RUTGERS
New Jersey Agricultural Experiment Station

E265

2022 COMMERCIAL BLUEBERRY PEST CONTROL RECOMMENDATIONS FOR NEW JERSEY

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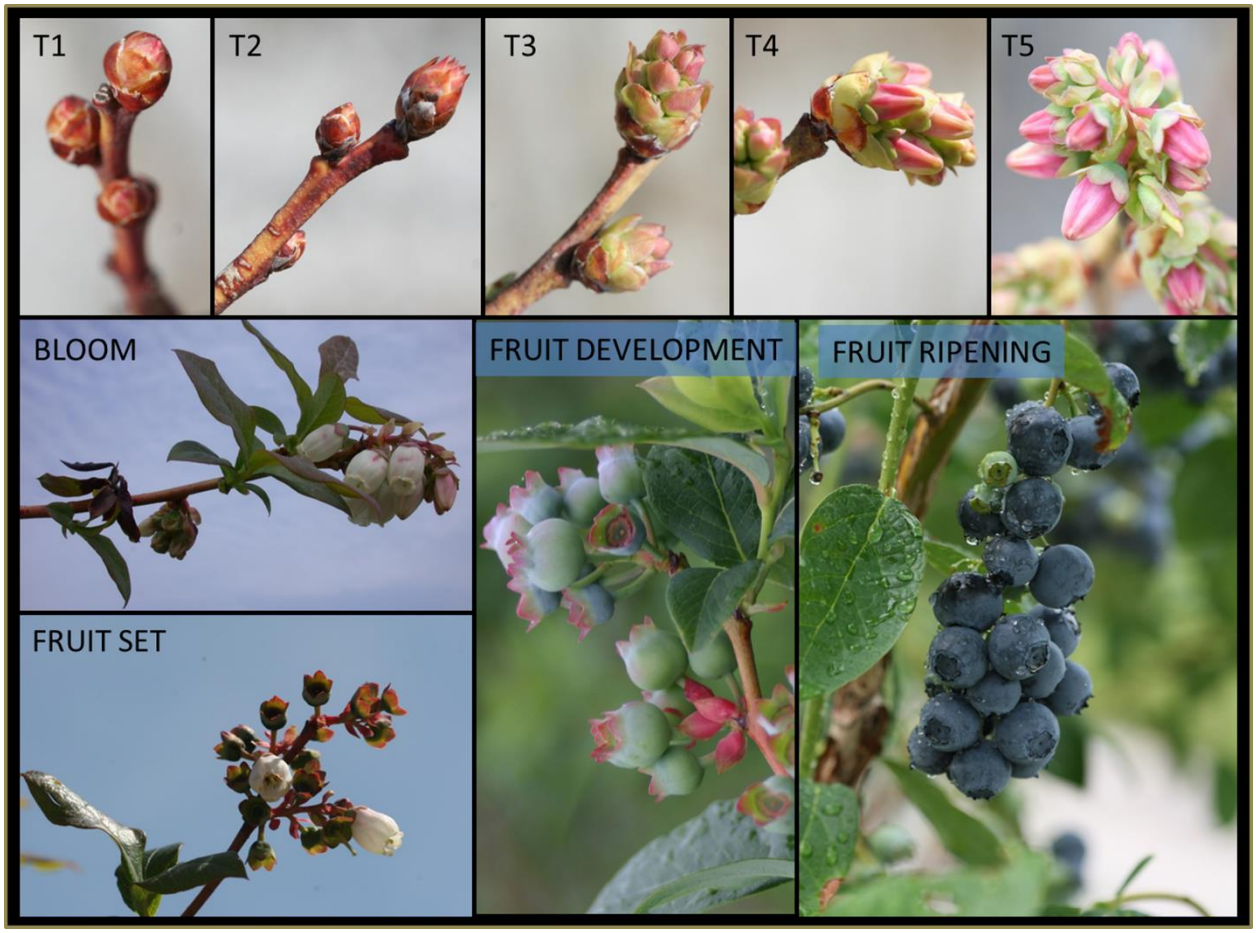
Welcome to the revised 2022 blueberry spray guide. Please be aware that the recommendations made in this guide are aimed at New Jersey crop production situations and do not always apply to other growing locations. Specifically, registrations and rates may differ. Always refer to the label to identify the legal rates, methods of application, site and target organisms. All spray formulations are presented in amount of formulated product per acre. Apply sprays so that good foliage coverage is achieved without excessive runoff. It is also critical to be confident of your sprayer calibration. Insufficient material delivered to the plant surface results in poor efficacy whereas excess material can lead to phytotoxicity and illegal residues on the harvested fruit. Not all pesticide treatments recommended here are necessary to manage insect and disease problems in every field. Always use local scouting information on insects and diseases in arriving at insecticide and fungicide spray decisions. **Always read and follow the label instructions when using pesticides**. A new section entitled Pollinator Safety in Blueberries was included this year.

A **Degree Day Calculator** (https://benedick.sebs.rutgers.edu/BlueberryWeather/) was introduced in 2010 for use in blueberry cultivation and now contains information on chilling hour accumulation. This website can be accessed by anyone with a computer and internet connection. It provides estimates on the timing of three growth stages (bud break, beginning of bloom and first pick of Duke) from three locations (Chatsworth, Hammonton and Piney Hollow). In addition, the website provides output from a model predicting the onset of flower thrips and can be used to determine the necessity of in-bloom thrips treatment.



Pesticide mixing and evaluation for compatibility.

