



# Croptime

## Growth Stage Guide

<http://smallfarms.oregonstate.edu/croptime>



**First edition**

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# VEGETABLE CROP DEVELOPMENT DATA COLLECTION & THE GROWTH STAGE GUIDE

These descriptions of vegetable growth stages were adapted from the 2<sup>nd</sup> edition of “Growth stages of mono- and dicotyledonous plants: BBCH Monograph”, edited by Uwe Meier (2001). The Crowthime Growth State Guide describes vegetable growth stages for use when collecting crop development data to contribute to degree-day models in collaboration with the Crowthime project: <http://smallfarms.oregonstate.edu/crowthime>.

When collecting data for Crowthime degree-day models:

1. Print Crowthime Growth Stage Notes for collecting field data (pp 5-6).
2. Record the growth stage of 11 plants. Avoid plants clearly affected by environmental stress. Record median growth stage reached by the sixth most developed plant, except when noted otherwise.
3. True leaves are considered fully unfolded when they have unfurled (no longer cupping) and the next leaf is visible, but they have not necessarily reached full size.
4. Start recording the next physiological growth stage as soon as it becomes apparent. Be sure to read the next expected growth stages when visiting a site. For example, a common mistake is to keep counting leaves when the beginning of the reproductive stage should be noted.
5. Please overlap measurement of two growth stages by one site visit. For example, continue recording number of true leaves for one week (or one visit) after you start recording crown diameter of parsnip or flower bud emergence in cucumber.
6. When measuring diameter of a plant part, measure 2 diameters at 90° angle, and record the average diameter. 

Entering and submitting data:

1. Enter data using the OSU Crowthime spreadsheet template available from your Crowthime advisor or Nick Andrews.
2. Save worksheet using crop and variety name.
3. Send the completed spreadsheet and a copy of your original field data sheet to your Crowthime advisor or Nick Andrews.

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# AMARANTHACEAE

## SPINACH

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001 & 009	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 soil, estimate percent of crop emerged.
<b>Number of true leaves</b>	100	Count number of fully unfolded true leaves on main stem. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 105 = 5 true leaves unfolded.
<b>First harvest</b>	406-412	Plants have reached typical size for harvest. For bunching spinach this occurs at about 6 or more true leaves, or when 10-12 plants form a marketable bunch. 406 = 6 true leaves, 412 = 12 true leaves
<b>End of harvest period</b>	501	501 = Main shoot begins to elongate, flower buds become visible and leaves are no longer marketable. Stop here unless modeling seed production.
<b>Senescence</b>	902	Leaves begin to discolor and are no longer marketable.

# AMARANTHACEAE

## SPINACH



**100:** Cotyledons completely unfolded



**102:** Two true leaves unfolded



**104:** 4 true leaves unfolded



**407:** 8 true leaves unfolded; harvest



**407:** 8 true leaves unfolded; harvest



**501:** End of harvest; main shoot begins to elongate, flower buds

# APIACEAE

## CARROT

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001-009	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 soil, estimate percent of crop emerged.
<b>Number of true leaves</b>	100-109	Count number of fully unfolded true leaves on main stem. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 105 = 5 true leaves unfolded. The first few leaves are unifoliate. Starting about the fourth leaf they become multifoliate. Unifoliate and multifoliate leaves each count as one true leaf. Don't count individual leaflets.
<b>Root diameter</b>	401-420	Measure root diameter across the widest point on the crown starting when the crown begins to expand at 5-7 true leaves (i.e. ½" root diameter). Record median root diameter. 405 = .50" root diameter, 410 = 1", 415 = 1.5" root diameter.
<b>Harvest</b>	408-415	Record the date and crown diameter at harvest. First harvest varies by variety. Harvestable crown size is approximately ¾ -1½" diameter.
<b>Ongoing harvest</b>	415	Continue to note crown size in diameter if multiple harvests.
<b>End of harvest</b>	420	90% of roots have greater than or equal to 1 ½" diameter.

