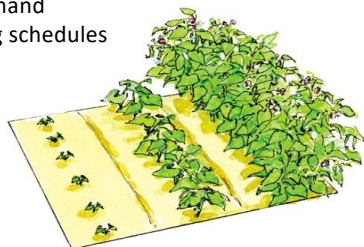


Succession Planning and Maturation Forecasting

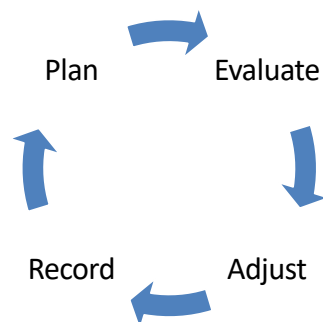
Challenges:

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



1

Succession Planning and Maturation Forecasting



3

Understand Your Market Yield Needed And Timing

	2007 \$	VOLUME	2006 \$	VOLUME	2005 VOLUME	2004 \$	VOLUME	2003 \$	VOLUME	2002 \$	VOLUME
Bridge totals	4400	180	3547	129	3081	130	2640	110	2424	101	2588
Gr. Kale	2062	75	1880	72	1872	78	1656	69	1200	50	1104
Lacinato	8105	222	5307	193	4700	196	3096	129	1608	67	1728
Kale total	12567	457	10835	394	9653	404	7392	308	5232	218	5400
Gr. Cabbage	2706	123	2649	117	3036	138	3278	149	2904	132	1386
Red Cabbage	2295	85	2241	83	2403	89	2768	104	2403	89	1269
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	254	5976	248	3308
Cucumbers					10235	243	7615	194	8315	220	2340
Sweet Corn	7151	341	8813	383	6097	273	6100	303	3720	186	3960
Green Peppers	3908	126	3534	114	4540	140	4174	142	2805	90	3968
Red Peppers	2876	101	3969	72	6030	121	3343	68	1800	26	3090
Tomatoes	12370	312	16024	408	11662	335	10410	280	13775	417	8430
Italian Saladette	5960	149	6560	164	3535	101	1080	27			
Sunshine	1400	2400H	735	1260H	1788	4260H	1630	3480H	1362	3000H	1386
NEW ORCHO	1645	2820H	770	1320H	1434	3540H	1116	2460H	1146	2520H	870

4

Middle Way Farm
Seasonal Availability Chart
Availability depends on weather, supply, and other factors
We also grow a few crops not listed on this chart

Grinnell Iowa

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Arugula								
Beets								
Broccoli								
Brussels								
Sprouts								
Cabbage								
Carrots								
Chard								
Cucumber								
Eggplant								
Garlic								
Green Beans								
Green Onions								
Kale								
Kohlrabi								
Leek								
Leffraco								
Onion								
Pear								
Pepper								
Potato								
Radish								

5

	June	July	August	September	October	November
CSA Week	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23					
Basil						
Beans						
Beets						
Broccoli						
Cabbage						
Carrots						
Cauliflower						
Citrus/Dill						
Celery						
Celery Root						
Chard						
Cucumbers						
Eggplant						
Fennel						
Garlic scapes						
Garlic bulbs						
Greens, Chinese						
Greens, Fall						
Kale/Collards						
Kohlrabi						
Lettuce						
Onion, spicy						
Onion, sweet						
Peppers, sweet						
Potatoes						
Radishes						
Squash, summer						
Squash, winter						
Sweet potatoes						

Potomac Vegetable Farm, Virginia

6

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>

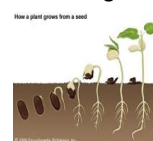
7

- 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 3 rd day
Last plants feed us through winter	

8

- **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



9

[illegible]

10

	Variety	Days	Planting				Yield			Harvest Length	Expected Maturity
			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 ma

