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VEGEdge

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Understanding Factors Driving Success with Pre-Emergence Applied Herbicides

Elizabeth Buck, Cornell Cooperative Extension, Cornell Vegetable Program

Herbicides that have activity on weeds that are not yet emerged (what "PRE herbicide" will mean in this article) can be a great weed control tool. Effectively, they remove weeds as they germinate and emerge and prevent weeds from entering into competition with your crops for a number of weeks.

Anyone who has used PRE herbicides knows that they can be a little finicky. When working well, PREs offer solid control of species against which the herbicide is highly effective. Most people have also experienced failures of control with PRE herbicides. Most failures come down to a few factors related to how these herbicides work. If you understand these factors, you can anticipate the potential for underperformance and adjust your subsequent weed control plans.

SOIL TEXTURE

Herbicides can bind to soil particles. In order to be active and available in the soil for killing weeds, a sufficient amount of the herbicide must be able to come off the soil particles and exist in the soil water solution. If an herbicide is too tightly bound to the soil, you will have a difficult time getting an effective rate into the soil water solution. Some herbicides (not all) bind more or less to different types of soil particles. Generally speaking, clay and organic matter particles have a greater ability to hold onto herbicides and sand has much less ability to hold onto herbicides. PRE herbicides that bind to soils in varying degrees will have labels that specify soil-texture specific rates. Dual is an example of one such herbicide. You must match the rate to the soil texture to achieve good control and an acceptable margin of crop safety. Too high or your soil type and you will risk crop injury because too much herbicide can be available and active in the soil water. For some herbicides you may be risking leaching of the herbicide by mismatching your rate and soil texture. Too low and there may not be enough herbicide available in the soil water solution to offer a high degree of control.

SOIL MOISTURE, "ACTIVATION", AND VOLATILIZATION

"Activation" is a concept related to many PRE herbicides. Several PRE herbicides need extra effort to get into the soil water solution. Without reaching the soil water solution, these herbicides are limited in how much weed control they can offer. There are

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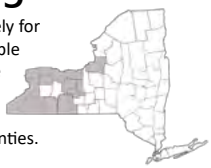

VegEdge newsletter is exclusively for enrollees in the Cornell Vegetable Program, a Cornell Cooperative Extension partnership between Cornell University and CCE Associations in 14 counties.

The newsletter is a service to our enrollees and is intended for educational purposes, strengthening the relationship between our enrollees, the Cornell Vegetable Program team, and Cornell University.

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The next issue of VegEdge newsletter will be produced on June 2, 2021.

Berry Specialist Transitions

Julie Kikkert and Peter Landre, Cornell Cooperative Extension

Recognizing that many of our vegetable farms also grow berries, we have appreciated the contributions that Esther Kibbe has made to VegEdge and other educational programs throughout our region. Esther has accepted a position with Mastronardi BerryWorld America and is no longer with Cornell Cooperative Extension.

New Berry Specialist, Anya Osatuke begins June 3, 2021.

While we will certainly miss Esther, we are pleased to announce the appointment of Anya Osatuke to the position of Berry Specialist for the Harvest NY team covering areas outside of Eastern NY. Anya earned her M.S. in Horticulture from Cornell University with Dr. Marvin Pritts, focusing on field management and site characteristics and their effects on strawberry quality issues and fruit yield on New York State berry farms. Anya earned her B.A. in Botany and Russian Studies from Miami University. Anya has a broad background in berry and small fruit production and will work in close collaboration with the New York State Berry Growers Association and other fruit specialists to develop and implement programs and trouble-shoot issues with berries and small fruit on commercial farms. Anya will start June 3. You will be able to reach her via email at aco56@cornell.edu or by phone at 513-237-0392.

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two ways to achieve activation, and the strategy differs based on individual herbicide chemistry and sometimes the crop.

The first and most common is activation by rainfall or irrigation. PRE herbicide sprayed on the soil surface are dissolved with the moisture and move into the upper layer of the soil. Remember that PRE herbicides in this article means herbicides that are active on weeds before they emerge. Many PREs act on very young seedlings and need to be absorbed by seedling structures that remain below ground. If the PRE herbicide remains on the soil surface, "unactivated", sensitive parts of germinating weed seedlings are far less likely to come into contact with an effective rate of the herbicide.

The second way to achieve activation is to mix the herbicide into the soil yourself. These are materials applied PPI, or Pre-Plant Incorporated. Materials may have a PPI label on them for activation, they may have a PPI label on them for crop-specific reasons, or they may have a PPI label on them because the herbicide has volatility issues. Herbicides that can volatilize are at risk of evaporating off the soil surface and must be mixed into the soil. Such materials are only applied PPI. When working in PPI materials you want to work them shallowly and follow the label directions closely. PPI materials may need to mixed in for several reasons:

Herbicides that need "activation" or will specify a need for incorporation, rainfall or irrigation within so many days of application on the label.

HERBICIDE DEGRADATION

Most PRE herbicides are broken down in the soil by microbial degradation. Good bacteria & fungi eat the herbicide and break the chemical down into non-herbicidal pieces. Microbial degradation is usually an aerobic process, meaning it doesn't happen well in saturated soils. Microbial degradation also occurs much more slowly in cool conditions because the microbes are far less active and can't multiply as quickly. So, cold wet soil tends to allow PRE herbicides to persist longer, which means that the concentration in the soil can remain higher for longer than under more typical conditions. These conditions can increase the risk for crop injury when you use certain PRE herbicides.