A convenient and economical method for controlling several pest problems at once is through the use of pesticide mixtures. Fungicides and insecticides are commonly used in combination for disease and insect control. Many problems can arise from inappropriate use of mixtures. Chemicals that are physically incompatible form an insoluble precipitate that clogs nozzles and sprayer lines. Other mixtures may be phytotoxic and result in a crop loss. Mixing formulations of diazinon with captan has caused crop injury. Therefore, diazinon and captan formulations should **not** be tank-mixed. This type of phytotoxicity results from either a direct interaction of the active ingredients or an interaction of the inert ingredients in one formulation that enhances the toxicity of the other one. A third type of incompatibility arises when one component of the mixture reduces efficacy of the other component. When using mixtures there are several guidelines to follow:

1. Read the label and follow the manufacturer directions. A section specifically addressing compatibility is usually included on the label. If you are in doubt contact the manufacturer, or a technical representative.

2. Obtain a compatibility chart and use it as a guideline only. Compatibility charts are frequently out of date because new pesticide formulations can alter compatibility. However, they provide useful baseline information.

3. Use a jar test to determine physical compatibility. Jar tests are conducted by mixing chemicals at approximately the same rate as specified on the labels. The volumes are scaled down to fit in a small (1 pint or 1 quart) container. Results are evaluated by observing the mixture for reactions such as formation of larger particles, the formation of layers or other changes that result in the formation of a precipitate (i.e., sludge at the bottom of the container).

4. Chemicals that are physically compatible may be phytotoxic. Therefore, mixtures of new chemicals should always be tested on a small number of plants before being sprayed on a larger area. Phytotoxicity may appear as wilting, spotting, dieback or other abnormalities in plant growth. The appearance of phytotoxicity may be environmentally controlled. For example, high temperatures may cause more severe expression of phytotoxicity. Environmental variables can play a big role in causing mixtures as well as single component sprays to perform not as predicted.

5. Use of spray additives, such as spreaders, stickers, or activators can greatly complicate chemical compatibility in mixtures. Unless recommended by the manufacturer these additives should be avoided.

6. Use of Aircraft - For aircraft sprays, apply at least 5 gal/A of spray mix. Use a jar test to check for compatibility of pesticides.

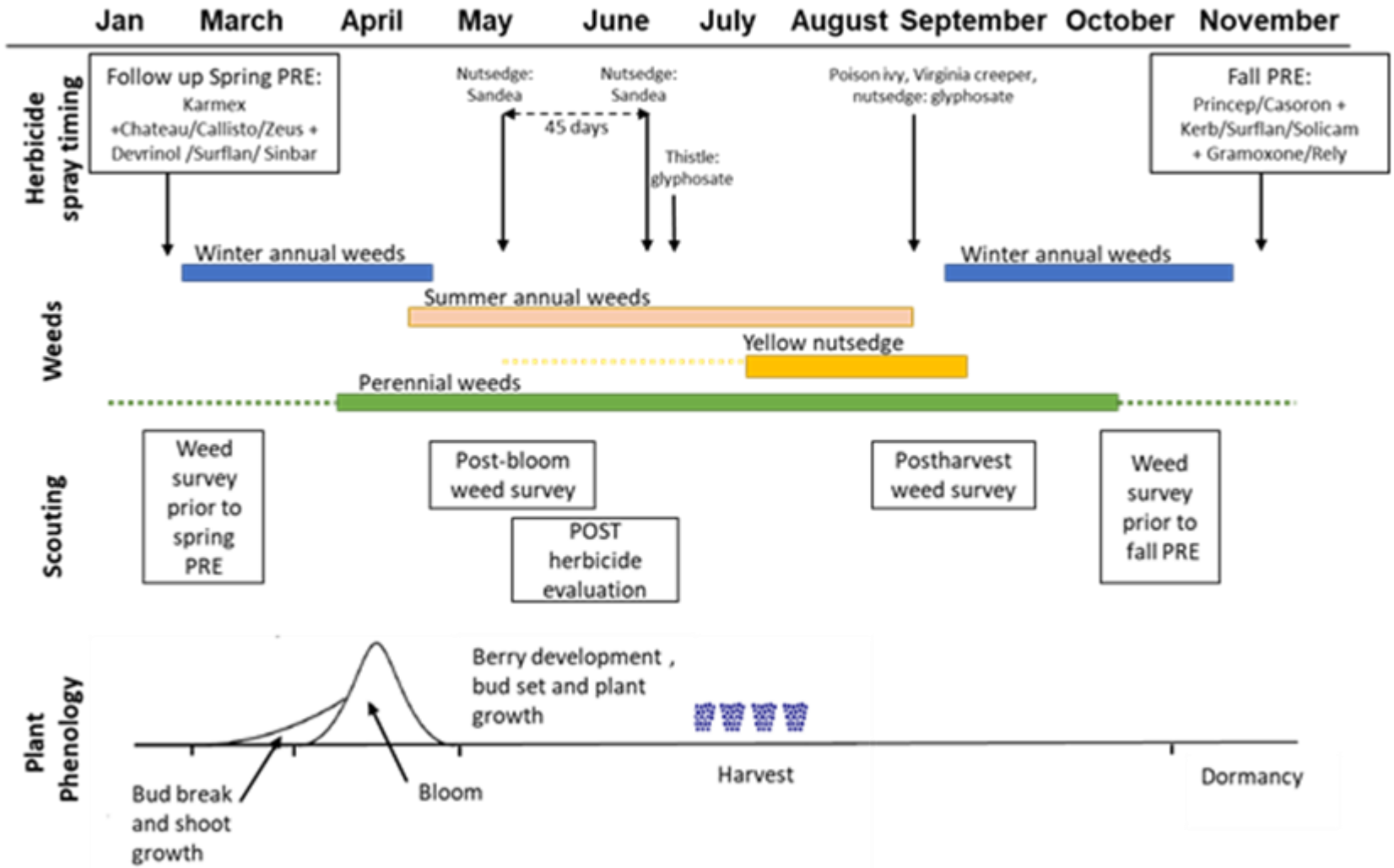
A final note. Mixtures provide an economical and efficient method for applying different classes of pesticides. Mixtures can provide enhanced activity through synergism and in some cases reduce the chance of resistance developing in the target population. Some chemical companies market pesticides pre-mixed. Thus, appropriate use of mixtures **requires** preliminary research to determine the compatibility.