# APIACEAE

## CARROT



**100:** Cotyledons completely unfolded



**101:** First true leaf unfolded



**103:** 3 true leaves unfolded



**106/405:** 6 true leaves unfolded, 0.5 inch root diameter at crown



**405:** Root diameter at crown 0.5 inches



**410:** Harvest root diameter at crown 1 inch

# APIACEAE

## PARSNIP

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001-009	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 soil, estimate percent of crop emerged.
<b>Number of true leaves</b>	100-109	Count number of fully unfolded true leaves on main stem. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 105 = 5 true leaves unfolded. The first few leaves are unifoliate. Starting about the fourth leaf they become multifoliate. Unifoliate and multifoliate leaves each count as one true leaf. Don't count individual leaflets.
<b>Root diameter</b>	401-425	Measure root diameter across the widest point on the crown starting when the crown begins to expand at 5-7 true leaves (i.e. ½" root diameter). Record median root diameter. 405 = .50" root diameter, 415 = 1.5", 420 = 2" root diameter.
<b>Harvest</b>	420-425	Record the date and crown diameter at harvest. First harvest varies by variety. Harvestable crown size is approximately 2-2½" diameter.
<b>Ongoing harvest</b>	415	Continue to note crown size in diameter if multiple harvests.
<b>End of harvest</b>	420	90% of roots have greater than or equal to 2 ½" diameter.

# APIACEAE

## PARSNIP



**100:** Cotyledons completely unfolded



**101:** First true leaf unfolded



**103:** 3 true leaves unfolded



**105/410:** 5 true leaves unfolded, 1.0 inch root diameter at crown



**425:** Root diameter at crown 2.5 inches



**425:** Harvest root diameter at crown 2.5 inches

# ASTERACEAE

## LETTUCE

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001-009	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 soil, estimate percent of crop emerged.
<b>Transplant</b>	102-104	Record the transplanting date and the number of true leaves at transplanting if appropriate.
<b>Number of true leaves</b>	100-114	Count number of fully unfolded true leaves. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 110 = 10 true leaves unfolded.
<b>Number of true leaves</b>	105-109	Count number of fully unfolded true leaves. 109 = 9 or more true leaves unfolded.
<b>Rosette</b>	110-114	Distinct circular cluster of leaves. Approximately 10-14 leaves.
<b>Cupping</b>	401	Tips of inner leaves begin to curl inwards on the edge, two youngest leaves do not unfold. <sup>1</sup>
<b>Heading</b>	402-409	Cupped leaves begin to overlap and cover the growing point of the plant forming a head. 402 = 20% of expected head size reached, 403 = 30%, etc. determine from harvest. 409 = typical size, form and firmness of heads reached.
<b>First harvest</b>		Record date at first harvest. The head reaches marketable size for the variety and leaves have not started to become bitter, 408-500.
<b>End of harvest period</b>	501-590	Main shoot inside head begins to elongate, flower buds become visible and heads become unmarketable. Stop here unless modeling seed production. 550 = 50% flowering, 590 = 90% flowering.

<sup>1</sup> Head lettuce

# ASTERACEAE

## LETTUCE



**103:** Transplant 3 true leaves unfolded



**105:** 5 true leaves unfolded



**110:** 10 true leaves/rosette



**401:** Rosette to cupping



**402:** Cupping to early heading



**500:** Harvest romaine



**500:** Harvest head lettuce



**500:** Harvest leaf lettuce

# BRASSICACEAE

## BROCCOLI AND CAULIFLOWER

Growth Stage	BBCH #	Description
Direct Seed	000	Note the seeding date if direct seeded in the field.
Germination	001 - 009	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	102-104	Record the transplanting date and the number of true leaves at transplanting if appropriate.
Number of true leaves	100-114	Count number of fully unfolded true leaves. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 110 = 10 true leaves unfolded.
Cupping	150	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	400	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	401-409	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	424-428	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	460	Harvest continues after first harvest and head diameter is no longer measured.
End of harvest period	501-590	Beginning of flower emergence, development pattern varies by variety. Heads become unmarketable. 501 = branches of inflorescence begin to elongate, 550 = 50% flowering 590 = 90% flowering