On the flip side, microbial degradation happens more quickly when soils are warm and moist. Under those conditions we might see shorter effective control windows for PRE herbicides. Weeds can "break through" and you can see entire flushes of previously controlled weed species come up through the more rapidly degraded herbicide barrier. In this case, season long control programs can fail not because the PRE herbicide didn't do its job, but because wet warm weather shortened its active life while pushing the weeds ahead. This is often exacerbated by wet ground preventing timely cultivation or application of herbicides that control already emerged weeds (POST emergence herbicides).

DEPTH PROTECTION

Some PRE herbicides rely on a concept of "depth protection" to gain a better margin of crop safety. Basically, depth protection means that the parts of the crop seedling or transplant that can take up the herbicide is physically separated from where the herbicide sits in the soil. Functionally, it sits below the herbicide barrier layer in the soil. Prowl is an example of an herbicide that relies on depth protection for seedling safety. When conditions are too wet, herbicides that normally sit in the top ¼ to ½ inch of soil (the zone most weed seeds germinate from) can be washed deeper into the ground and get into the crop germination zone (usually an inch or more). Excessive soil moisture can put the susceptible parts of the seedling, the roots and hypocotyl, in direct contact with more PRE herbicide than the crop can tolerate. The result is injury manifesting as stunting, root damage, brittleness, and other symptoms depending on your herbicide choice.

CROP INJURY WHEN CORRECT RATE IS USED IN THE CORRECT CROP

Plants that tolerate herbicides have to metabolize the herbicide into something harmless or not physically have contact between plant parts that can absorb the herbicide and herbicide itself. In the cold, plants aren't terribly active metabolically. If the plant isn't very active metabolically, then it can't efficiently process the herbicide through its system. Age of plant matters. Generally speaking, older crop plants can better tolerate and metabolize PRE herbicides because older plants are essentially "tougher skinned" - less likely to take up the active ingredient - and better equipped to metabolize it. S-metolachlors (Dual & many generics) tend to injure plants more in cold, wet soil conditions because the plants can't handle the herbicide as well as in warmer, better growing conditions.

I already touched on the physical separation bit related to depth protection. There is also physical separation on some labels that allow row-middle applications or directed applications away from the crop row. I most often see physical separation fail when folks spray herbicides over the top of the plastic and then rains wash that herbicide into the holes. This is a case of improper (off-label) herbicide placement.

When herbicide washes into plastic holes you end up with both a higher effective rate and more physical contact with the transplant than intended. Transplants and seedlings struggle to tolerate this. Not coincidentally, many labels do not allow broadcast spraying of herbicides over plastic. Some allow banded application under plastic mulch instead, because then the transplant can be set through the herbicide layer and into safe soil below, without risk of herbicide concentration during wet weather.

Muck Onion Research Highlight 2020: Effect of Spray Volume of Post-Emergent Herbicides on Onion Injury and Weed Control

Christy Hoepting, Cornell Cooperative Extension, Cornell Vegetable Program

FACTORS AFFECTING LEAF BURN

Post-emergent herbicides that cause leaf necrosis such as necrotic spotting and leaf burn include Goal, Chateau and Buctril (a.i. bromoxynil, tradenames Broclean, Brox, etc.). The Buctril label states to use at least 50 to 70 gpa, "water volume is important – CONCENTRATED SPRAYS KILL ONIONS… Thorough and uniform coverage is necessary for weed control." Theoretically, the higher spray volume would result in a less concentrated solution per spray droplet that comes in contact with the onion leaves. Also, the higher spray volume may more likely run off the vertical onion leaf while resting in place on top of a horizontal broadleaf weed leaf. As spray volume decreases, the concentration of the herbicide spray droplet increases, but there could be fewer droplets. Are fewer larger droplets of more concentrated spray solution more effective for weed control than more smaller droplets of more dilute spray solution? Pressure and nozzle type also contribute to droplet size. Since use of Chateau for post-emergent weed control in onion began ramping up over 10 years ago, growers have been asking me whether spray volume is important for both efficacy and weed control with Chateau. In my on-farm small-plot research trials, I use a CO2 pressurized backpack sprayer with flat fan nozzles (medium droplet size), 40 gpa and ~ 32 psi and I wonder how this compares to other arrangements. Finally, in 2020, I addressed these research questions in my on-farm small-plot herbicide trials.

SPRAY VOLUME, PRESSURE, DROPLET SIZE PUT TO THE TEST

I looked at the effect of spray volume (20 vs. 40 gpa) on high rates of a single application of four post-emergent herbicide treatments; 1) Chateau 2 oz/A; 2) Goal 2XL 4 fl oz/A; 3) Buctril 2EC 8 fl oz/A; and 4) Buctril 2EC 8 fl oz/A + bicyclopyrone 3.42 fl oz/A (Table 1).

In another trial, I focused on a "heavy" post-emergent application of Buctril 2EC 8 fl oz/A + Goal 2XL 4 fl oz/A, since this has become my go-to recommendation for post-emergent control of almost all broadleaf weed escapes, but can also cause unacceptable (>10%) visual onion injury. I trialed several combinations of spray volume (20, 40 & 60 gpa) over different spray pressures (32 to 58 psi), nozzle types (flat fan and air induction) and droplet sizes (fine, medium, coarse) (Table 2). Due to limitations of my ground/walking speed, I was not able to compare 20 and 40 gpa while keeping the other variables of spray volume, pressure and droplet size exactly the same. The only direct comparisons that can be made are in Buctril + Goal trial 20 vs. 40 gpa with 34 psi and fine droplet size (Table 2, trts 1 & 2) and 20 vs. 40 gpa with 32 psi and coarse droplet size (Table 2, trts 3 & 4).