Labels can be found on the CDMS or AGRIAN websites

http://www.cdms.net/LabelsMsds/LMDefault.aspx

https://www.agrian.com/labelcenter/results.cfm

Blueberry Weed Management Northeastern USA



Note: these are suggestions only. Postemergence herbicides should be used only when weeds are present and properly identified. Always follow the label and local recommendations regarding rate, weed size and application timing

Effectiveness of herbicides on major Summer Annual Weeds.

Herbicide performance is affected by weather, soil type, herbicide rate, weed pressure, weed growth and other factors. These ratings indicate ONLY relative effectiveness in tests conducted on coarse to medium-textured soils and with herbicides applied at the proper weed stage. Actual performance may be better or worse than indicated in this chart.

G = good control; F = moderate control; P = some control; N = little or no control: - = insufficient data

Trade Name	WSSA Site of Action	Monocots						Dicots										
		Barnyardgrass	Crabgrass	Fall panicum	Foxtail sp.	Goosegrass	Annual sedge	Carpetweed	Jimsonweed	Lambsquarters	Morningglory	E. B. nightshade	Shepherd's purse	Pigweed sp.	Common purslane	Common ragweed	Smartweed sp.	Velvetleaf
Soil-applied herbicides																		
Alion	**29**	**G**	**G**	**G**	**G**	**G**	N	**G**	F	**G**	F	**G**	**G**	**G**	**G**	**G**	**G**	**G**
Callisto / Motif	**27**	N	F	N	P	N	F	**G**	F	**G**	F	**G**	**G**	**G**	P	P	-	-
Casoron	**20**	F	F	F	F	F	**G**	-	-	**G**	-	-	**G**	**G**	-	**G**	-	-
Chateau	**14**	P	P	P	P	P	P	**G**	-	**G**	F	**G**	**G**	**G**	**G**	F	**G**	**G**
Devrinol	**15**	**G**	**G**	**G**	**G**	**G**	P	**G**	N	F	N	N	-	F	F	N	P	N
Dual Magnum	**15**	**G**	**G**	**G**	**G**	**G**	F	F	N	P	N	**G**	-	**G**	F	P	P	P
Karmex / Direx	**7**	**G**	F	**G**	**G**	F	F	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**
Kerb	**3**	**G**	**G**	**G**	**G**	**G**	N	**G**	N	**G**	-	-	-	**G**	**G**	P	-	P
Princep	**5**	F	F	P	F	F	F	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	F
Sandea	**2**	N	N	N	N	N	F	P	**G**	F	F	N	-	**G**	F	**G**	F	**G**
Sinbar	**5**	F	F	-	F	F	P	**G**	**G**	**G**	**G**	**G**	**G**	P	**G**	**G**	**G**	**G**
Solicam	**12**	**G**	**G**	**G**	**G**	**G**	F	P	F	F	P	-	-	F	**G**	**G**	-	F
Matrix SG / Solida	**2**	P/F	P/F	P/F	P/F	P	F	-	-	F	P	F	-	**G**	**G**	F	F	P
Surflan	**3**	**G**	**G**	**G**	**G**	**G**	N	F	N	F	N	N	N	F	F	N	P	P
Trellis	**21**	N	N	N	N	N	N	F	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**
Velpar	**5**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	-	**G**	**G**	**G**	**G**	**G**	**G**
Zeus XC / Shutdown	**14**	P	P	P	P	P	F	**G**	**G**	**G**	F	F	F	**G**	**G**	**G**	P	F
Postemergence herbicides																		
2,4-D	**4**	N	N	N	N	N	P	**G**	**G**	F	**G**	F	**G**	**G**	**G**	**G**	F	**G**
Aim	**14**	N	N	N	N	N	N	**G**	P	**G**	F	**G**	-	**G**	-	F	-	**G**
Callisto/Motif	**27**	N	F	P	P	P	F	F	**G**	**G**	F	**G**	F	**G**	P	P	-	**G**
Fusilade DX	**1**	**G**	F	**G**	**G**	**G**	N	N	N	N	N	N	N	N	N	N	N	N
glyphosate	**9**	**G**	**G**	**G**	**G**	**G**	F	**G**	**G**	**G**	F	**G**	**G**	**G**	**G**	F	**G**	**G**
Gramoxone	**22**	F	F	F	G	F	F	**G**	**G**	F	F	**G**	-	**G**	F	**G**	-	-
Matrix SG / Solida	**2**	**G**	F	F	**G**	P	F	-	F	F	F	P	**G**	**G**	F	P	P	F
Poast	**1**	**G**	**G**	**G**	**G**	**G**	N	N	N	N	N	N	N	N	N	N	N	N
Quinstar	**4**	**G**	**G**	-	F	N	N	-	-	F	**G**	-	-	P	-	P	N	P
Rely / Interline	**10**	F	**G**	**G**	**G**	P	F	**G**	**G**	**G**	F	F	**G**	**G**	**G**	**G**	**G**	**G**
Sandea	**2**	N	N	N	N	N	**G**	P	**G**	N	F	N	-	**G**	P	**G**	F	**G**
Select / Select Max	**1**	**G**	**G**	**G**	**G**	**G**	N	N	N	N	N	N	N	N	N	N	N	N
Stinger	**4**	N	N	N	N	N	N	-	F	P	-	F	-	**G**	N	**G**	**G**	P