# BRASSICACEAE

## BROCCOLI



100: Cotyledons completely unfolded



103: 4 true leaves unfolded



107: 7 true leaves



401: Cupping



402: Head initiation



500: Head development



500: Harvest



500: Early flowering

# BRASSICACEAE

## BROCCOLI AND CAULIFLOWER

Growth Stage	BBCH #	Description
Direct Seed	000	Note the seeding date if direct seeded in the field.
Germination	001 - 009	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	102-104	Record the transplanting date and the number of true leaves at transplanting if appropriate.
Number of true leaves	100-114	Count number of fully unfolded true leaves. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 110 = 10 true leaves unfolded.
Cupping	150	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	400	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	401-409	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	424-428	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	460	Harvest continues after first harvest and head diameter is no longer measured.
End of harvest period	501-590	Beginning of flower emergence, development pattern varies by variety. Heads become unmarketable. 501 = branches of inflorescence begin to elongate, 550 = 50% flowering 590 = 90% flowering

# BRASSICACEAE

## CAULIFLOWER



**100:** Cotyledons completely unfolded



**104:** 4 true leaves unfolded



**116/150:** 16 true leaves unfolded/cupping



**401:** Head initiation, 1/2" diameter



**404:** Head development, 4" head diameter



**427:** Harvest, head diameter 7"

# BRASSICACEAE

## CABBAGE

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001 - 009	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.
<b>Transplant</b>	102-104	Record the transplanting date and the number of true leaves at transplanting if appropriate.
<b>Number of true leaves</b>	100-114	Count number of fully unfolded true leaves. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 110 = 10 true leaves unfolded.
<b>Pre-cupping</b>	130	Approximately 10-12 leaves. The innermost heart leaves are growing in an upright fashion and begin to curve inwards. They are visible without moving any of the surrounding leaves. By the end of this stage the base of the stem and the bases of all leaves are concealed when the plant is viewed from above.
<b>Cupping</b>	150	Approximately 12-16 leaves. The innermost heart leaves, which are still growing in an upright fashion, are concealed by the larger, older leaves surrounding them. All visible leaves will later become the frame leaves (leaves not touching the mature head) of the mature plant.
<b>Early head formation</b>	401-403	Record the diameter across the head. A distinct head can easily be felt when squeezing, about 1-3" head diameter. 401 = 1" diameter, 403 = 3" diameter.
<b>Head fill</b>	404-412	Measure the diameter across the 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. 404 = 4" diameter, 410 = 10" diameter.
<b>First Harvest</b>		Record date and head diameter at harvest. First harvest varies by variety (i.e. 407-412).
<b>End of harvest period</b>	501	Early maturing heads in the field are starting to split. More than 20% of the heads in the field have started to split.

# BRASSICACEAE

## CABBAGE



**100:** Cotyledons unfolded



**103:** 8 true leaves unfolded



**107:** 7 true leaves



**401:** Cupping



**402:** Early head formation, 2 inch head



**404:** Head fill, 4 inch head diameter



**402:** Harvest, 7.5 inch head diameter



**404:** End of harvest period, head split

## BRASSICACEAE

### KALE

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001 - 009	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.
<b>Transplant</b>	102-104	Record the transplanting date and the number of true leaves at transplanting if appropriate.
<b>Number of true leaves</b>	100-114	Count number of fully unfolded true leaves. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 110 = 10 true leaves unfolded.
<b>Stem elongation</b>	305-319	Note beginning of stem elongation. For example, 305 = 5" visible stalk from the ground to the top growing point, 315 = 15" stalk length.
<b>First harvest</b>	401	Leaves have reached typical size and shape for harvest for that variety. (i.e. 10-12 leaves) If monitoring a variety trial, strip the lower leaves of about 5 plants to mimic ongoing harvest.
<b>Ongoing harvest</b>		Harvest continues
<b>End of harvest period</b>	501	Beginning of flower emergence. 501 = main shoot visible between uppermost leaves, 550 = 50% flowering, 590 = 90% flowering.