Both trials were set up on the same day. The treatments were applied to 2.5 leaf onions following fairly dry conditions on June 13, similar to the current weather conditions. Crop tolerance was evaluated 7 and 17 days after treatment (DAT) in both trials. Weed control was only rated in the Buctril + Goal 2XL trial, of which Lamb's quarters (LQ) was the dominant species.

Table 1. Effect of spray volume on crop injury of post-emergent herbicides applied to onion (c.v. Red Wing) at 2.5 leaf stage, small-plot field trial, Elba, 2020.

Speed: 2.6 mph				Visual Onion Injury (%) 7 days after application to 2-3 leaf onion			
Spray Volume GPA[1]	Spray Pressure PSI[2]	Droplet Size	Nozzle Type[3]	Chateau 2 oz/A	Goal 2XL 4 fl oz/A	Buctril 2EC 8 fl oz/A	Buctril 2EC 8 fl oz/A + bic. 3.42 fl oz/A
20	34	fine	TP 8002 VS	4.3 cde[4]	5.0 bcd	6.7 ab	5.0 ab
40	32	medium	TP 8005 VS	3.7 cde	7.3 a	3.7 cde	4.7 bcd
20	32	coarse	AI 8002	4.3 cde	5.7 abc	4.3 cde	4.3 cde
40	39	coarse	AI 8004	3.7 cde	6.7 ab	2.3 e	3.0 de
			Average Injury[5]:	**4.0 B**	**6.2 A**	**4.3 B**	**4.3 B**

1 **GPA**: gallons per acre.
2 **PSI**: pounds per square inch.
3 All nozzles are TeeJet. TP #### VS are flat fan; AI #### are air induction.
4 Numbers in this table followed by the same small letters are not significantly different, Fisher's Protected LSD test, p = 0.0015.
5 **Average injury per herbicide**, pooled across GPA, PSI and droplet size. Numbers in this row followed by the same capital letter are not significantly different, Fisher's Protected LSD test, p = 0.0031. There were no significant differences among GPA, PSI or droplet size when these variables were pooled across the other variables (e.g. GPA pooled across herbicides, PSI and droplet size).
Pink border: Standard GPA, PSI and nozzles used by Hoepting in small-plot research trials with CO2 pressurized backpack sprayer.

SPRAY VOLUME MOST IMPORTANT FOR BUCTRIL

None of the single applications of high rates of post-emergent herbicides resulted in unacceptable levels of onion injury (e.g. > 10%) 7 days after single application to 2.5 leaf onion (Table 1 & 2). Highest onion injury occurred in the Buctril 2EC + Goal 2XL 4 fl oz trial, which ranged from 6% to 10% (average 7.8%). In the other trial, Goal 2XL 4 fl oz had significantly higher average injury (6.2%) than Buctril 2E 8 fl oz (4.3%), Buctril 2EC 8 fl oz + bicyclopyrone 3.42 fl oz (4.3%) and Chateau 2 oz (4%) (Table 1). In this trial, onion injury dropped to 4% or less 17 DAT (data not shown). **These results demonstrate that when weather is sunny and dry that onions can sustain high rates of post-emergent herbicides without incurring unacceptable injury.**

In 6 out of the 8 side-by-side comparisons between 20 and 40 gpa in the herbicide trial, numerically slightly less onion injury resulted with 40 gpa. Alternatively, 40 gpa had more injury than 20 gpa with Goal 2XL, especially with flat fan nozzles (fine/medium droplet size). We saw the **greatest differences in spray volume with**

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Buctril +/- bicyclopyrone where 20 gpa/34 psi/fine droplet size had the highest onion injury and 40 gpa/39 psi/coarse droplet size had the least injury.

In the Buctril + Goal trial, there were no significant differences in injury among treatments 7 DAT. At 17 DAT, significant differences occurred among treatments, which ranged from 2.7% to 6.7% (Table 2). **Consistent differences between 20 and 40 gpa did not occur.** Treatments with the least injury included the coarse droplet size at 20 and 40 gpa/32 psi (trts. 3 & 4), while the highest injury was also with coarse droplet size/40 gpa, but with higher pressure 40 psi (trt. 8). High volume 60 gpa 40 psi/medium droplet size (trt. 8) and 49 psi/fine droplet size (trt. 9) also caused higher levels of onion injury.

DROPLET SIZE AFFECTED WEED CONTROL

Best control of LQ with Buctril 2EC 8 fl oz/A + Goal 2XL 4 fl oz, which included kill of up to 4" with remaining LQ fairly injured was 40 gpa/32 psi/medium droplet size (Trt. No. 5) and 40 gpa/58 psi/fine droplet size (Trt. No. 6). Of these, both had some of the lowest onion injury in the trial. In very general terms, less control of LQ was observed in the treatments with coarse droplet size (air induction nozzles), especially when used at 32 psi. Of these, the 40 gpa/39 psi (trt. 7) resulted in significantly more onion injury than the 20/40 gpa with 32 psi (trts. 3 & 4).

