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Early Season Predictions: Methods to Predict Weed Emergence

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Fill in the blank: Apply crabgrass preemergence herbicide when_____is in bloom.

If you said forsythia, you would be correct. Most of us have been told the answer to this for many years, but have you ever thought to yourself, 'Is it true?'

Figure 1. Callery pear in flower gives an indication of certain weed seeds germinating.

There are many ways that people make decisions on when to apply herbicides. Some of you may use growing degree-days, phenological cues (Figs. 1 and 2), or are you the one that says, 'I always put down my preemergence (PRE) herbicides on March 15th'? If you are the latter, there is a good chance that you spray a great deal of postemergence (POST) herbicides because of the weeds you missed with the PRE application.

Figure 2. Maple at bud break is an example of using a phenological cue to time weed control.

So, what exactly are phenological cues? Phenology is defined as the study of cyclic and seasonal natural phenomena, especially in relation to climate and plant and animal life. The use of phenology is applicable in many applications, including insect emergence and development, bloom dates, weed development and germination, and more. Continuing with our example of applying crabgrass PRE according to the timing of forsythia flowering, this is the utilization of this method of phenological cues to time the germination of a weed. Research has long demonstrated that plants break bud, germinate, and flower based on growing degree days. We can time these events to consistently apply preemergence herbicides at the correct time to prevent emergence by observing bud break and flowering of ornamental plants.

Utilizing growing degree-days to time phenological cues gives an approximation of the soil temperatures (which is a factor of what determines the timing of the germination of the weed seeds).

Growing degree-days (GDD) are calculated by finding the mean temperature for the day. You do this by adding the high and low temperature and divide by two to find the mean. That number is then subtracted from the base temperature (usually 40° or 45° F for many ornamental species) to get the GDD for each day. We typically use between 35° and 50° F for the temperatures in which GDD's are accumulated. After an accumulation of these GDD's plants will begin to break bud, flower, produce seeds, etc. This number varies within species, which is why it is important to have an idea of the GDD's to time these phenological cues. There are calculators online that can be used in determining the amount of GDD's currently. A couple of recommended sites are: http://www.gddtracker.net/ or https://www.oardc.ohio-state.edu/gdd/.

Weed germination varies greatly by species, and sometimes even between ecotypes. Some weeds will complete germination within a few weeks, such as kochia (Fig. 3),

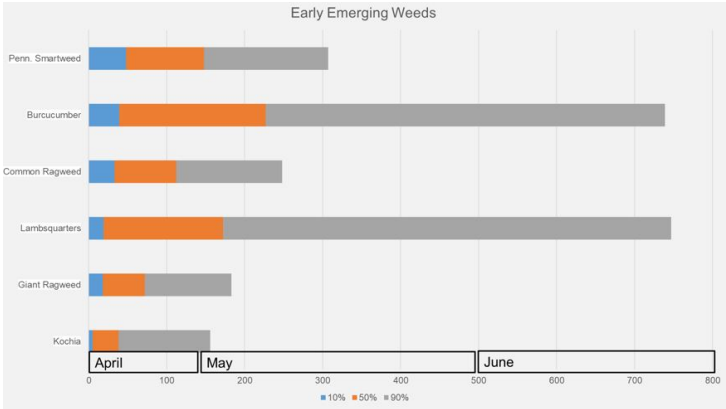

Figure 3. Early emerging weeds based on growing degree days. Blue is 10% germinated, orange is 50% germinated, gray is 90% germinated. Adapted from Werle et.al. (2014).