11

Broccolini 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

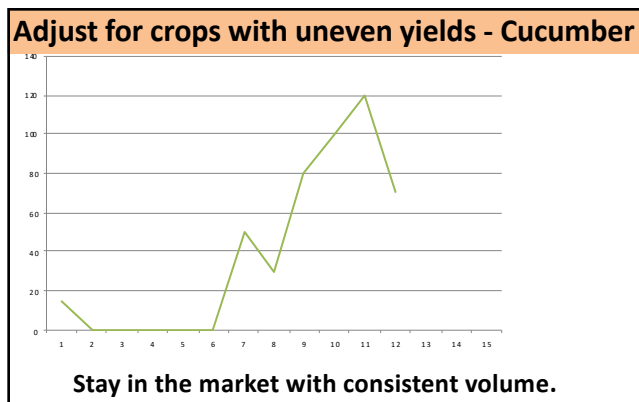
BROCCOLI	Date	Expected	Actual
2004	Amount Planted	Harvest	Harvest
Packman	3000 7/8	9/1	8/19 - 9/2
Gypsy	2600 6/29	9/1	8/27 - 9/9
Packman	3000 7/15	9/8	8/21 - 90% unshippable d
Gypsy	3000 7/5	9/8	9/2 - 9/17
Gypsy	3000 7/14	9/15	9/9 - 9/20
ATX - 3040	1800 7/5	9/15	9/7 - 9/22
Arcadia	1200 7/5	9/15	8/30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

12

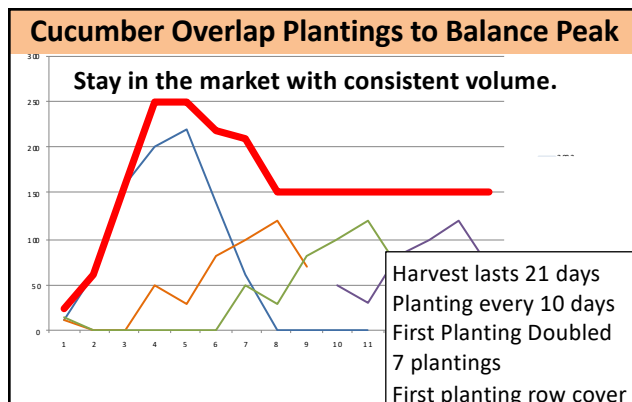
- The number of days from seeding or transplanting to harvest
- Add the average length of the harvest period
- Add days to allow for the slowing rate of growth in fall (10-20)
- Planting 2-3 days later can mean 2-3 weeks later in fall harvest.
- What is your risk tolerance? If low, add days for chance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



13



14



15

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.

16

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



17

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

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Fruit and Vegetable Connection - Midwest Vegetable Variety Trial Report Bulletins

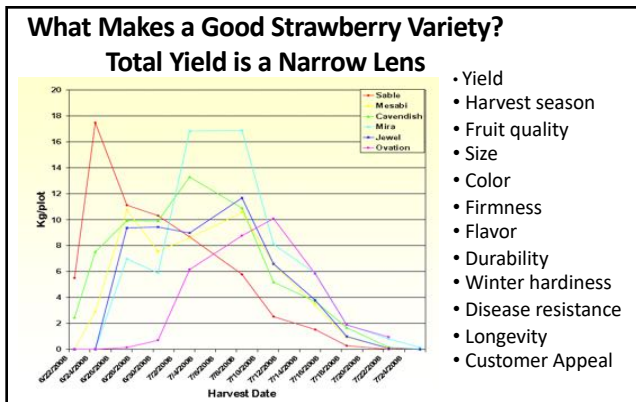
Variety Trials

- 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

19



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NC STATE Vegetable Cultivar Descriptions for North America

Crop Cultivar Lists (editors; numl)

- Amaranth (Davis and Cox; 4)
- Asparagus (Wahner; 20)
- Bean-Coy (Butter, Coyne; 299)
- Bean-Green, A-1 (Brenthuis, Sess, Myers; 563)
- Bean-Green, M-2 (Brenthuis, Sess, Myers)
- Bean-Lima (Brenthuis, Sess, Myers; 42)
- Bean-Mung (Coyne; 1)
- Beet (Graham; 97)
- Broccoli (Farnham; 164)
- Brussels sprouts (De Vos; 229)
- Cabbage (Dickson, Griffiths; 310)
- Cabbage-Chinese (Dickson, Griffiths; 24)
- Carrot (Simon; 263)
- Cauliflower (Farnham; 101)
- Celery (Quinn; 78)
- Chickpea (Griffin; 2)
- Collard (Farnham; 12)
- Corn Salad (Wahner; 2)
- Cucumbers, A-1 (Wahner; 719)
- Cucumbers, J-1 (Wahner)
- Cucumbers, S-2 (Wahner)
- Cucumbers-American (Wahner; 3)
- Eggplant (Huffman, Probst; 122)
- Endive (Plyler; 42)
- Endive-Batavia (Plyler; 4)
- Escarole (Plyler; 5)
- Ground Serrano (Decker-Walters; 12)
- Kale (Graham; 101)
- Kohlrabi (Graham; 101)
- Lettuce (Graham; 101)
- Lima (Brenthuis, Sess, Myers; 42)
- Mung (Coyne; 1)
- Napa (Graham; 101)
- Okra (Graham; 101)
- Onions (Graham; 101)
- Peas (Graham; 101)
- Peppers (Graham; 101)
- Potatoes (Graham; 101)
- Pumpkins (Graham; 101)
- Radishes (Graham; 101)
- Spinach (Graham; 101)
- Squash (Graham; 101)
- Swiss Chard (Graham; 101)
- Tomatoes (Graham; 101)
- Turnips (Graham; 101)
- Watermelons (Graham; 101)
- Zucchini (Graham; 101)