IN A NUTSHELL

- Onion injury: Chateau < Buctril 2EC 8 fl oz +/- bicyclopyrone 3.42 fl oz < Goal 2XL 4 fl oz < Buctril 2EC 8 fl oz + Goal 2XL 4 fl oz
- Higher spray volume, 40 gpa vs. 20 gpa was most important for crop safety with Buctril +/- bicylopyrone.
- Spray volume was less important to crop injury with Chateau, only 0.5% difference between 20 and 40 gpa
- For Goal 2XL 4 fl oz, crop injury was higher with 40 gpa than 20 gpa, especially with fine/medium droplet size.
- Best weed control with Buctril 2EC 8 fl oz + Goal 2XL 4 fl oz occurred with 40 gpa/fine/medium droplet size. Weed control decreased slightly with fine/medium droplet size and higher volume 60 gpa.
- Weed control with Buctril 2EC 8 fl oz + Goal 2XL 4 fl oz was notably less with coarse droplet size, especially with 32 psi; higher pressure 30 psi resulted in improved control with coarse droplet size.
    - For coarse droplet size, onion injury followed the same trend.

Table 2. Effect of spray volume, pressure and droplet size on crop injury and weed control of post-emergent application of Buctril 2EC 8 fl oz + Goal 2XL 4 fl oz applied to onion (c.v. Red Wing) at 2.5 leaf stage, small-plot field trial, Elba, 2020.

						Buctril 2E 8 fl oz + Goal 2XL 4 fl oz applied onion 2-3 leaf								
						Visual Onion Injury (%)		Control of Lamb's quarters (13 DAT) Jun 26						
								Main weed size /plot[4]	Herbicide Injury Rating Scale for Weeds[5]: 0-6 by size					
No.	Spray Volume GPA[1]	Spray Pressure PSI[2]	Droplet Size	Nozzle Type[3]	Speed mph	7 DAT[6] Jun 20	17 DAT Jun 30		1"	2"	3"	4"	6"	8"	10"
1.	20	34	fine	TP 8002 VS	2.6	8.3	3.7 bc[7]	3-4"	6 1-4	6	6 2	0-2 6	0 2	--	--
2.	40	34	fine	TP 8002 VS	1.3	7.3	4.3 abc	4-6"	6	6 2	6	2-3 6	1-2	--	--
3.	20	32	coarse	AI 8002	2.6	6.0	3.0 c	4-6"	6	0-2 6	6 1,3	2	0-2	--	1
4.	40	32	coarse	AI 8002	1.3	7.7	2.7 c	4-6"	0-1 6	6 1	2	1	1	2	2
5.	40	32	medi-um	TP 8005 VS	2.6	6.7	3.3 bc	3-6"	6	6 1,5	6 2	6	1-2 5	2	--
6.	40	58	fine	TP 8004 VS	2.6	7.7	5.0 abc	2-4"	6	6	6 4	5-6 3	5 2	2	--
7.	40	39	coarse	AI 8004	2.6	8.0	6.7 a	2-4"	6	6 2-3	2-3 6,5	1,3 5	1,3 5	--	--
8.	60	40	medi-um	TP 8008 VS	2.6	8.3	5.7 ab	3-6"	6 1-4	6 4-5	6 1-2	2-4 5,6	1-2 3,5	2	--
9.	60	49	fine	TP 8006 VS	2.6	10	4.0 bc	4"	6	6 1	6 5	2 1,4	2 1	2	--
					p value (α = 0.05):	NS	0.0024								

1 **GPA**: gallons per acre
2 **PSI**: pounds per square inch
3 All nozzles are TeeJet. TP #### VS are flat fan; AI #### are air induction.
4 Main weed size per plot in inches wide or tall, whichever is the largest.
5 **Herbicide Injury Rating Scale for Weeds (scale 0-6)**: 0 = no injury; 1 = minor injury (can see some injury but growth otherwise normal); 2 = minor-moderate injury (injury evident, but weed will grow out of it); 3 = moderate injury (can't tell whether weed will grow out of injury or eventually die); 4 = moderate-severe injury (weed looks like is going to die); 5 = severe injury (almost dead); 6 = dead. Numbers on the top row are dominant injury rating per size class.
6 **DAT**: days after treatment
7 Numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, p >0.05.
Pink border: Standard GPA, PSI and nozzles used by Hoepting in small-plot research trials with CO2 pressurized backpack sprayer.

Vegetable Transplant Precautions

Robert Hadad, Cornell Cooperative Extension, Cornell Vegetable Program

When transplanting when it is hot, dry, and going into black plastic or even the biodegradable mulches, make sure the holes are wide enough so that the transplant stems do not touch the edges of the mulch. The mulch gets hot in the sun and can injure the tender stems. Filling in the holes with soil can be done to keep the plants from leaning over and touching the edges.

Transplant holes that are too deep, or if the ground, ridge, or bed is uneven, can leave significant space between the soil level and the mulch. If the wind picks up, the mulch can flap, creating a bellows effect, blasting the transplant with hot air causing injury. Don't rush bed preparation and work trying to provide a mostly level surface to transplant into.

Don't Reuse Stakes for Crop Support

Robert Hadad, Cornell Cooperative Extension, Cornell Vegetable Program

Don't reuse stakes. Simple, right? Bacterial diseases such as canker, speck, and spot can all survive on stakes. Not just wooden stakes but any stake that has a rough surface. Disease can spread from the stakes onto the plants repeating a cycle over again year after year. If using wooden stakes, it is better to start each season with new ones for tomatoes and peppers. Reuse the old wooden ones for pole beans, holding up pea netting, or having a July 4th bonfire.