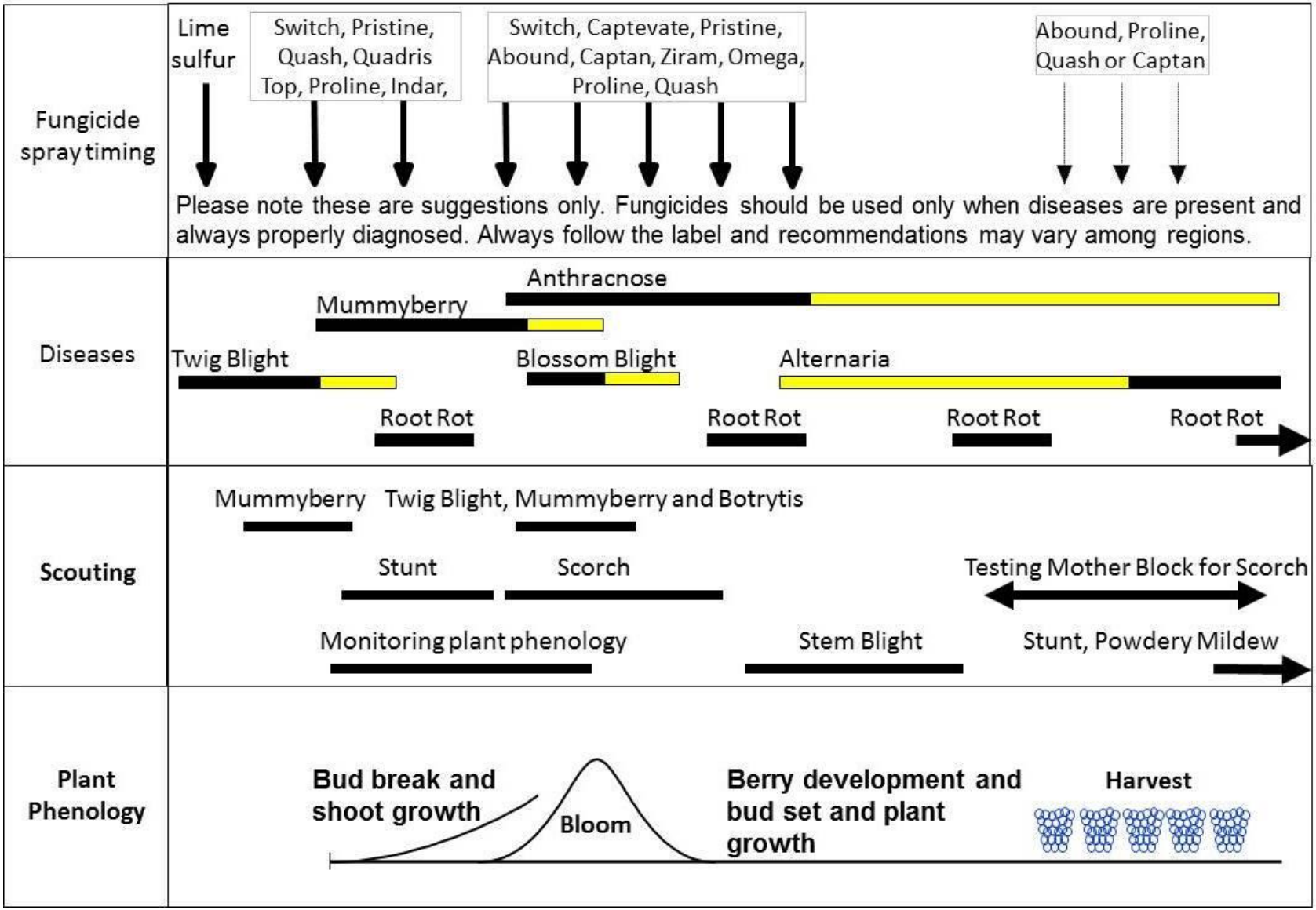
Effectiveness of herbicides on major Winter Annual and Perennial Weeds.

Herbicide performance is affected by weather, soil type, herbicide rate, weed pressure, weed growth and other factors. These ratings indicate ONLY relative effectiveness in tests conducted on coarse to medium-textured soils and with herbicides applied at the proper weed stage. Actual performance may be better or worse than indicated in this chart.

G = good control; F = moderate control; P = some control; N = little or no control: - = insufficient data