Vegetable Cultivar Descriptions for North A Broccoli

Lists 1-27 Combined

Edited by Mark W. Farnham

USDA/ARS Vegetable Laboratory
2815 S. Salisbury Highway
Charleston, SC 29414

Apex - Breeder and vendor: Sunseeds. Characteristics: F1 hybrid, early, short, medium head size. Similar: Futura.

Apollis (SPH 485) - Breeder and vendor: Agrigrow Seed Co. Characteristics: F1 hybrid, less hollow stem than Gem.

Similar: Futura and Green Duke; 1981.

Aradia (983-3) - Breeder and vendor: Sakata. Characteristics: midseason about 108 day maturity from sowing, v head with small fine beads of dark green color, good cold resistance for winter harvest, suitable for fresh market a tolerance to downy mildew, black rot, similar: hybrid broccoli, Marathon; 1985.

Atlantic (300 1001) - Breeder and vendor: Agrigrow Seed Company, New Haven, Connecticut. Characteristics: very maturity, short compact plant, medium large heads and side shoots, matures after Coastal but one week earlier if Adaptation: eastern United States. Agrigrow Your Choice, 90, 8, number 8, Fall 1991.

Baccus (SPH 5023) - Breeder and vendor: Agrigrow Seed Co. Characteristics: F1 hybrid, early, heat tolerant for fall. Similar: Packman, Galaxy. Adaptation: Great Lakes and eastern seaboard; 1986.

BCR02 - Breeder and vendor: DeekFreest. Characteristics: slightly earlier than BCR020, excellent quality in a high-c crown look, light head with good color and minimal hollow core in the head; 2005.

Big Boy (2001608) - Breeder and vendor: Agrigrow. Characteristics: small plant, clean stem, domed head, 77 day r Futura, Symphony; 1990.

Bonanza - Breeder and vendor: Brown-You Seed Co. Vendor: W. Atlee Burpee Co. Characteristics: F1 hybrid, less hollow stem than Gem. Similar: Futura and Green Duke; 1981.

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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.

Crop name	variety	Area planted (Ft ²)	Total yield (lbs)	Transplants	Seeded Date (Transplants/rows (in.) (date))	Spacing within rows (in.)	Spacing between rows (in.)	Infrastructure/irrigation	Harvest Method	Month	State	Zip	Zone	Notes
broccoli	normal	200	40	Transplanted	05/02/2015	12	24	Yes	07/07/2015	None	Ohio	43012	1b	Summer Broccoli Variety Trial 2015 - Jordan Schuler, and Jeff Rogers, et al.
broccoli	normal	117	17	Transplanted	05/11/2015	18	36	Yes	07/10/2015	None	Ohio	43004	1b	Summer Broccoli Variety Trial 2015 - Mark Spivey - Agrigrow (2001608), etc.
broccoli	spiky	300	40	Transplanted	05/02/2015	12	24	Yes	07/08/2015	None	Ohio	43076	1a	Summer Broccoli Variety Trial 2015-2017 - Mark Spivey - Agrigrow (2001608), etc.
broccoli	spiky	450	40	Transplanted	07/04/2017	18	36	Yes	10/10/2017	None	Ohio	43004	1b	Broccoli Hybrid Following - Brown and Redhead Seed Company - 2017 - Mark Spivey.

<https://data.practicalfarmers.org/>

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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.

23

Phenological Observations As A Prediction Tool

Maturation Forecasting and Decision Making

24

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

Will help you adapt to changing climate

25

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

Temperature



Precipitation



26

Phenology happens everywhere.