If you truly insist on reusing stakes, then you should spend some time (like now) to soak them in a disinfecting solution. To kill the bacteria lingering in the stakes, fill a tank with one part bleach (germicidal type, not laundry) to 9 parts water (assuming the NaCl concentration is around 5.2%. If higher then follow label directions for disinfecting soak). Other sanitizers can be used such as hydrogen peroxide and peroxyacetic acid (PAA) are also commonly available to use with some PAA certified organic. The stakes should stay submerged for 30 minutes. If using well water, check the pH. The water should have a near neutral pH otherwise if it is too high, chlorine products may become inactivated. Adjust the pH with something like white table vinegar.

Spring Concerns in High Tunnel Tomatoes

Judson Reid, Cornell Cooperative Extension, Cornell Vegetable Program

MONITOR MOISTURE CONDITIONS

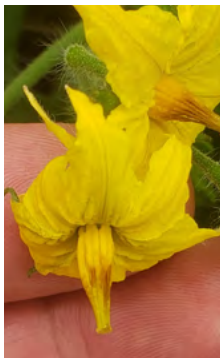
As soil temperatures warm, water demand in fruiting plants can be surprisingly high. If there is a competition for water within the plant, fruit can be short-changed calcium, which leads to Blossom End Rot (BER). At this time of year we often see Internal BER, more than the classic symptoms at the flower end of the fruit. Internal BER presents as sunken black spots, often in a circular pattern around the lower half of the fruit. High levels of nitrogen can also contribute to Internal BER as the plant is growing too fast and cannot distribute sufficient calcium to both shoots and fruits. Response? Monitor soil and water calcium levels, avoid excessive N in the spring and provide regular, adequate water. How much water? That is site and crop stage specific. Remove affected fruit.

Lack of calcium, often from water shortage or excess nitrogen can lead to Internal Blossom End Rot. *Photo by J. Reid, CVP*

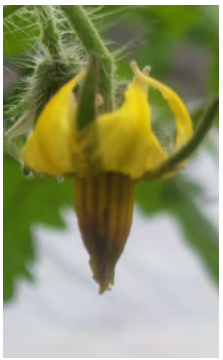
'BEE DAMAGE' TO FLOWERS

Bumblebees are very effective at pollination in greenhouses, and sometimes too effective. Flowers that are visited too often will turn black, and eventually drop at the 'knuckle'. Why does this happen? Quite simply there are too many bees and not enough flowers or pollen. When ordering bumblebees let your supplier know the square footage of your greenhouse and number of plants. Ideally the hive will arrive when the first flower cluster is fully open. This can be difficult to time, so be in contact with the supplier before flowering begins. Once the bumblebees are working the greenhouse, monitor flowers for visits. A pair of light brown marks indicates the flower has been visited. If these are black, or the entire stamen begins to darken, the bees are visiting the same flower too often. Solutions:

- Close the hive for a day or two to wait for more flowers to open (provide sugar water or pollen to hive).
- Restrict the number of hours the hive is open per day.
- Provide additional flowering plants to support the hive early in the season.
- Most greenhouses in our area will need the smallest commercial hive available.



A pair of light brown marks can indicate successful pollination. *Photo by J. Reid, CVP*



This flower has been visited too often! It will likely drop from the plant. *Photo by J. Reid, CVP*

Processing Green Peas: Post-Emergence Weed Control with Herbicides

Julie Kikkert, Cornell Cooperative Extension, Cornell Vegetable Program

The earliest planted peas are flowering while others were just planted this week. Scouting and managing weeds in all pea fields is critical until the crop begins flowering. The best chance for control is when the weeds are young. Growers of conventional processing peas rely largely on herbicide use for weed management and most apply a pre-emergence herbicide. The application of post-emergence herbicides should be based on the dominant weed species present and the growth stage of the peas. A chart on relative effectiveness of herbicides available for peas in NY in 2021 is available on the CVP website in the pea crop section. Contact Julie Kikkert at 585-313-8160 if you'd like a copy of the chart mailed to you. Note that this chart is only for succulent green (English) peas. If you are growing edible pod or other types of peas, please make sure to look at the product labels carefully.

The application of post-emergence herbicides to succulent peas must be made at certain growth stages. Herbicide labels often refer to peas at a certain number of nodes (point where a leaf meets the stem). In peas, the first two nodes have only scale leaves and are often below the ground (Fig. 1). These should be counted in green peas. (Note this is different for dry field peas.) Furthermore, afila (leafless) peas do not have true leaves, rather they have stipules and tendrils.

Basagran and Thistrol don't have any soil residual, so the best time to spray is when the majority of weeds have emerged. Ideally, the first flush of weeds would have one or two leaves and the next flush would be in the cotyledon stage. Keep in mind that rain will stimulate new flushes of weeds. If you have nightshades, pigweed or mustard in your field, a better choice may be Raptor or Pursuit. Basagran will only control hairy nightshade, whereas Raptor and Pursuit will control both hairy and eastern black nightshade. Poast, Assure II/Targa and Select Max all provide good to excellent control of the most prevalent annual grasses in NY.