Trade Name	WSSA Site of Action	Winter Annuals						Perennials										
		Bluegrass	Chickweed	Groundsel	Henbit	Horseweed	Mustard sp.	Bermudagrass	Quackgrass	Yellow nutsedge	Aster sp.	Bindweed sp.	Canada thistle	Goldenrod sp.	Hemp dogbane	Red sorrel	Horsenettle	Virginia creeper
Soil-applied herbicides																		
Alion	**29**	**G**	**G**	**G**	**G**	**G**	**G**	N	N	N	N	N	N	N	N	N	N	N
Callisto / Motif	**27**	N	**G**	-	-	**G**	**G**	N	N	F	F	P	P	P	P	N	-	-
Casoron	**20**	F	**G**	**G**	**G**	**G**	**G**	F	F	F	F	F	F	F	F	F	F	P
Chateau	**14**	P	**G**	**G**	**G**	**G**	**G**	N	N	N	F	P	P	P	P	P/F	P	N
Devrinol	**15**	F	F	N	P	P	-	N	N	N	N	N	N	N	N	N	N	N
Dual Magnum	**15**	F/**G**	-	-	-	-	-	N	N	N	N	N	N	N	N	N	N	N
Karmex / Direx	**7**	**G**	**G**	P	**G**	**G**	**G**	N	P	P	P	P	P	P	P	P	P	N
Kerb	**3**	**G**	**G**	-	F	-	F	P	**G**	N	N	N	N	N	N	P/F	N	N
Princep	**5**	F	**G**	-	**G**	**G**	**G**	N	P	P	P	P	P	P	P	P	P	N
Sandea	**2**	N	F	-	N	P/F	-	N	N	F	N	-	N	N	N	N	N	N
Sinbar	**5**	F	**G**	**G**	**G**	**G**	**G**	N	P	P	P	P	P	P	P	P	P	N
Solicam	**12**	**G**	F	P	F	F	F	P	F	P/F	P	P	P	P	P	P	P	N
Matrix SG / Solida	**2**	N	F	F	F	F/**G**	P	N	-	P	N	N	N	N	N	N	N	N
Surflan	**3**	F	**G**	P	P	P	P	N	P	N	N	N	N	N	N	N	N	N
Trellis	**21**	-	-	-	-	-	-	N	N	N	-	-	-	-	-	-	-	-
Velpar	**5**	**G**	**G**	-	**G**	**G**	**G**	P	F	F	**G**	F	F	F	F	F	-	P
Zeus XC / Shutdown	**14**	N	**G**	-	-	**G**	-	N	N	P	N	N	N	N	N	N	N	N
Postemergence herbicides																		
2,4-D	**4**	N	P/F	P/F	P	**G**	**G**	N	N	N	**G**	F/G	F/**G**	F	P	P	P/F	F
Aim	**14**	N	N	F	-	P	P	N	N	N	N	N	N	N	N	N	N	N
Callisto/Motif	**27**	N	F	F	F	F/**G**	-	N	N	F	F	-	G	F	F	-	F	-
Fusilade DX	**1**	P	**G**	N	N	N	N	F/**G**	**G**	N	N	N	N	N	N	N	N	N
glyphosate	**9**	**G**	**G**	**G**	**G**	N	**G**	F	**G**	P/F	**G**	F	F	**G**	F	**G**	F	F
Gramoxone	**22**	F	**G**	**G**	**G**	F/**G**	**G**	P	P/F	N	P/F	P	P	P	P	P	P	P
Matrix SG / Solida	**2**	F	F	F	F	P	F	P	P/F	F	N	N	N	P/F	P/F	N	N	N
Poast	**1**	P	N	N	N	N	N	F	F/**G**	N	N	N	N	N	N	N	N	N
Quinstar	**4**	N	N	N	N	N	N	N	N	N	G	-	-	-	N	N	N	N
Rely / Interline	**10**	P	**G**	**G**	**G**	**G**	**G**	N	P	N	P	P	P	P	P	P	P	P
Sandea	**2**	N	F	N	-	N	-	N	N	F/**G**	N	-	N	N	N	N	N	N
Select / Select Max	**1**	F	N	N	N	N	N	F	**G**	N	N	N	N	N	N	N	N	N
Stinger	**4**	N	P	**G**	N	G	N	N	N	N	**G**	N	F	F	P	F	N	N

In Season Blueberry Disease Management Northeastern USA



Fungicides labeled for Blueberry Production in the USA. Local restrictions may apply, always consult the label!

This table is intended to provide information on effectiveness for diseases that appear on the label plus additional diseases that may be controlled from application. — indicates insufficient data; +++ = good control; ++ = moderate control; + = some control; 0 = not recommended for use