27

Plants Are Primarily Ectothermic

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



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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, market	18-23
Corn, processing	21-27
Cucumber, pickling (½-1½ in. in diameter)	4-5
Cucumber, slicing	11-18
Eggplant (½ maximum size)	35-40
Okra	4-8
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 ¹
Squash, summer, straightneck	5-6 ¹
Squash, summer, scallop	4-5 ¹
Squash, summer, zucchini	3-4 ¹
Squash, winter, butternut	70-80
Squash, winter, Boston Marrow	60-70
Squash, winter, buttercup	60-70
Squash, winter, butternut	60-70
Squash, winter, Golden Delicious	60-80
Squash, winter, hubbard	55-60
Squash, winter, Table Queen or acorn	25-42
Strawberry	35-45
Tomato, mature green stage	45-60
Tomato, red ripe stage	45-60



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

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

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

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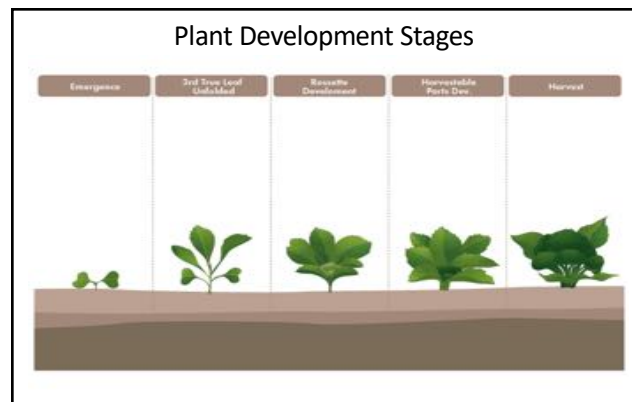
TABLE 3.6. DAYS REQUIRED FOR SEEDLING EMERGENCE AT VARIOUS SOIL TEMPERATURES FROM SEED PLANTED 1/2 IN. DEEP (Continued)

Vegetable	Soil Temperature (°F)								
	32	41	50	59	68	77	86	95	104
Lettuce	49	15	7	4	3	2	3	NG	NG
Onion	NG	NG	NG	27	17	13	7	4	7
Onion	136	31	13	7	5	4	4	13	NG
Parsley	—	—	39	17	14	13	32	—	—
Parsnip	172	57	27	19	14	15	32	NG	NG
Pea	—	36	14	9	8	6	6	—	—
Potato	NG	NG	NG	13	8	6	8	9	NG
Radish	NG	29	11	6	4	4	3	—	—
Sprout	63	23	12	7	6	5	6	NG	NG
Turnip	NG	NG	43	14	8	6	6	9	NG
Turnip	NG	NG	5	3	2	3	1	3	3
Watermelon	—	NG	—	—	12	5	4	3	—

Adapted from R. E. Hartshorn and D. A. Mizeg, "Vegetable Seed Germination," California Agricultural Experiment Station Leaflet (1964).
NG = No germination; — = not tested.

KNOTT'S HANDBOOK

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BROCCOLI AND CAULIFLOWER

Developmental Stage	Leaf #	Description
Direct Seed	000	Note the seeding date if direct seeded in the field.
Germination	001	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	100	Record the transplanting date and the number of true leaves at transplanting if appropriate.
Number of true leaves	100	Count number of fully unfolded true leaves. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 110 = 10 true leaves unfolded.
Cupping	120	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 12-15 leaves.
Head initiation	400	The harvestable head is visibly initiating on median plant. Head can be felt without destroying leaves (1 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	400	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: 400 = 2" diameter, 406 = 6" diameter.
First harvest	426	Record date and head diameter at first harvest. First harvest varies by variety. 424 = first harvest with 4" median head diameter, 426 = first harvest with 6" head diameter.
Ongoing harvest	426	Harvest continues after first harvest and head diameter is no longer measured.

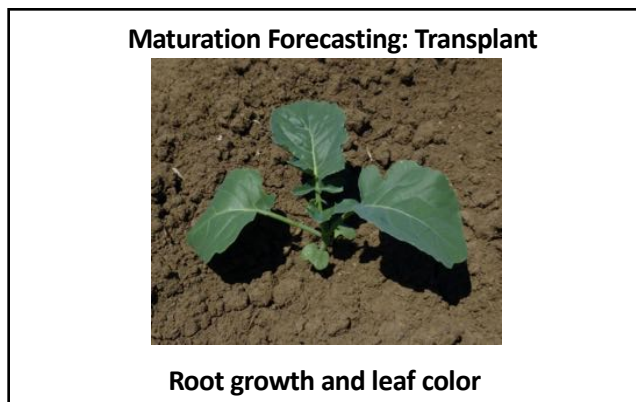
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DETAILED RECORDS ARE CRUCIAL FOR SUCCESSFUL PLANNING

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

35



36



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Maturation Forecasting: Head Initiation



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

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Maturation Forecasting: Harvest



424-460 gdd

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Maturation Forecasting: Early Flowering



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

40

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.