Figure 1. Node Count in Succulent Green Peas

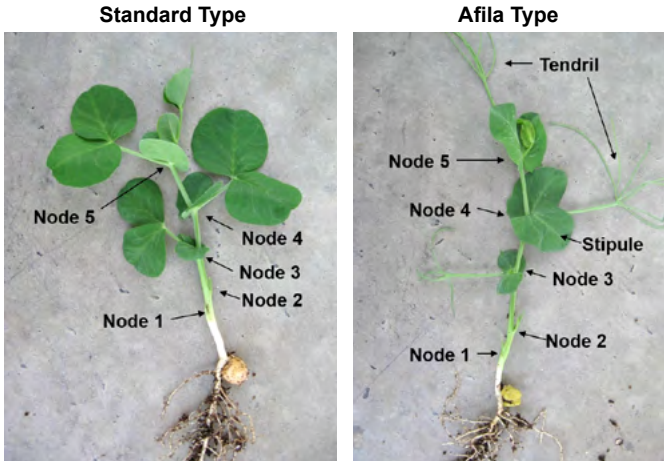


Image by Julie Kikkert, CCE Cornell Vegetable Program

Although Basagran is labeled for yellow nutsedge, the rate we use in peas (1.0 – 2.0 pt/A) is too low to kill nutsedge, however, you may see suppression of weed growth. That is why on the pea herbicide chart Basagran is given a "poor" rating on yellow nutsedge. In the future, make note that Dual Magnum applied pre-emergence is very effective against nutsedge. Better yet, control nutsedge in fallow fields or rotational crops as a long-range plan for a particular field.

If you have Canada thistle in your fields, you may either hand-pull if there are small patches or apply a spray of Thistrol when the thistle is 4 to 10 inches tall. Use a rate of 3 to 4 pints/acre. This will prevent the thistle from forming flower buds that can contaminate the pea product, but will not kill the thistle. Remember that Thistrol cannot be applied to peas that are later than 3 nodes before flowering. In early peas, those at nodes 9-11, the timing of this postemergence application is critical. Late applications in early peas cause nonuniform flowering, resulting in uneven maturity. Canada thistle management is best done in rotational crops or in the fall. Stinger is the most effective herbicide, because it moves to the roots. Note that there is an 18-month restriction before you can plant peas in a field where Stinger has been applied. Stinger is labeled for field corn, sweet corn, cabbage, beets and spinach, and pasture/forage crops. The optimal time for application is in April and May before the thistle buds open. Later in the season, you can use 2,4-D in labeled crops (not peas). In the fall, Roundup + Banvel can be used.

Table 1. Average node to first flower for commonly grown processing pea varieties in New York

Variety	Vine Type	1st Node to Flower
Early Season		
FP 2269	Afila	9 to 10
PLS M-14	Normal	9
Premium	Normal	9
Spring	Normal	9 to 10
Mid-Season		
BSC712	Afila	13 to 15
DA1470	Determinant Afila	12 to 13
Portage	Afila	10
Late-Season		
Boogie	Afila	14 to 15
PLS196	Afila	11 to 16
Ricco	Afila	16
SV6844	Afila	13 to 16

CROP Insights

Observations from the Field and Research-Based Recommendations

The temperature is supposed to drop into the low 40's Friday and Saturday night, with upper 30's forecast in the southern tier. Erie and Ontario will moderate the temperature nearby and keep those close to the lakes in the mid to upper 40s. Sunday night they are calling for the weather to be only a few degrees warmer. While this cold front holds the best promise of bringing us some much-needed rain, it makes me quite nervous. There are a lot of eggplants, beans, and vine crops that have been transplanted or sown this past week. Those little guys are used to warm temps and several nights of low 40's could be pushing it for some plantings, especially any newly emerged seedlings of tender crops. I know it is 85 and everyone is irrigating. Get the row covers out. - EB

ASPARAGUS

Be on the look out for asparagus beetles. Adults should be moving in from weedy field edges looking to feed on fronds as well as laying eggs on spears. Most insecticides are not useful at this stage because the pre-harvest interval is too long. Cleaning up the field after the season is over by plowing under asparagus fern debris, keeping down overwintering weeds along the field edge, and avoid volunteer asparagus from establishing outside of the bed area can help reduce the populations. - RH

BEETS

Planting and growing conditions have been quite variable for this crop again this year. There are good stands in some fields and in other fields beets are struggling because of dry soils. Beet seed germination can be delayed or uneven because of dry conditions, but they will usually emerge once moisture is adequate. In conventionally grown beets, a pre-emergence herbicide application of Dual Magnum in combination with Nortron does a good job of preventing weeds if there is moisture to activate the herbicides. Beets should be scouted for weed escapes soon after emergence and for the next several weeks. Choose post-emergence herbicides based on the weed species present. It is common to tank mix herbicides for beets. Review the February 3, 2020 issue of VegEdge for an article "Grow Beets, Not Weeds!" The Ro-Neet label was updated for NY on 4/23/2021, which is probably why this product did not make it into the 2021 Cornell Guidelines. An updated chart of the relative effectiveness of herbicides labeled in beets on various weed species is available on our website or in print by request. - JK

CARROTS

The weather has been rough on young carrots. Some plantings had snow on them before emergence and others emerged, but young seedlings sat in the heat and sun last week. Growth overall has been slow. Two important things to do this week are to check stands for loss because of heat and wind, wirestem disease, or herbicide injury. Rain showers predicted this week will cause weeds to grow quickly. Pigweed, lambsquarters, and other annual weeds can soon outgrow carrots. It is a delicate balance between killing weeds and not injuring carrot seedlings. Linuron (Lorox) can be applied at 0.25 lb/acre to carrots having at least 1 fully developed true leaf and 0.5 lb/acre to carrots having 3 or more leaves. Multiple applications are needed. The activity of Lorox on both carrots and weeds increases if applied after 3 days of cloudy weather. If spraying is done under these conditions, rates should be reduced. Do not apply when the temperature is greater than 85F. Caparol can be used up to the 6-leaf stage of carrots (2 pts/acre with 2 applications possible). Adjuvants that should be used with postemergence applications of Caparol include non-ionic surfactants (0.5% NIS) or crop oil concentrate (1.0% COC). Metribuzin can be applied after carrots have formed 5 to 6 true leaves, but before weeds are 1 inch in height or diameter. A second application can be applied after 3 weeks. Make sure to read all product labels before use because this is only a brief overview. - JK

COLE CROPS

Flea beetles are heavy in many locations. But seeing smaller growers rely on row cover for exclusion. This seems to be doing a fairly good job. - RH

Asian greens like bok choi, tatsoi, and chinese cabbage will often draw earlier and heavier flea beetle pressure than other brassicas planted in close proximity. Use this to your advantage to make your scouting more efficient and likely to get an early idea of pressure.

