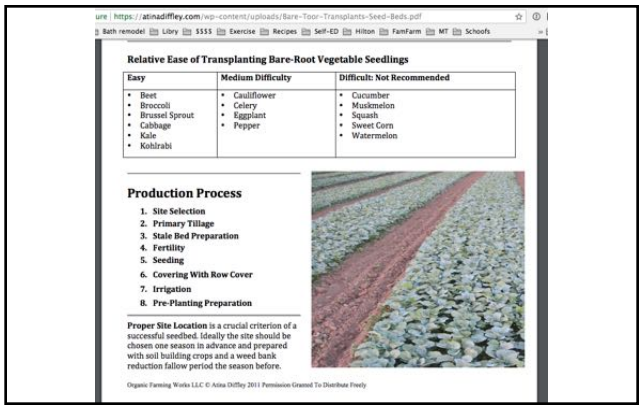
How Do Roots Affect Maturation Timing And Yield

64

How will maturation differ for these?
How will yield differ?
What information do you want to record?

65

66



Relative Ease of Transplanting Bare-Root Vegetable Seedlings

Easy	Medium Difficulty	Difficult: Not Recommended
• Beet • Broccoli • Brussel Sprout • Cabbage • Kale • Kohlrabi	• Cauliflower • Celery • Eggplant • Pepper	• Cucumber • Muskmelon • Squash • Sweet Corn • Watermelon

Production Process

1. Site Selection
2. Primary Tillage
3. Stale Bed Preparation
4. Fertility
5. Seeding
6. Covering With Row Cover
7. Irrigation
8. Pre-Planting Preparation

Proper Site Location is a crucial criterion of a successful seedbed. Ideally the site should be chosen one season in advance and prepared with soil building crops and a weed bank reduction fallow period the season before.

67

68

Not all vegetables require succession planting

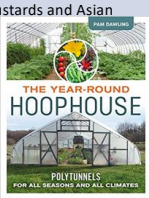
Processing crops
Bulb onions
Winter squash

Can you reduce # of plantings with storage?
Cabbages, root crops

69

Winter Hardiness Table, Pam Dawling, VA

36° F	Basil
32° F	Bush beans, cauliflower, corn, cowpeas, cucumbers, eggplant, limas, melons, okra, some pak choy, peanuts, peppers, potato vines, squash vines, sweet potato vines, tomatoes
27° F	Most cabbage, sugarloaf chicory, radicchio
25° F	Broccoli heads, chervil, chicory roots, Chinese Napa cabbage, endive, escarole, annual fennel, inner leaves of lettuce, some mustards and Asian greens
22° F	Arugula, tatsoi
20° F	Some beets, inside cabbage heads, celeriac, some musta
15° F	Some beets, beet leaves, broccoli leaves, young cabbage, rowcover, cilantro, endive, fava beans, Russian kales, koh especially small plants, parsley, Asian winter radish with

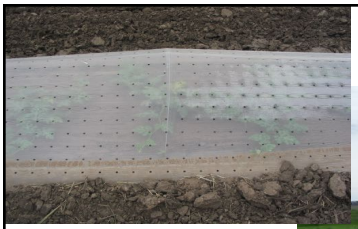


70

Row cover
Or
Clear plastic?

SEASON EXTENSION
Earliest protected planting date
Last protected harvest date

71



72

PLAN AND RECORD
One Document

Earliest unprotected planting date:
Last unprotected harvest date:
Market Dates Goal:
General Harvest Window:

Variety Expectations					Planting					
Variety	Days to Maturity / Seed or Plant	Expected Maturation Date	Expected Harvest Window	General Succession Interval	Transplant Seed Date	Target Field Planting Date	Target # To Plant & Type (seed or	Actual Field Planting Date	Actual # Planted and Type (seed or	Weather Protection / Season Extension

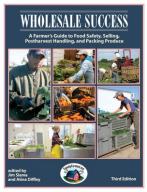
Plan → Evaluate → Adjust → Record

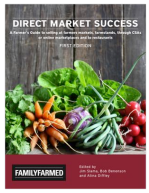
73

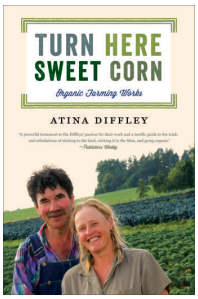
THANK-YOU

- Evaluations

www.atinadiffley.com
www.familyfarmed.org







74

1. Continuous harvest or specific windows?
2. Use heat and cold tolerant varieties as needed.
3. One variety, or multiple/different days to maturity.
4. As the weather warms up interval time is reduced.
5. Maturation will slow in cold weather. Plant more frequent, and/or more volume for cool harvest times.
6. Consider season extension needs.
7. Consider market demands.
8. Do you need plantings to overlap?
9. Do you want to reduce # of plantings with storage?

75

Not yet emerged

77

Just emerging

78

The first leaf is starting to roll up but it is still rolled

79

The 2nd leaf is emerging but is still rolled. The plant has a characteristic "V" shape

80

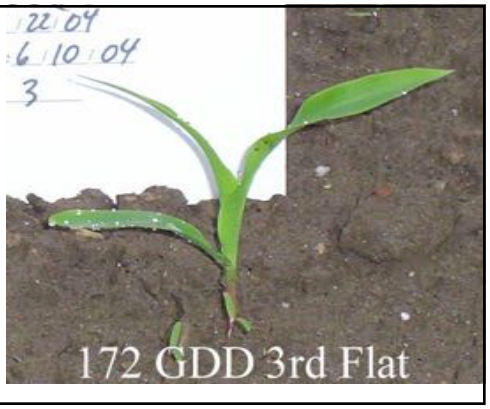
The third leaf is just emerging as a spike.

81

The 3rd leaf is larger, but still rolled so it stays fairly upright

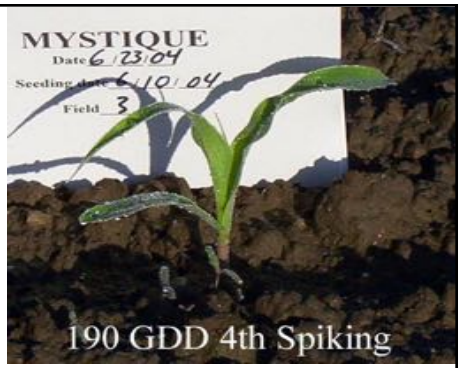
82

The 3rd leaf is fully open as indicated by the end falling below 45 degrees



83

The 4th leaf emerges as a spike.



84

The 4th leaf is starting to flatten out but is still rolled enough that the end of the leaf has not fallen below 45 Degrees.

85