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HEAD LETTUCE PLAN AND RECORD

[Historic Weather Data](#)

Knott's Handbook

Temperatures for best growth

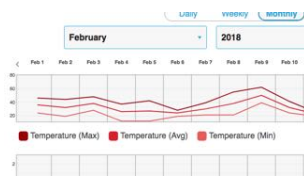
Optimum Minimum Maximum Freezing point
60-65 40 75 31.7° mature, 25° hardened seedlings

Tbase 40°

Johnnys

Full-Size Head Lettuce

Sow up to 8 weeks before first fall frost
Plant at 10-day intervals



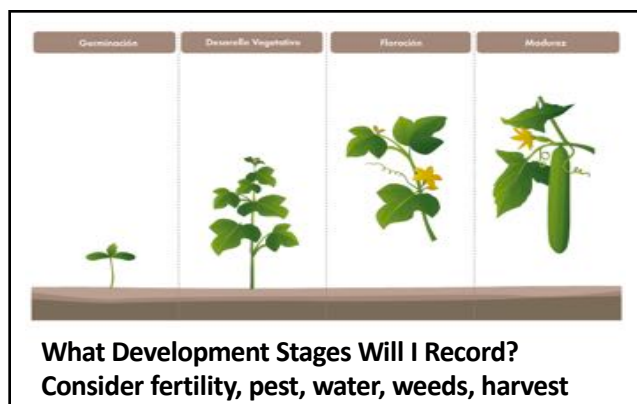
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What will your field tour schedule be?

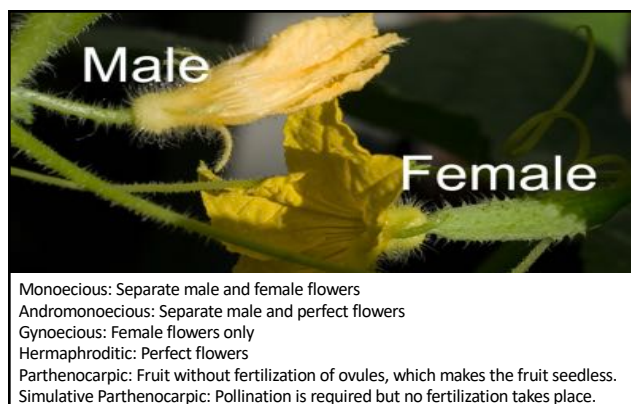


Developmental Stages: Germination, true leaf, vegetative stage, leaf count, flower, fruit development, rosette, beginning head, etc.										Phenology
Broccoli										
# of true leaves on transplant	Roots leave ball	Leaves color up	Cupping date, # of leaves	10% of heads initiation	50% of head initiation	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				