# BRASSICACEAE

## KALE



3 true leaves



5 true leaves



7 true leaves



Ongoing harvest, 15 true leaves

# CUCURBITACEAE

## CUCUMBER AND SUMMER SQUASH

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001 - 009	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 soil, estimate percent of crop emerged.
<b>Transplant</b>	101-103	Record the transplanting date and the number of fully unfolded true leaves at transplanting if appropriate. 101= 1 true leaf unfolded, 103 = 3 true leaves unfolded.
<b>Number of true leaves</b>	100-109	Count number of fully unfolded true leaves on main stem. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 105 = 5 true leaves unfolded.
<b>Flower bud development</b>	501-509	Female flower buds are developing (elongated ovaries are visible on main stem). 501 = 1 <sup>st</sup> female flower bud visible, 505 = 5 <sup>th</sup> female flower bud visible.
<b>Flowering</b>	601-609	Female flowers open. 601 = 1 <sup>st</sup> open female flower, 605 = 5 <sup>th</sup> open female flower.
<b>Fruit development</b>	701-719	Measure developing fruit length. 701 = 1", 705 = 5" long fruit. Note any early fruit culling.
<b>First harvest</b>	745-747	Record the date and largest fruit length at harvest. First harvest varies by variety. 745 = harvest with 5" fruit, 747 = harvest with 7" fruit.*
<b>Ongoing harvest</b>	760	Harvest continues after first harvest and fruit length is no longer measured.
<b>End of harvest</b>	901	901 = Plants decline and fruit is no longer harvested.

\*pickling = 742-744, slicing = 745-749, summer squash = 745-459

# CUCURBITACEAE

## CUCUMBER



**100:** Cotyledons completely unfolded



**102:** 2 true leaves unfolded



Male flower bud development



**501:** 1<sup>st</sup> female flower bud visible



Male flower open



**601:** 1<sup>st</sup> open female flower



**702:** Fruit development, 2 inch fruit



**748:** Harvest, 8 inch fruit length

# CUCURBITACEAE

## CUCUMBER AND SUMMER SQUASH

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001 - 009	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 soil, estimate percent of crop emerged.
<b>Transplant</b>	101-103	Record the transplanting date and the number of fully unfolded true leaves at transplanting if appropriate. 101= 1 true leaf unfolded, 103 = 3 true leaves unfolded.
<b>Number of true leaves</b>	100-109	Count number of fully unfolded true leaves on main stem. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 105 = 5 true leaves unfolded.
<b>Flower bud development</b>	501-509	Female flower buds are developing (elongated ovaries are visible on main stem). 501 = 1 <sup>st</sup> female flower bud visible, 505 = 5 <sup>th</sup> female flower bud visible.
<b>Flowering</b>	601-609	Female flowers open. 601 = 1 <sup>st</sup> open female flower, 605 = 5 <sup>th</sup> open female flower.
<b>Fruit development</b>	701-719	Measure developing fruit length. 701 = 1", 705 = 5" long fruit. Note any early fruit culling.
<b>First harvest</b>	745-747	Record the date and largest fruit length at harvest. First harvest varies by variety. 745 = harvest with 5" fruit, 747 = harvest with 7" fruit.*
<b>Ongoing harvest</b>	760	Harvest continues after first harvest and fruit length is no longer measured.
<b>End of harvest</b>	901	901 = Plants decline and fruit is no longer harvested.