Cabbage maggot is in an active phase for the first of the 3 or 4 generations we get in a NY field season. Typically damage is less once we hit the peak of summer so the first and second generations are the main concern. Expect the first generation of adults to start when the weedy Yellow Rocket starts to bloom and the second generation when day lilies begin flowering. This is the final field season that chlorpyrifos can be used, and only until July. It would be wise to start testing out new management strategies in sections of your fields. Coragen is labeled for suppression. Diazinon is a labelled organophosphate option that has a relatively high environmental impact compared to many other insecticides. Row cover works well on small-

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er areas. All fields will be less attractive if they don't have freshly decaying organic matter – give that cover crop or weedy field a few weeks between plowing and planting.

White cabbage butterflies are the **adults of imported cabbage worms**. They've been out flying and while their numbers are relatively low, I am seeing egg laying and expect early caterpillar damage. The yellow, bullet shaped eggs stand on end and are laid singly or in loose clusters of 2-3 on the undersides of leaves. It is useful to get a sense of the potential pressure now so you know whether you'll have to schedule in an application when they hatch. The threshold for seedlings is 20% of plants with worms (eggs for now), for transplants through cupping the threshold increases to 30% of plants infested.

It is possible that heading brassicas planted quite early might have gotten enough heat in early April and enough cold a few weeks later to push them into a reproductive stage prematurely. Cauliflower seems to be more prone to this than broccoli – may be worth spot checking your fields for cupping if you had plants out in those wild temperature extremes. - EB

CUCUMBERS

Early plantings are looking good. The benefit of the warm weather is that transplants have not had to sit in trays and get leggy. What I've seen have been nice, stout, good colored, low stress transplants that are getting their feet under them quickly and not tipping over or suffering from scalded stems. On the pest front, cucumber beetles are starting to emerge, so keep an eye out for them on your little transplants or new seedings.

For those of you with high tunnel cucumbers that are starting to produce, now's the time to go through and scout for thrips, aphids, and spider mites. Odds of having thrips and aphids is high if you had ornamentals in the house earlier (or still). Tap flowers onto a piece of paper to look for the fast moving, skinny line shaped, orange-yellow to bronzy colored thrips. Aphids are the most obvious pest on the leaf underside, you'll also find thrips feeding and maybe some two spotted spidermites getting started after all this heat. Hand lenses are useful for spotting thrips and two spotted spidermites, especially if you're new at scouting for these pests. - EB

GARLIC

Be on the look out for allium leaf miner. This pest has been confirmed as far west as Tompkins County in 2019 and is expected to have continued spreading and establishing itself in areas further west. Check out the picture to identify the tell-tale markings on leaves that resemble 1/8th inch white dots in a row. When the maggots hatch out, they burrow through the leaf tissue while they feed. Feeding damage looks like yellowish to tan trails under the leaf surface. If symptoms like these are seen, please contact the Cornell Vegetable Program team.

Oviposition and feeding scars by allium leaf miner. *Photo from Penn State Extension*

Another issue for garlic is lack of water. Some areas have been fairly dry. Garlic plants have short root systems and can struggle if the soil has dried down. Irrigation may needed to keep plants in good shape for strong growth. If you notice normal dark green leaves looking a little grayish, get some irrigation to those plants. Several smaller applications of moisture during the week allows for more seepage around the root zone rather than dumping on huge gallonage and most of the water running off. Having higher organic matter in the soil also helps with good water retention. - RH

LETTUCE AND GREENS

Plantings are looking good to date. Watch for weeds to take off once they get some rain or irrigation, temperatures have certainly been favorable and the pre-emergent herbicides applied to early plantings is likely wearing off by now. - EB

ONIONS

It's been a hot and breezy past couple of weeks. Onions have been growing very nicely, but could use some rain! (but not too much!) Earliest direct seeded onions are at 2.5 leaf stage with many fields in 1-2 leaf stage. Earliest transplants are in the 6-leaf stage, which is the maximum crop stage for application of post-emergent herbicide Chateau. 5-leaf is the maximum crop stage for post-emergent applications of Buctril 2EC (a.i. bromoxynil, tradenames Broclean, Brox, etc). With the heat has come weed escapes, which are also growing rapidly. 2-3 leaf stage is first safe stage to apply high rates of post-emergent herbicides including Goal 2XL 4 fl oz and Buctril 2EC 8 fl oz +/- Goal 2XL 4 fl oz, the latter combination which should control most broadleaf weed escapes up to 2-3" in size (depending on species and conditions) (Fig. 1). Until 2-3 leaf stage, lower rates of Goal 2XL 0.25-0.75 fl oz, Goaltender 1-2 fl oz and Chateau

Figure 1. No ragweed allowed! Transplanted onions in 3-4 leaf stage got Buctril 2EC 8 fl oz + Goal 2XL 4 fl oz which killed or severely injured all of the ragweed in cotyledon to 1.5 inch. *Photo by C. Hoepting, CVP*