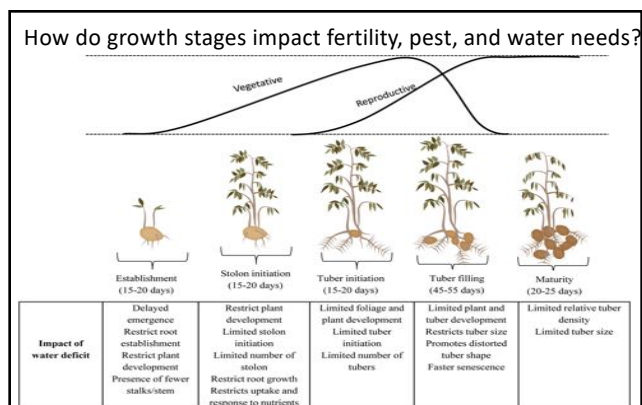
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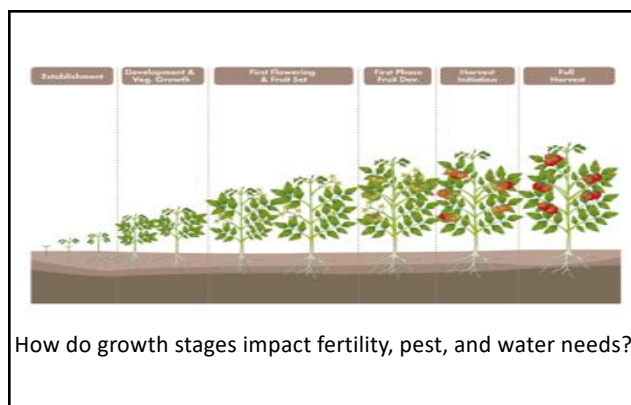
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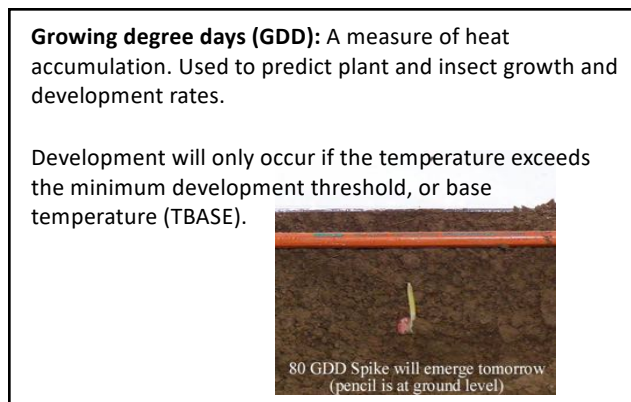
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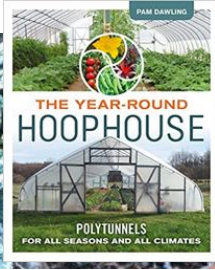
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Overwintering Spring Hardy Crops

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)



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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

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

Plant Family Crop	Opt	Min	Max	GDD Base °F
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

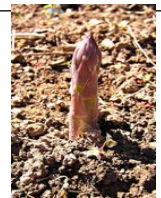
Source: Maynard, D.N. and Hochmuth, G.J. 2007. Kott's Handbook for Vegetable Growers, 5 ed. John Wiley and Sons, New York.

52

$$\frac{T_{max} + T_{min}}{2} = MT - T_{base} = GDD$$

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

$$\frac{70 + 50}{2} = 60 - 60 = 0 \text{ GDD}$$



Daily maximum temperature = 70°

Daily minimum temperature = 50°

Mean temperature = 70° + 50° / 2 = 60°

Tbase for broccoli is 40°

Tbase for okra is 60°

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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

54

Modified Growing Degree Days:

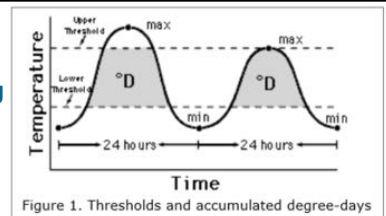


Figure 1. Thresholds and accumulated degree-days

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 $86 + 68 = 154 / 2 = 77$.

55

Thermal time to maturity (2013-14 data)

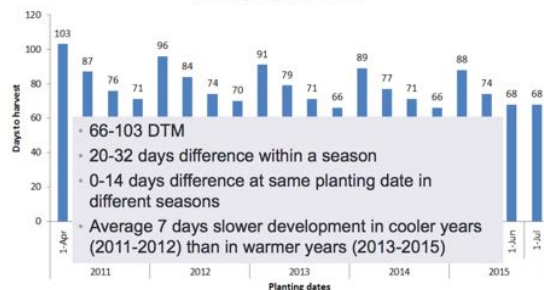
Cucumber 50/80F, SSICO	First flower	First harvest	Accuracy (± days)
Cobra (DS)	561	870	2.88
Marketmore (TP)	358	682	4.0
Marketmore (DS)	654	952	2.5

~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.

56

Transplanted Arcadia brocolli
Aurora, OR, 2011-2015

CROP TIME Oregon State

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You might use Growing Degree calculations to:

- Plan succession timing in advance
 - Can use historic data for planning
 - How will cool weather change maturation

Adjust planting schedule to account for cold weather in season or other delays in development

- Predict maturation of a crop from a specific development stag

EX: I plant the next planting of broccoli when the last planting's:

- true leaves have greened up and
- the roots have left the ball.