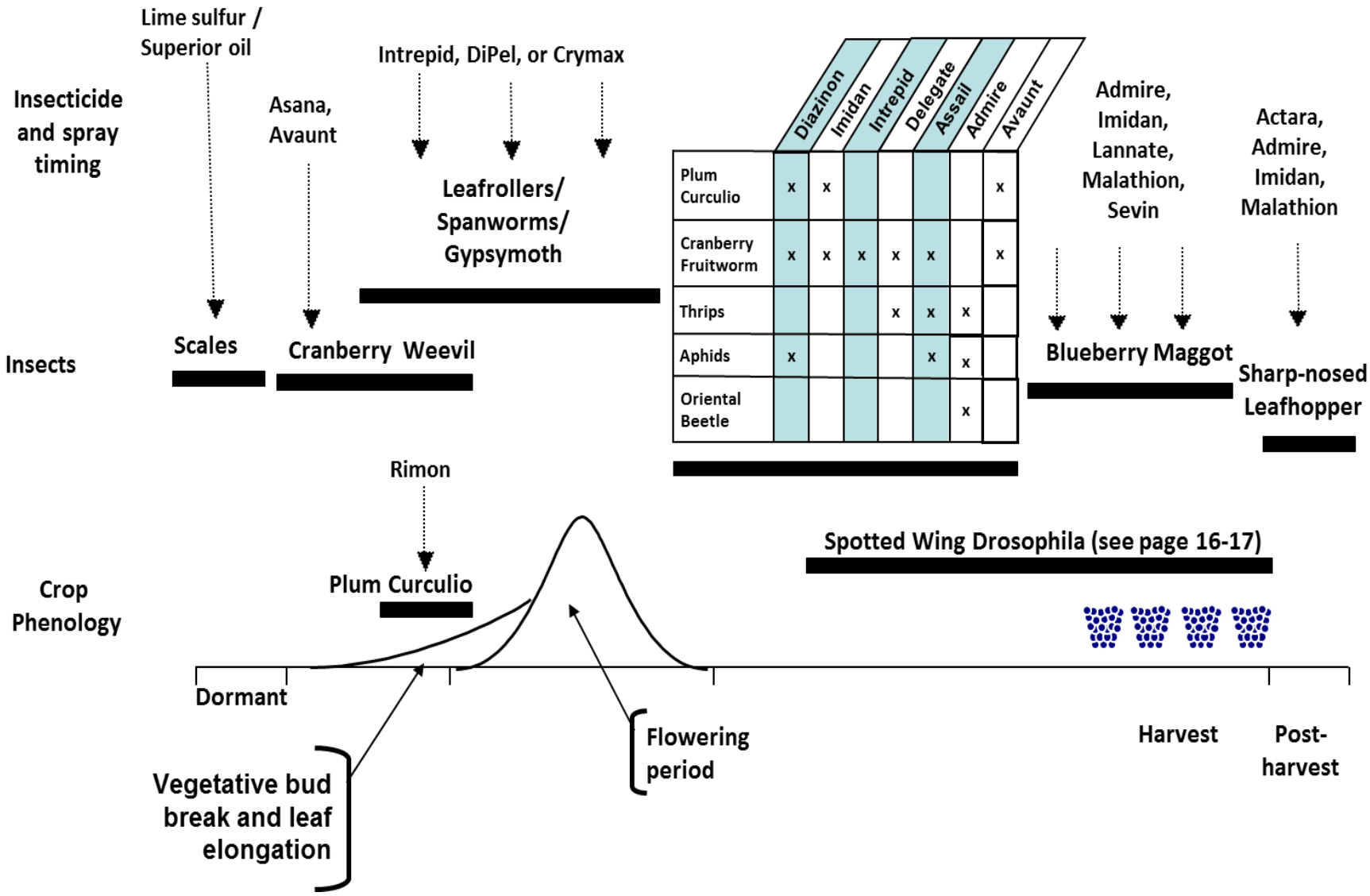
PESTICIDE	FRAC	REI (HR)	PHI (DAY)	AERIAL	IMPORTANT NOTES	Anthrac-nose	Botrytis	Mummy Berry	Root Rot	Alter-naria	Twig Blight
Azoxystrobin*	11	4	0	Yes	3 applications maximum; utilize resistance management strategies for Group 11 (Page 21)	+++	++	+++	0	++	0
Abound, Aframe, Satori etc. There are over 30 products that contain azoxystrobin. Always read the label and be sure the formulation contains the expected concentration of active ingredient.											
Fluoxastrobin* (Aftershock, Evito)	11	12	1	Yes	4 applications maximum; utilize resistance management strategies for Group 11 (Page 21) Use as a soil treatment for rhizoctonia in cutting beds	+	+	+	0	0	0
Pristine	11 & 7	24	0	Yes	DO NOT mix this fungicide. 4 applications maximum. Effective against powdery mildew	+++	+++	+++	0	++	0
Miravis Prime	7 & 12	12	0	Yes	Two applications maximum per season. Use patterns are still being established for this fungicide	++	++	+++	0	++	++
Propulse	3 & 7	12	7	No	Contains same ai as Proline and Luna; 2 applications per season. A use pattern is not established for this product	+++	++	+++	0	++	+++
Elevate	17	12	0	No	Same active ingredient found in Captevate	0	+++	0	0	0	0
Captevate	17 & M4	72	0	No	Contains both Captan and Elevate therefore an application of this material counts as both Captan and Elevate. This fungicide is no longer being manufactured and is no longer available. The label is still good until existing supplies are used up.	+++	+++	+	0	+	0
Omega, Orbus, Lektivar	29	12	30	No	Use up to 6 applications per season. Allergic reactions may occur…see label	+++	+++	0	0	+++	++
Indar	3	12	30	Yes	Four applications maximum per season	0	++	+++	0	++	+++
Proline	3	12	7	No	Two applications maximum per season	+++	++	++++	0	+	+++
propiconazole*	3	12	30	Yes	Use up to 5 applications or 30 fl oz per season.	0	0	+++	0	0	+++
Quash	3	12	7	Yes	Do not exceed 3 applications per season	+++	+	+++	0	++	+++
Quadris Top	3 & 11	12	7	Yes	Do not exceed 4 applications (see Page 21)	+++	+	+++	0	++	+++
Aliette	33	12	0	Yes	4 applications maximum; DO NOT mix with copper compounds	++	0	0	+++	0	0
Phosphite Fungicides	33	4	0	Yes	Use in a minimum of 50 gallons/acre and spray water pH above 5.0	++	0	0	+++	0	0
Orondis	4	0	0	No	Two applications maximum per season	0	0	0	+++	0	0

Fungicides labeled for Blueberry Production in the USA. Local restrictions may apply, always consult the label!

This table is intended to provide information on effectiveness for diseases that appear on the label plus additional diseases that may be controlled from application. — indicates insufficient data; +++ = good control; ++ = moderate control; + = some control; 0 = not recommended for use

