

Sweet Corn, *Zea mays* L.
Vegetable Phenology (Degree-Day) Model Documentation
Version 1.0, 10/21/2019

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CROPTIME project funded by USDA Western SARE

Introduction: The CROPTIME project of OSU is intended to aid vegetable producers in timing the planting and harvest dates for major vegetable varieties, serving Western Oregon and Washington, and perhaps other regions with similar climate and soil conditions. Heat units in the form of degree-days can be used to provide closer guidance than simple average days to development. We have determined the thresholds and degree-day requirements for three fresh market and two processing sweet corn varieties. Using the range of forecasts available at uspest.org, one may reasonably predict events such as tasseling, silk, and harvest dates for these and similar (related) varieties.

Methods: Using events monitored in the field, the lowest error (C.V. or coefficient of variation) was used to determine lower and upper threshold temperature values for five direct seeded and three transplanted sweet corn varieties. We used between 2 and 8 site-years for each variety/planting type. All site years were from the Willamette Valley of Western Oregon, plus Estella farm, N. of Spokane, WA, from 2013-2015. Standard sites included the OSU vegetable farm (near Corvallis, OR) and the OSU NWREC research farm (near Aurora, OR), with other farms depending on variety and year. Fresh market varieties included: “Luscious”, “Sugar Pearl”, and “Temptation”. The processed market varieties included “4001”, and “Kokanee”. Degree-day values were calculated online at uspest.org using the sweet corn growing degree-day (GDD) formula.

The main model interval used to determine thresholds for most varieties was from either the direct seeding date or the transplant date (at 1 or 2 true leaves) to first fresh market harvest (determined subjectively), or processed market harvest (determined by processor harvest date or moisture tests). Other stages for which degree-day requirements were estimated included: approximate five true leaves, 5” tassel length, 95% silk, and processed market harvest for the two processing varieties.

Results: All sweet corn phenology models (Table 1) were determined by a combination of the lowest C.V. method, consideration of published results from the literature, and the goal of using best overall concordant thresholds where possible. The fresh market varieties all had lower thresholds than is known for the standard processing variety, “Jubilee”, and were found to have good agreement at 44°F (6.67°C), whereas the two processing varieties were found to have good agreement with a lower threshold of 50°F (10°C), the same as “Jubilee”. All varieties were found to be in agreement as far as the upper threshold, as with “Jubilee”, at 86°F (30°C). Degree-day models for the 5 direct seeded varieties had C.V. values between 2.4 and 3.7, whereas the 3 transplant varieties had C.V. values between 0.22 and 1.35. The mean absolute deviations (MAD) to predict harvest date using the models ranged from 0.3 to 3.1 days. For fresh market varieties “Sugar Pearl” and “Temptation”, results were very similar. For example the average harvest times differed by only 1 GDD for direct seeded, and only 12 GDD for transplanted. Therefore, the data were combined into just two models, one for direct seeded and one for transplanted for the two varieties together.

Using the Models: These models are available at the OSU Integrated Plant Protection (IPPC) websites <https://uspest.org/dd/model> and https://uspest.org/dd/model_app (the latter also available as a mobile device app; search for “uspest.org” at your app store starting Feb. 2019 for Android and Dec. 2019 for Apple). To use the website, select the nearest weather station code by entering a nearby city, zipcode, or weather station code, or clicking on a weather station pin in the Google map. Then select “CROPTIME models” at “Model Category” and select any of the listed sweet corn models using the “Model:” pulldown menu. Enter up to 4 start dates (not available for model_app version), end date (any date after expected last harvest date), and forecast type (for table output). Click on button (or tab) for model output. The new charts compare up to six forecast types showing a range of expected harvest dates. For more information, see the CROPTIME website at: <https://extension.oregonstate.edu/croptime>.

Quick links to the sweet corn variety models:

Luscious (direct seed): <https://uspest.org/dd/model?spp=sclds>

Luscious (transplant): <https://uspest.org/dd/model?spp=scltp>

Sugar Pearl and Temptation (direct seed): <https://uspest.org/dd/model?spp=scsds>

Sugar Pearl and Temptation (transplant): <https://uspest.org/dd/model?spp=scstp>

4001 (direct seed): <https://uspest.org/dd/model?spp=scfds>

Kokanee (direct seed): <https://uspest.org/dd/model?spp=sckds>

Jubilee (direct seed): <https://uspest.org/dd/model?spp=scn>

Suggested applications for the models: The models can be used in a variety of ways:

- Predict harvest dates using planting date and local temperature
- Time crop planting dates to achieve a specific harvest date
- Plan for successive harvests during the growing season
- Predict whether late plantings will mature
- Use long-term forecasts and climate models to predict time to harvest

Table 1. Summary for sweet corn varieties. For fresh market varieties: lower threshold 44°F. For processing varieties: lower threshold 50°F. For all varieties: upper threshold 86°F, corn GDD calculation method, begin date either at time of seeding, or time of transplanting. Data from Western Oregon plus one site in Eastern Washington, 2013-2015.

Variety	Abbrev.	Dir. seed or transplant	GDDs (Tupper = 86F for all)									
			Tlow (F)	5 True leaves	5" Tassel	95% Silk	Fresh market harvest	Processed market harvest	Days to maturity	% CV (plant-harvest)	Mean abs. dev. (days)	# data sets
Luscious	scl ds	DS	44	442	1084	1414	1854	N/A	78	3.1	1.9	7
Luscious	scl tp	TP	44	451	1123	1516	1934	N/A	81	0.9	0.3	3
Sugar Pearl + Temptation	scs ds	DS	44	446	982	1342	1883	N/A	75	2.0	1.5	4
Sugar Pearl + Temptation	scs tp	TP	44	409	1099	1555	2014	N/A	81	4.4	2.6	5
4001	scf ds	DS	50	390	794	1075	1441	1644	105	2.5	1.8	4
Kokanee	sck ds	DS	50	300	845	1130	1498	1650	96	3.7	3.1	8