\*pickling = 742-744, slicing = 745-749, summer squash = 745-459

# CUCURBITACEAE

## SUMMER SQUASH



**009:** Cotyledons emerge from soil



**102:** 2 true leaves unfolded



Flower bud and side shoot development



**502/702:** Flower bud development (2<sup>nd</sup> female flower bud visible)/ Fruit development, 2 inch fruit length



**746:** Harvest, 6 inch fruit length



**760:** Ongoing harvest

# CUCURBITACEAE

## WINTER SQUASH

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001 - 009	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 soil, estimate percent of crop emerged.
<b>Transplant</b>	101-103	Record the transplanting date and the number of fully unfolded true leaves at transplanting if appropriate. 101= 1 true leaf unfolded, 103 = 3 true leaves unfolded.
<b>Number of true leaves</b>	100-109	Count number of fully unfolded true leaves on main stem. 100 = cotyledons completely unfolded, 101 = first true leaf unfolded, 105 = 5 true leaves unfolded.
<b>Flower bud development</b>	501-509	Female flower buds are developing (elongated ovaries are visible on main stem). 501 = 1 <sup>st</sup> female flower bud visible, 505 = 5 <sup>th</sup> female flower bud visible.
<b>Flowering</b>	601-609	Female flowers open. 601 = 1 <sup>st</sup> open female flower, 605 = 5 <sup>th</sup> open female flower.
<b>Fruit development</b>	701-731	Record the length of the earliest developing fruit. 705 = largest fruit is 5" long, 715 = 15" long. Note any early fruit culling.
<b>Fruit ripening</b>	801-808	801 = 10% of fruits show typical fully ripe color, 802 = 20%, etc.,
<b>Harvest</b>	809	Fruit has reached typical harvest size, color and form for variety. Record first harvest date and fruit length at harvest. 809 = Fully ripe: fruits have typically fully ripe color.
<b>Plant senescence</b>	901	Vines are dying back (i.e. due to powdery mildew). This may occur before harvest.

# CUCURBITACEAE

## WINTER SQUASH



100: Cotyledons completely unfolded



102: 2 true leaves unfolded



105: 5 true leaves



501-601: Flower bud development and flowering



703-808: Fruit development and fruit ripening



809: Harvest, record fruit length and date

# FABACEAE

## SNAP BEANS

Growth Stage	BBCH #	Description
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001 - 009	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 soil, estimate percent of crop emerged.
<b>Cotyledons unfolded</b>	100	Cotyledonous seedlings are emerging from the soil and completely unfolded, growing point or true leaf initial visible. Estimate percent unfolded cotyledons.
<b>Unifoliolate leaves</b>	102	First 2 full leaves completely unfolded (first leaf pair).
<b>Number of trifoliolate leaves</b>	103-109	Count number of trifoliolate leaves. 103 = 3 <sup>rd</sup> true leaf (first trifoliolate leaf) unfolded, 105 = 5 <sup>th</sup> true leaf (2 <sup>nd</sup> trifoliolate leaf) unfolded.
<b>Flower bud development</b>	501-509	First flower buds visible. 501 = first flower buds visible, 505 = first flower buds enlarged, 509 = first petals visible.
<b>Flowering</b>	601	First flowers open
<b>Pod development</b>	701-70	Record length of most developed pod. 705 = .5", 710 = 1", 715 = 1.5".
<b>Pod filling</b>	705	First pods are filling as seed develops.
<b>First harvest</b>	707	Record date and harvest one bean pod from each of 10 plants. Remove one seed from the middle of each pod. Line the 10 seeds up tip to tip. Variety is ready to harvest when length measures 3.5-4".
<b>Ongoing harvest (fresh market only)</b>	710	Harvest continuing.
<b>End of harvest</b>	901	901 = Plants decline and remaining pods become over-mature for snap bean (i.e. hard, inedible pods)

# FABACEAE

## SNAP BEANS



**100:** Cotyledons completely unfolded



**102:** Unifoliate leaves, first leaf pair



**103:** 1<sup>st</sup> trifoliate leaf unfolded



**501:** 1<sup>st</sup> flower buds visible



**502, 504, 601, 702, 710:** (Left to right) First flower buds visible, first flower buds enlarged, flowers open, pod development < .25 inch length, pod development 1 inch length



**720:** Fruit development, 2 inch fruit



**710:** Ongoing harvest, 5 inch fruit length

**POACEAE**  
**SWEET CORN**

<b>Growth Stage</b>	<b>BBCH #</b>	<b>Description</b>
<b>Direct Seed</b>	000	Note the seeding date if direct seeded in the field.
<b>Germination</b>	001 - 009	001 = seed can imbibe water due to soil moisture, irrigation or priming (this may be the same as direct seed date), 009 = coleoptile emerges from the soil. Estimate the percent of emergence.
<b>Transplant</b>	101-103	Record the transplanting date and the number of fully unfolded true leaves at transplant.
<b>Number of true leaves</b>	101-119	Count number of fully unfolded true leaves.* 101 = first leaf unfolded, 109 = ninth leaf fully unfolded.
<b>Tassel development</b>	501-509	Tassel develops at the top of plant. 501 = beginning of tassel emergence (tassel detectable at top of stem), 503 = tip of tassel visible, 505 = middle of tassel begins to separate, 509 = end of tassel emergence: tassel fully emerged and separated.
<b>Ear and silk development</b>	610-690	Ears emerge in leaf sheaths and silk develops. 610 = tip of ear emerging from leaf sheath, 630 = tips of first silk (i.e. 5%) visible, 650 = silk fully emerged, 670 = silk drying, 690 = silk completely dry.
<b>Kernel development</b>	701-709	Kernels fill to the tip of the ear and develop to milk and early dough. 701 = kernels at tip still at blister stage, 705 kernels at tip are full, 709 = kernels begin to dry to early dough.
<b>Fresh market harvest</b>	705	Cobs are mature with full kernels at tip; milk stage and sweet to taste, about 80% moisture content.
<b>Processing market harvest</b>	709	Kernels meet requirements for processing. Percent moisture: 72-73% for sugary types and 75-76% for sh2. Processor calls pick date.
<b>Senescence</b>	907	907 = plants dead