PESTICIDE	FRAC	REI (HR)	PHI (DAY)	AERIAL	IMPORTANT NOTES	Anthrac-nose	Botrytis	Mummy Berry	Root Rot	Alter-naria	Twig Blight
Ridomil	4	48	45 days	No	Use up to 2 applications per season. The granular formulation is NOT labeled on blueberry	0	0	0	+++	0	0
Cannonball	12	12	0	No	Use as a soil treatment for rhizoctonia in cutting beds						
Switch/Alterity	9 & 12	12	0	Yes	Do not use more than 56 oz/acre per season	+++	+++	++	0	0	0
Lime Sulfur	M2	48	label	No	Dormant applications only	+	+	+	0	0	++
Sulforix	M2	48	label	No	May cause phytoxicity – Read the Label	+	0	+	0	0	++
Ziram (EPA SLN NJ-20001)	M3	48	14	No	2 applications maximum. Use a PHI of 20-30 days to avoid visible residues on fruit. The Ziram SLN is only valid in NJ.	+++	++	0	0	+	0
Captan (many formulations)	M4	72	0	Yes	No more than 70 lb of the 50WP or 43.75 lb of the 80WP can be applied during 1 crop cycle. Do not mix with oil or solvent based pesticides.	+++	++	+	0	+	0
Cevya	3	12	0	Yes	Up to 3 applications permitted. This fungicide has not been tested in our production area and is labelled on mummy berry only	?	?	+++	0	?	?
Prolivo	U8	4	0	Yes	This fungicide is effective against powdery mildew and is not used in NJ	0	0	0	0	0	0
Luna Tranquility	7 & 9	12	0	Yes	This fungicide is also effective against powdery mildew and leaf drop	+	+++	?	0	?	+
Luna Flex	7 & 3	12	7	Yes	Useful for leaf drop						
Kenja	7	12	7	Yes	Do not use more than 3 (high rate) or 4 (low rate) times per season	0	+	?	0	?	?
Inspire Super Vango	3 & 9	12	7	Yes	Up to 4 (high rate) or 5 (low rate applications per year. Cross reference with Quadris Top and Switch to calculate number of applications	++	+++	+++	0	++	++
Chlorothalonil	M5	12	42	Yes	Up to 3 applications permitted. Observe the PHI generally not a good fit for blueberry disease management programs in NJ	+++	++	+	0	+	+

Blueberry Insect Management for New Jersey



Effectiveness of insecticides and miticides on blueberry pests.

Not all insecticides listed below are labeled for all the insects listed. This table is intended to provide information on effectiveness for insects that appear on the label plus additional insects that may be controlled from application. NR= Not recommended; +++ = good control; ++ = moderate control; + = some control; 0 = little or no control

Product	Aphid	BB Maggot	Bud Mite	CB Weevil	Fruit-worm	Japan Beetle	Leaf-hopper	Leaf-roller	Plum Curc	Scale	Thrips	White Grubs	SWD
Actara	+++	+	0	+++	0	++	+++	NR	+	NR	0	NR	NR
Altacor	0	0	0	0	+++	0	0	+++	0	0	0	0	NR
Apta	NR	NR	NR	NR	NR	NR	NR	NR	++	NR	NE	NR	NR
Asana	++	++	0	+++	++	++	++	+	++	NR	NR	NR	+++
Assail	+++	+++	NR	NR	++	++	+++	NR	NR	NR	++	NR	0
Avaunt	NR	NR	NR	+++	++	NR	NR	NR	+++	NR	NR	NR	NR
Aza-Direct	NR	+	NR	NR	NR	+	NR	NR	NR	NR	NR	NR	NR
Bifenture	++	++	NR	NR	++	NR	++	++	++	++	NR	NR	+++
Brigade	++	++	NR	NR	++	NR	++	++	++	++	NR	NR	+++
Bt Products	0	0	NR	0	NR	0	0	++	0	0	0	0	NR
Includes Crymax, Deliver, Dipel, Javelin													
Confirm	0	0	NR	0	++	0	0	+++	0	0	0	0	NR
Crymax	0	0	NR	0	NR	0	0	++	0	0	0	0	NR
Danitol	NR	NR	NR	NR	+++	+++	NR	+++	++	NR	NR	NR	+++
Delegate	NR	NR	NR	NR	+++	NR	0	+++	NR	NR	++	0	+++
Deliver	0	0	NR	0	+	0	0	++	0	0	0	0	NR
Diazinon	++	++	0	++	++	0	+++	++	+++	+++	+	NR	++
Dipel	0	0	NR	0	NR	0	0	++	0	0	0	0	NR
Entrust	0	0	0	0	+++	0	0	+++	0	0	0	0	+++
Esteem	0	0	0	0	++	0	0	NR	0	+++	0	0	NR
Exirel	++	++	NR	NR	+++	NR	NR	+++	++	NR	NR	NR	+++
Hero	++	NR	NR	NR	+++	+++	++	++	++	++	NR	NR	+++
Imidacloprid													
foliar	+++	+++	NR	NR	NR	+++	+++	NR	NR	NR	++	NR	0
soil	+++	+	0	NR	0	+	++	NR	NR	NR	0	+++	0
Imidan	NR	+++	NR	+++	+++	++	+++	+++	+++	++	0	NR	+++
Intrepid	0	0	0	0	+++	0	0	+++	0	0	0	0	NR
Javelin	0	0	NR	0	+	0	0	++	0	0	0	0	NR

Effectiveness of insecticides and miticides on blueberry pests.

Not all insecticides listed below are labeled for all the insects listed. This table is intended to provide information on effectiveness for insects that appear on the label plus additional insects that may be controlled from application. NR= Not recommended; +++ = good control; ++ = moderate control; + = some control; 0 = little or no control

