

## UNDERSTANDING GROWING DEGREE DAYS IN WILD BLUEBERRY PRODUCTION

### Introduction

#### What is Growing Degree Days?

Growing Degree Days (GDD) is a measure of heat accumulation based on the daily temperature. GDD is used to estimate the growth and development of plants and insects during the growing season. Plants and insects will start their development once the air temperature is above a minimum development threshold or base temperature. As development starts and temperatures rise further into the season, plants and insects will develop into different growth stages, such as plant emergence, floral bud formation and open flowers. The basic concept is that as plants and insects receive enough heat from the environment and reach the required accumulation of growing degree days (GDD), they develop into different growth stages.

Growing degree day models of crops, weed species or insects study those species' growth stages aligning with their GDD. Once the model is developed, it can be used year after year to understand and predict how plant development progress in the season based on the current season's daily temperature starting from a pre-determined date at the beginning of the growing season. GDD is not perfect, but it is a more reliable method to predict plant and insect development than calendar days. GDD is a weather-based indicator and uses current year weather data to predict development stages based on the developed GDD models.

### How is Growing Degree Days Calculated?

There are different methods to calculate growing degree days. In this factsheet, we will introduce a simple method called the temperature averaging method. Under this method, below equations show how we get the GDD:

$$\text{Daily } T_{\text{MEAN}} = (\text{Daily } T_{\text{MAX}} + \text{Daily } T_{\text{MIN}})/2$$

$$\text{Daily GDD} = T_{\text{MEAN}} - T_{\text{BASE}}, \text{ if } T_{\text{MEAN}} \text{ is greater than } T_{\text{BASE}}$$

$$\text{Or Daily GDD} = 0, \text{ If } T_{\text{MEAN}} \text{ is less than } T_{\text{BASE}}$$

Different crops, insects or weeds have different  $T_{\text{BASE}}$  based on crop types. In wild blueberry growing degree days model development, it is common to use  $T_{\text{BASE}} = 0^{\circ}\text{C}$  or  $T_{\text{BASE}} = 5^{\circ}\text{C}$ . When developing models, based on the crop type and study regions, the beginning accumulation date can be different as well. In Nova Scotia, it is common to use April 1 as the start date for wild blueberry model development.

Therefore, the accumulation of GDD is the sum of daily GDD from April 1 to a certain date you choose.

## Wild Blueberry Phenology

Phenology is the development of a plant across its lifetime, as known as the “growth stages”. Plants require heat accumulation to develop into different stages. It is critical to understand a crop’s growth stages in order to make correct management decisions. Commercial wild blueberry production is using a 2-year production cycle, therefore, we need to understand the growth stages for sprout and crop phases. In the sprout stage, wild blueberry plants start with plant emergence then leaf emergence stages, tip-die back, bud development and leaf drop & bud hardening. During the crop phase, wild blueberry plants go through those critical stages before harvest, such as vegetable and floral bud development stages, bloom and fruit development. It is important to have a clear understanding of each growth stage and their timings during the season, so we can better model and predict the growth of wild blueberry relative to local weather.

## Wild Blueberry Growing Degree Days Model

Before we use a crop, weed or insect growing degree days model for the region, we need to consider: 1) if the model is developed using the same region data (study species growing data and local weather data); 2) if the model is developed outside of the region, the model needs validation before it is employed to make sure accurate information will be delivered to growers.

Based on those principles and the most recent research development, we are able to use a wild blueberry GDD model developed by Dr. Scott White from Dalhousie University. His model studied some important stages for both sprout and crop phases.

**Table 1. Wild Lowbush Blueberry Growing Degree Days Model (White 2012)<sup>1, 2</sup>**

Non-bearing (Sprout) Year		Bearing (Fruit) Year	
Stages	Cum. Degree-days	Stages	Cum. Degree-days
Plant emergence - start	270 GDD	Stems with open flowers - start	390 DD
Plant emergence - 10%	290 GDD	Stems with open flowers - 10%	412 DD
Plant emergence - 25%	325 GDD	Stems with open flowers - 25%	440 DD
Plant emergence - 50%	405 GDD	Stems with open flowers - 50%	480 DD
Plant emergence - 90%	750 GDD	Stems with open flowers - 90%	600 DD
Tip Dieback - start	690 GDD		
Tip Dieback - 10%	834 GDD		
Tip Dieback - 25%	940 GDD		
Tip Dieback - 50%	1080 GDD		
Tip Dieback - 90%	1475 GDD		

<sup>1</sup> GDD start calculation date: April 1; Base T= 0°C; GDD calculation method: averaging method (GDD = Tmean – Tbase)

<sup>2</sup>As the model development continues, we will update this factsheet and present the most up-to-date data in Table 1 or add other GDD models being developed or validated in Nova Scotia into this factsheet

For example, under this model, wild blueberry plant emergence starts in sprout fields at around 270 GDD.

Research into the timing and GDD of phenological stages in wild blueberry is ongoing. The more we understand more stages and their GDD, we will be better to improve management and provide support for decision-making to growers.

Besides the wild blueberry growing degree day model, there are potentials for future research development such as weed species GDD models for better herbicide application timing support, as well as insect GDD models, such as SWD and Blueberry Maggot.

## Using Growing Degree Days in wild blueberry production

Under the Weather Station Assistance Program (Nova Scotia Department of Agriculture and Perennia, 2021-2022), we are expecting a good number of weather stations to be installed in major wild blueberry production in Nova Scotia. Those on-farm weather stations provide daily weather updates and generate daily GDD as needed, therefore we will start to give updates on GDD from those installed stations in wild blueberry fields through the growing season.

We provide GDD updates in Perennia's Wild Blueberry Blog and growers can see the most updated GDD from the weather station near their fields. Please visit this link to find GDD information from weather stations in wild blueberry fields in Nova Scotia:

<http://www.novascotiawildblueberryblog.com/p/phenology-tracker.html>



Figure 1. Growing Degree Days from Weather Stations in Wild Blueberry Fields, Nova Scotia

As soon as growers click on a station they are interested to know the current GDD, they can see the most updated GDD information. Please use this information and compared it with the wild blueberry growing degree days model in Table 1, and the information will help you to make decisions in your production.

Please contact Perennia's Wild Blueberry Specialist for more information.

<https://www.perennia.ca/portfolio-items/wild-blueberries/?portfolioCats=87>

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