58

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,

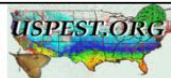
redbud early to full bloom,

Black Hills spruce bud caps

splitting)

<http://uspest.org/wea/>

MyPest Page -
IPM Pest and Plant
Disease Models and
Forecasting



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

Introduction Quick Start Map Index Shortcut Links Degree-day Maps

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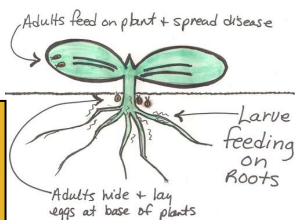
Striped Cucumber Beetles

- 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**

60

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



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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)

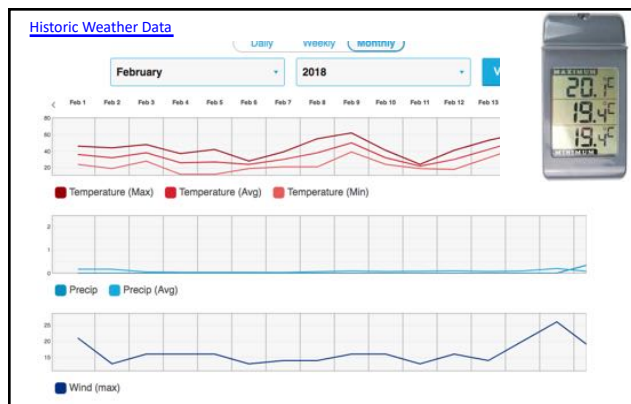
Base	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
40 M	80	149	303	519	793	1057	1210	1136	918	630	263	93	7153
40 S	80	230	533	1052	1845	2902	4112	5249	6167	6797	7060	7153	7153
45 M	21	62	169	372	638	907	1055	981	768	476	138	28	5615
45 S	21	83	251	623	1261	2169	3224	4205	4973	5449	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

62



63

Smallfarms.oregonstate.edu/croptime

OSU Oregon State University Extension Service

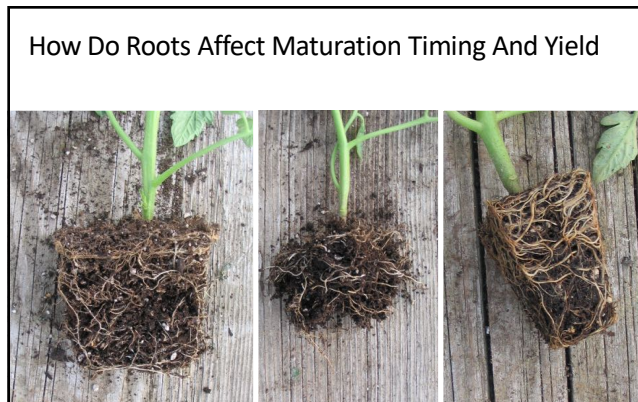
Date	Temp/Precip	DD	Day length	Cum DD	Crop events
Month Day	Max Min Precip	DDs Today	Day length (hr)	QA + Notes Cumu. DDs	Starting 4-1 Model Events
4 1	53.0 40.1 0.10	14.6	13.1	15	transplanted - 2-4 leaves
5 1	73.8 45.6 0.00	27.5	14.6	612	
6 1	62.5 53.9 0.21	26.2	15.8	1458	
6 11	81.4 49.9 0.00	31.4	16.0	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	

64

Seed Versus Transplant

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

65



66

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

67



68

url: <https://atinadiffley.com/wp-content/uploads/Bare-Root-Transplants-Seed-Beds.pdf>

Bath remodel | Library | \$555 | Exercise | Recipes | Self-ED | Hilton | FanFarm | MT | Schools

Relative Ease of Transplanting Bare-Root Vegetable Seedlings

Easy	Medium Difficulty	Difficult: Not Recommended
<ul style="list-style-type: none"> • Beet • Broccoli • Brussels Sprout • Cabbage • Kale • Kohlrabi 	<ul style="list-style-type: none"> • Cauliflower • Celery • Eggplant • Pepper 	<ul style="list-style-type: none"> • Cucumber • Muskmelon • Squash • Sweet Corn • Watermelon

Production Process

1. Site Selection
2. Primary Tillage
3. Stake 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.

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Not all vegetables require succession planting

Processing crops
Bulb onions
Winter squash

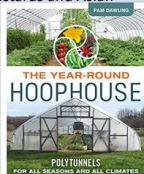


Can you reduce # of plantings with storage?
Cabbages, root crops

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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 mustards
15° F	Some beets, beet leaves, broccoli leaves, young cabbage, rowcover, cilantro, endive, fava beans, Russian kales, kohlrabi, especially small plants, parsley, Asian winter radish with rowcover



72

Row cover
Or
Clear plastic?