while others can take months, such as fall panicum (Fig. 4),

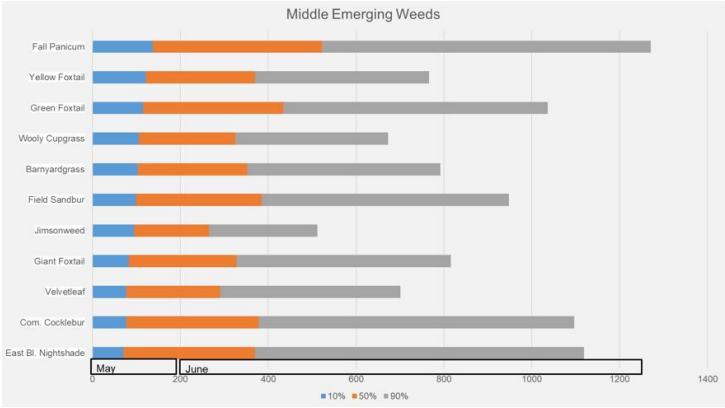

Figure 4. Middle germinating weeds based on growing degree days. Adapted from Werle et.al. (2014).

or ivyleaf morningglory (Fig. 5).

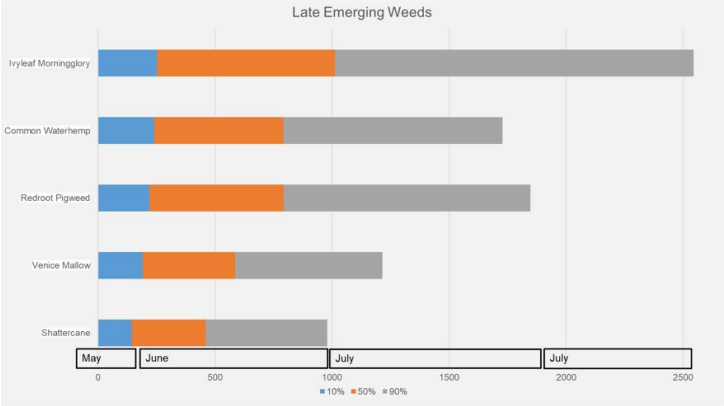

Figure 5. Late germinating weeds based on growing degree days. Blue is 10% germinated, orange is 50% germinated, gray is 90% germinated. Adapted from Werle et.al. (2014).

The longer germinating species can be more difficult to control due to the breakdown of the herbicide in the soil. To aide in increasing the longevity of your preemergence treatment, a split application can be utilized. A split application is applying half your product early and the other half about a month later.

As a reminder, remember that the most effective nursery and landscape weed control programs should rely on PRE as the primary chemical control method. By reducing the amount of POST, phytotoxicity chances are reduced, money is saved by decreased labor inputs, and the weed seed bank is reduced. Remember that PRE must be applied PRIOR to weed germination or they are ineffective.

The figures and charts in this publication should be helpful in scheduling and planning your spring weed control program. As of the release of this article, silver maple is in bloom in West Lafayette, IN. I suspect most everything will be in a 'holding pattern' or 'suspended animation' until we begin to receive more warm weather later next week.

Common Name	Phenological Event	Date	Degree Day
Red Maple	First Bloom	March 20	49
Red Maple	Full Bloom	March 30	71
Star Magnolia	First Bloom	April 4	89
Border Forsythia	First Bloom	April 4	922
Border Forsythia	Full Bloom	April 13	105
Saucer Magnolia	First Bloom	April 13	119
Bradford Pear	First Bloom	April 15	137
Star Magnolia	Full Bloom	April 16	149
Saucer Magnolia	Full Bloom	April 18	184
Bradford Pear	Full Bloom	April 19	189
Eastern Redbud	First Bloom	April 20	192
Snowdrift Crabapple	First Bloom	April 21	213
Common Lilac	First Bloom	April 24	231
Common Horsechestnut	First Bloom	April 30	264
Eastern Redbud	Full Bloom	April 30	277
Snowdrift Crabapple	Full Bloom	May 1	268
Flowering Dogwood	First Bloom	May 4	293
Common Lilac	Full Bloom	May 7	331
Winter King Hawthorn	First Bloom	May 8	344
Common Horsechestnut	Full Bloom	May 13	385
Winter King Hawthorn	Full Bloom	May 15	423
Black Locust	First Bloom	May 20	459
Black Locust	Full Bloom	May 28	565
Washington Hawthorn	First Bloom	June 2	641
Northern Catalpa	First Bloom	June 5	678
Washington Hawthorn	Full Bloom	June 10	775
Northern Catalpa	Full Bloom	June 13	818

Table 1. Common ornamental plants bloom times based on growing degree days. Adapted from Cardina et.al. (2011).