\*leaf unfolded when tip of next leaf is visible

# POACEAE

## SWEET CORN



**009:** Coleoptile emerges from soil

**101:** First leaf unfolded

**102:** Two leaves unfolded



**105:** 5 true leaves unfolded



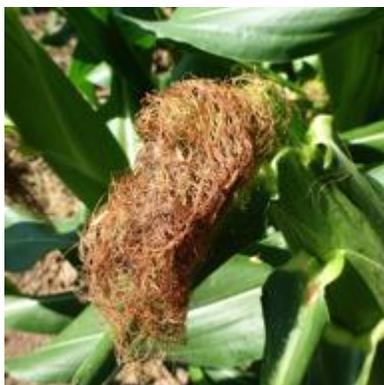
**503:** Tip of tassel visible

**505:** Tassel begins to separate

**509:** Tassel fully emerged



**640:** Silk emerging (75% visible)



**670:** silk drying



**705:** Fresh market harvest

# SOLANACEAE

## PEPPER

Growth Stage	BBCH #	Description
<b>Transplant</b>	104-107	Record the transplanting date and the number of fully unfolded true leaves.* Note if flowers are present.
<b>Transplant shock</b>		Note any leaf senescence that occurs. Also note when new growth begins indicating that transplant shock is over.
<b>Number of true leaves</b>	105-109	Count number of fully unfolded true leaves and leaf scars. 105 = 5 leaf scars and true leaves unfolded, 109 = 9 leaf scars and true leaves unfolded.
<b>Side shoots</b>	201-209	Optional: you can count number of side shoots instead of true leaves. 209 = 9 side shoots visible.
<b>Flower bud emergence</b>	501	First flower bud visible.
<b>Bud development</b>	502-509	Buds are present but flowers have not opened. 509 = flower buds visible.
<b>First flowering</b>	601-609	First flower open, record percentage of plants with first flower open. 601 = first flower open, 603 = 3 <sup>rd</sup> flower open.
<b>Fruit set</b>	620	First fruitlets visible but very small, i.e. < 1" diameter.
<b>Fruit growth</b>	621-629	First fruit expanding, estimate percent of full size for that variety. 621 = first fruit is 10% of typical full sized fruit, 625 = 50% of full size, 628 = 80% of full size.
<b>Fruit development</b>	701-719	Record the number of full-sized fruit that are still green. Typical fruit size varies with variety. For example, Sweet Italian types = 5-7" long, Bell types = 4-5".
<b>First green harvest</b>		If green fruit is harvested record the date and number of full-sized fruit at harvest. First green harvest varies by variety (i.e. about 704 for bell types).
<b>Fruit color change</b>	720-729	Most mature fruit is developing ripe color (i.e. red). For example, 720 = first fruit is breaker (first color change), 723 = first fruit is partially red, 729 = first fruit fully red.
<b>Fruit ripening</b>	801-809	Record the number of fruit that show typical ripe color. 801 = 1 <sup>st</sup> fruit is ripe, 804 = 4 <sup>th</sup> fruit is ripe.
<b>First ripe harvest</b>		Record the date and number of ripe fruits at harvest. First ripe harvest varies by variety (i.e. about 804 for bell types).
<b>Ongoing harvest</b>	820	Harvest continues after first harvest and ripe fruit no longer counted.
<b>Senescence</b>	901-907	901 = Plants decline and fruit is no longer harvested., 907 = plants dead.