SEASON EXTENSION

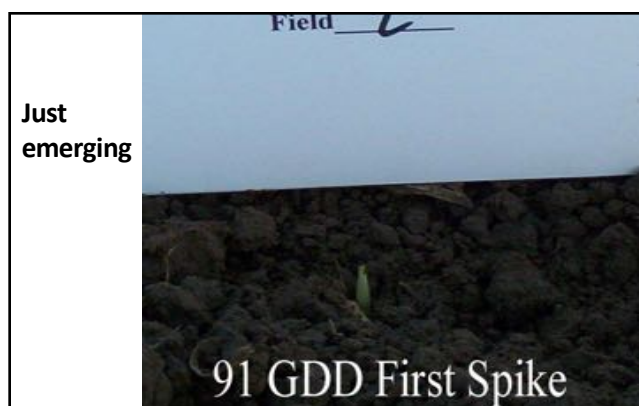
Earliest protected planting date
Last protected harvest date

73

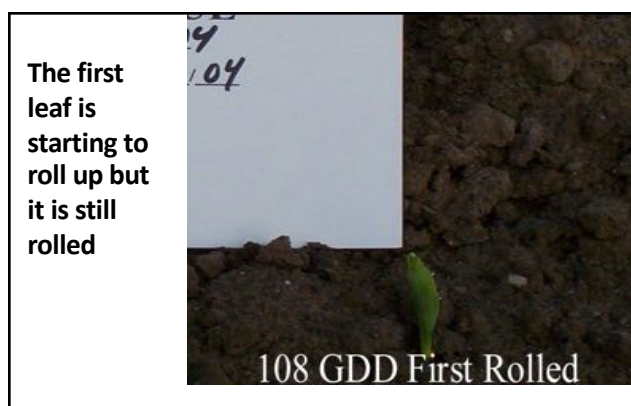


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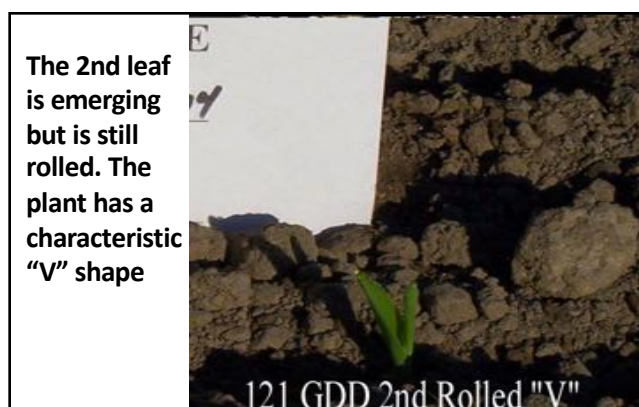




81



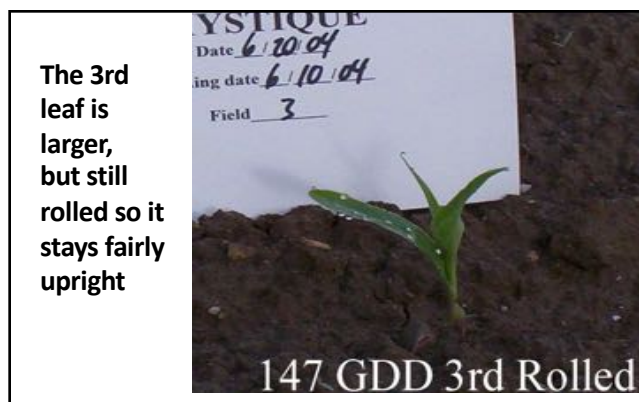
82



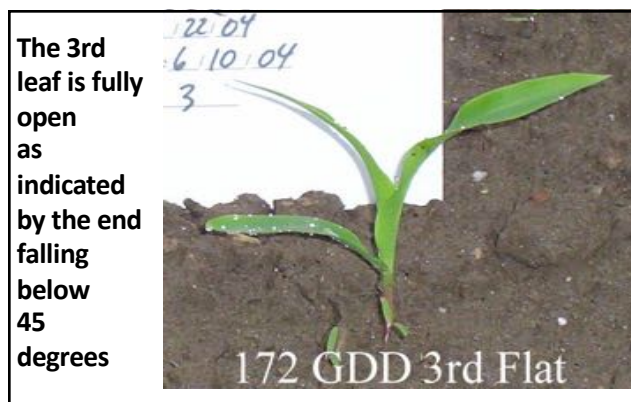
83



84



85



86

The 4th leaf
emerges
as a spike.



87

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.



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