Common Name	Environment	Emergence	Date	Degree Day
Smooth Crabgrass	Lawn	First Emergence	April 16	155
Smooth Crabgrass	Bare Ground	First Emergence	April 17	178
Large Crabgrass	Lawn	First Emergence	April 24	211
Smooth Crabgrass	Lawn	25% Emergence	April 28	263
Smooth Crabgrass	Bare	25% Emergence	May 1	284
Large Crabgrass	Bare	First Emergence	May 2	306
Smooth Crabgrass	Lawn	50% Emergence	May 7	347
Smooth Crabgrass	Bare	50% Emergence	May 9	354
Smooth Crabgrass	Bare	80% Emergence	May 19	448
Large Crabgrass	Lawn	25% Emergence	May 20	472
Large Crabgrass	Bare	25% Emergence	May 22	502
Smooth Crabgrass	Lawn	80% Emergence	May 24	548
Large Crabgrass	Bare	50% Emergence	June 1	623
Large Crabgrass	Lawn	50% Emergence	June 6	692
Large Crabgrass	Lawn	80% Emergence	June 30	1160
Large Crabgrass	Bare	80% Emergence	July 1	1188

Table 2. Using growing degree days to predict germination of large and smooth crabgrass. Adapted from Cardina et.al. (2011).

Common Name	Environment	Emergence	Date	Degree Day
Giant Foxtail	No Fall Tillage	25% Emergence	May 10	286
Giant Foxtail	Fall + No Tillage	25% Emergence	May 11	288
Giant Foxtail	Fall Tillage	25% Emergence	May 11	290
Giant Foxtail	Fall + No Tillage	50% Emergence	May 15	380
Giant Foxtail	Fall Tillage	50% Emergence	May 16	382
Giant Foxtail	No Fall Tillage	50% Emergence	May 18	413
Giant Foxtail	Fall Tillage	80% Emergence	May 30	578
Giant Foxtail	Fall + No Tillage	80% Emergence	June 8	693
Giant Foxtail	No Fall Tillage	80% Emergence	June 9	717

Table 3. Giant foxtail germination based on growing degree days in tilled vs. no-tilled areas. Adapted from Cardina et.al. (2007).

If you are a nursery or landscape company that would like to discuss your weed control program, please contact me at daniel38@purdue.edu.

References:

Cardina, J., Herms, C.P., Herms, D.A., and Forcella, F. 2007. Evaluating Phenological Indicators for Predicting Giant Foxtail (Setaria faberi) Emergence. Weed Science Society of America. 55(5). Pgs. 455-464.

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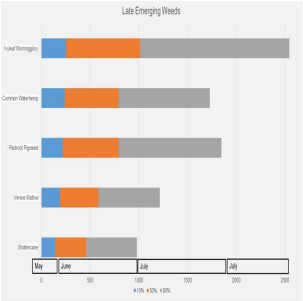

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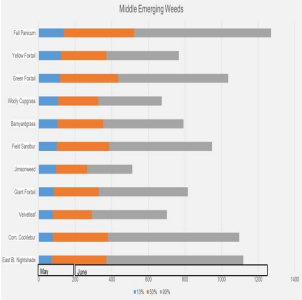

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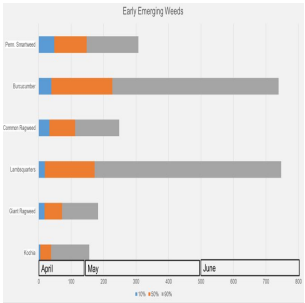

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