\*count number of leaf scars and fully unfolded true leaves before planting

# SOLANACEAE

## PEPPER



**107:** Transplant, 7 fully unfolded true



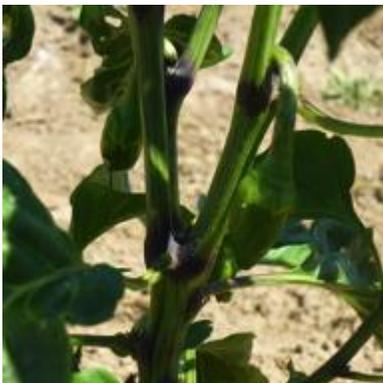
**206:** 6 side shoots visible



**509:** 9 flower buds visible



**601:** 1<sup>st</sup> flower open



**623:** First fruit is 30% of full size



**626:** First fruit is 60% of full size



**706:** First green harvest, 6 inch fruit



**806:** First ripe harvest, 6 fruit ripe color

# SOLANACEAE

## TOMATO

Growth Stage	BBCH #	Description
<b>Transplant</b>	104-107	Record the transplanting date and the number of fully unfolded true leaves.* Leaves are compound and multi-foliolate, be sure not to count individual leaflets. Note horizontal or vertical planting and whether it was planted deep or shallow. Note if flowers are present.
<b>Transplant shock</b>		Note any leaf senescence that occurs. Also note when new growth begins indicating that transplant shock is over.
<b>Number of true leaves</b>	105-109	Count number of fully unfolded true leaves and leaf scars. 105 = 5 leaf scars and true leaves unfolded, 109 = 9 leaf scars and true leaves unfolded.
<b>Side shoots</b>	201-209	Optional: you can count number of side shoots instead of true leaves. 209 = 9 side shoots visible.
<b>Pruning</b>		Note any pruning
<b>Flower bud emergence</b>	501	First inflorescence visible (first bud erect).
<b>Bud development</b>	502-519	Buds are present but flowers have not opened. 509 = 9 inflorescences visible.
<b>First flowering</b>	601	First inflorescence: first flower open. Record percentage of plants with first flower open.
<b>Flowering</b>	602-609	Inflorescence with first flower open. 609 = 9 <sup>th</sup> inflorescence: first flower open.
<b>Fruit set</b>	620	First fruitlets visible but very small (<1" diameter). Period of cell division.
<b>Fruit growth</b>	621-629	First fruit on the first fruit cluster is expanding (>1" diameter). Estimate percent of full size for that variety. 621 = first fruit is 10% of typical full sized fruit, 625 = 50% of full size, 628 = 80% of full size.
<b>Fruit development</b>	701-719	Record the number of full-sized fruit that are still green. 701 = first fruit has reached typical size, 705 = 5 <sup>th</sup> fruit is full size.
<b>Fruit color change</b>	720-729	Most mature fruit is developing ripe color (i.e. red). For example, 720 = first fruit is breaker (first color change), 723 = first fruit is pink, 729 = first fruit fully red.
<b>Fruit ripening</b>	801-809	Record the number of fruit that show typical ripe color. 801 = 1 <sup>st</sup> fruit is ripe, 804 = 4 <sup>th</sup> fruit is ripe.
<b>First harvest</b>		Record the date and number of ripe fruits at harvest. First ripe harvest varies by variety (i.e. about 804 for slicing tomatoes).
<b>Ongoing harvest</b>	820	Harvest continues after first harvest and ripe fruit no longer counted.
<b>Senescence</b>	901-907	901 = Plants decline and fruit is no longer harvested. 907 = plants dead.

\*count number of leaf scars and fully unfolded true leaves before planting

# SOLANACEAE

## TOMATO



**105:** Transplant, 5 fully unfolded true



**208/508:** 8 side shoots visible/ 8 unfolded



**509:** Flower bud development,



**601:** 1<sup>st</sup> inflorescence with flowers open



**620:** Fruit set



**628:** Fruit growth, first fruit is 80% of full



**720-728:** Fruit color change



**802:** Fruit ripening ,2<sup>nd</sup> fruit is ripe

# Croptime

## Growth Stage Guide

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**Extension Service**