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1-2 oz can be used to "hold back" weed escapes ideally keeping them less than 2" until higher rates can be used at 2-3 leaf stage (Fig. 2). See article on page x for research highlights investigating effect of spray volume, pressure and droplet size on crop tolerance and weed control of post-emergent herbicides. When the onions are tough from days of sunshine and wind and can tolerate higher herbicide rates, the weeds are also tougher and need higher herbicide rates to be effective. In the 2020 study under such similar conditions, no matter the combination of spray volume, pressure and nozzle type, none of the high rates of herbicides resulted in more than 10% onion injury. Higher spray volume was most important for crop safety for Buctril, and coarse droplet size from air induction nozzles resulted in the poorest weed control. - CH

Figure 2. The onion weed race is on and the onions are winning! This plot got Goal 2XL 0.25 fl oz with barley-kill herbicides when onions were just past flag (1st true leaf same size or taller than flag) and then Goaltender 2 fl oz at 1-leaf. Mixed broadleaves including many smartweed/ Lady's thumb are dead or severely injured while the onions look good. *Photo by C. Hoepting, CVP*

PEAS

Planting of processing peas is finishing up this week. The earliest peas are flowering. Hopefully, they will get a shot of rain this week. Rain will bring on a flush of weeds, so make sure to scout and apply post-emergence herbicides when the weeds are small. See the article "Processing Green Peas: Post-Emergence Weed Control with Herbicides" on page 7. - JK

SNAP BEANS

An eagle-eye grower pointed out that S-metolachlor was missing from the 2021 Cornell Vegetable Guidelines Bean chapter. This was an accidental omission. The Dual II Magnum label has not changed since 2014, however, the Dual Magnum label was updated 5/19/2021. What's the difference? Dual II Magnum has a safener added. Planting of processing snap beans started near the usual target date of May 15th this year. - JK

SWEET CORN

The pheromone trap network for worm pests is getting set up. Most sites should be putting out their traps this week or next.

From the NY Sweet Corn Trap Network Report, 5/25/21:

Only three sites reported this week (Lyndonville, Ransomville and Hurley). One European corn borer (ECB)-E and one ECB-Z was caught at the Hurley site as well as two hybrid ECB. Two corn earworm (CEW) were caught at the Lyndonville site. No other moths were caught. First spring ECB moths begin to fly when accumulated degree days reach 374. Only a few of the sites have reached this and they are all located in eastern NY.

Dr. Kelly Hamby, Associate Professor/Extension Specialist with the Department of Entomology at University of Maryland, is leading a team of researchers who have developed a survey to prioritize research and extension efforts for improving corn earworm management in sweet corn throughout the Northeast. We appreciate your participation in this survey and will use results to develop a grant proposal to try to get federal funding to address these needs. Please take a few minutes to fill out the survey.

Open ground plantings that I've seen are emerging to about 6" in size. Plastic has been cut off the earliest plantings and those fields are about 12-14" high and have weed escapes. While there are a ton of herbicide options for sweet corn relative to other vegetables, remember that even the best herbicide won't get the job done on big weeds. A big weed is 3-4 inches and asking an herbicide to take out a 6" weed can be expecting a lot. Cultivation to reset the field to a clean stage followed by an application POST-emergent to the crop of a material that has some PRE-emergent activity. Said another way, that's a POST timing of an herbicide that kills weeds as they germinate. If your weeds in sweet corn are small, a POST timing of a POST-emergent activity herbicide (kills established weeds) can get the job done nicely. - EB

TOMATO, PEPPERS & EGGPLANTS

Transplants are going into the field are typically at a healthy stage, haven't sat in the flats too long. Plants that have been struggling with root rot in the greenhouse or fungus gnats are doing well getting their feet set under them in the field thanks to the warm and generally dry conditions that promote good root development and are unfavorable to those problematic organisms. Adequate water has been important in getting transplants through these hot windy days. Remember to inspect your tomato and pepper flats for signs of bacterial speck and spot before transplanting! If you have a history of speck and spot, recheck your fields 2-3 weeks after transplanting since stress can cause symptoms to manifest. And one more time for those in the back – REUSED STAKES REINFECT FIELDS! - EB

Growing Degree Days (GDDs)

Julie Kikkert, CCE Cornell Vegetable Program

Accumulated Growing Degree Days (AGDD)
Base 50°F: April 1 - May 24, 2021

Location**	2021	2020	2019
Albion	263	127	153
Arkport	233	118	168
Bergen	246	135	168
Brocton	289	168	191
Buffalo*	294	166	152
Burt	189	99	120
Ceres	227	125	219
Elba	236	130	147
Fairville	240	137	157
Farmington	263	148	159
Fulton*	233	157	161
Geneva	272	149	178
Hammondsport	254	147	178
Hanover	264	162	189
Lodi	259	165	189
Niagara Falls*	246	134	125
Penn Yan*	293	152	201
Rochester*	262	144	204
Sodus	276	132	156
South Bristol	272	148	177
Varick	301	172	208
Versailles	257	161	201
Williamson	209	124	133

* Airport stations
** For other locations: http:newa.cornell.edu

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VEGEdge
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VegEdge is the highly regarded newsletter produced by the Cornell Vegetable Program. It provides readers with information on upcoming meetings, pesticide updates, pest management strategies, cultural practices, marketing ideas and research results from Cornell University and Cornell Cooperative Extension. VegEdge is produced every few weeks, with frequency increasing leading up to and during the growing season.

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