Product	Aphid	BB Maggot	Bud Mite	CB Weevil	Fruit-worm	Japan Beetle	Leaf-hopper	Leaf-roller	Plum Curc	Scale	Thrips	White Grubs	SWD
Lannate	++	++	NR	++	+++	NR	++	++	+	NR	+	0	+++
Malathion	+	+++	NR	+	+	+	+	+	++	NR	++	0	++
M-Pede	++	NR	NR	NR	NR	NR	+	NR	NR	NR	NR	NR	NR
Movento	++	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mustang Max	NR	NR	NR	+++	NR	NR	NR	++	++	NR	NR	NR	+++
Platinum	+++	NR	0	NR	0	NR	++	NR	NR	NR	0	NR	NR
Portal	NR	NR	+++	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pyganic	+	+	NR	NR	NR	+	NR	NR	NR	NR	NR	NR	+
Pyrellin	NR	+	NR	+	+	++	NR	++	+	NR	NR	NR	NR
Rimon	NR	+++	NR	NR	++	NR	NR	++	NR	NR	NR	NR	NR
Sevin	NR	+	NR	+	+	+++	++	+	+	NR	NR	NR	+
Sivanto	+++	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Superior Oil	++	0	+	0	0	0	0	0	0	+++	0	0	NR
Surround	NR	+	NR	NR	NR	NR	NR	NR	++	NR	NR	NR	NR
Thionex	+	0	+++	NR	+	NR	0	NR	+	0	NR	NR	NR
Verdepryn	NR	++	NR	NR	+++	NR	NR	+++	++	NR	NR	NR	+++

Blueberry Nutrition and Fertilization:

Highbush blueberry nutritional requirements are very different from most agronomic crops. Aside from their low pH requirement, they lack root hairs which impedes nutrient uptake. It is essential to use the correct form of fertilizer when designing your nutrition program. For N, the ammonium form (urea or ammonium sulfate) is taken up by blueberry plants while nitrates can cause root damage. Note that long-term use of ammonium sulfate will lower soil pH. Soils that have a pH below 4.5 require a lime application. Table 1 shows the recommended rates. As a rule of thumb, nonbearing plants require a total of 20 pounds of nitrogen for the first two years after planting. In some cases, depending on soil type and growing conditions, this requirement may be as much as 30 pounds of nitrogen the second season. In addition, soil pH should fall in the range of 4.5 to 5.0. Sulfur is used to adjust the soil pH and Table 21 shows recommended rates. Fully mature, bearing plants may require 60 pounds or more of nitrogen per acre. The prior season's tissue analysis is the best method to fine-tune your blueberry fertility program. Table 32 shows recommended nitrogen application rates for a blueberry planting. Nitrogen should be applied annually using half the recommended amount during bloom and the other half approximately 6 weeks later. Dormant applications of fertilizer to blueberries are not efficient because the fertilizer is not taken up and the fertilizer leaches into the ground water. Usually nitrogen, phosphorus and potassium are applied at the same time, for example in a 10-10-10 formulation. A typical fertilizer application would be 600lbs. of 10-10-10 per acre applied in a split application, at bloom and 6 weeks later. This recommendation should be adjusted once a tissue analysis is conducted. Tissue analysis will also indicate possible deficiencies of other essential nutrients. Keeping magnesium, manganese, iron, copper, boron and zinc within the correct range levels will insure efficient uptake of fertilizer, maximize plant growth and ultimately result in optimum yields.

Table 1. Amount of lime (lb/A) required to increase the soil pH to 4.5 for blueberries.

present soil pH	SAND	LOAM	CLAY
3.0	1,300	1,500	1,700
3.5	800	1,000	1,200
4.0	400	500	600

Table 2. Amount of sulfur required to lower soil pH for blueberries.

present soil pH	DESIRED PH VALUE FOR BLUEBERRIES					
	4.5			*5.0*		
	SAND	LOAM	CLAY	SAND	LOAM	CLAY
	(lb/100 sq ft)[a]					
4.5	—	—	—	—	—	—
5.0	0.4	1.2	1.4	—	—	—
5.5	0.8	2.4	2.6	0.4	1.2	1.4
6.0	1.2	3.5	3.7	0.8	2.4	2.6
6.5	1.5	4.6	4.8	1.2	3.5	3.7
7.0	1.9	5.8	6.0	1.5	4.6	4.8
7.5	2.3	6.9	7.1	1.9	5.8	6.0

[a]To convert to lb/A, multiply by 435.

Table 3. Postplant nitrogen recommendations for blueberries.

Age of planting (Years)	Lb Actual n/a	Lb A.S./a*	Lb Urea/a	Grams A.S./plant**	Oz A.S./plant**
≤2	40	200	90	95	3.4
3	50	250	110	120	4.5
4	60	300	130	140	4.9
5	72	350	150	160	5.6
6+	82	400	170	180	6.4

*A.S. = ammonium sulfate. If pH is more than 4.5, ammonium sulfate should be used. If pH is less than 4.5, urea can be used.

**Assumes a 5-by-9-ft spacing.

2022 BLUEBERRY PEST CONTROL RECOMMENDATIONS FOR NEW JERSEY

DORMANT (November – January)

PESTS / WEEDS	REMARKS	MATERIALS	RATE/A
Putnam scale, mite, phomopsis, and botrytis	Heavy Putnam scale infestations requiring oil sprays are now appearing in some blocks. Pruning out older canes will make conditions less favorable for Putnam scale and blueberry bud mite. The retention of old canes can also increase Twig Blight, and Botrytis.		
Annual and perennial broadleaves / grasses (residual)	Apply in late winter/early spring, before weed growth begins. Casoron is volatile in temperature ≥ 55°F and must be irrigated or mechanically incorporated after application.	Casoron 4G Velpar DF CU Velpar L CU	100 to 150 lb 1.3 lb 4 pt
	WARNING: The effect of Velpar on blueberries varies with soils, plant vigor, uniformity of application, and rainfall. Some varieties are susceptible to injury and productivity may be affected even when phytotoxicity is not apparent.		
Annual and perennial grasses, red sorrel from seeds (residual)	Apply in late fall when soil temperature is between 35 and 55°F. Use the high rate for controlling perennial grasses (quackgrass, bluegrass, bermudagrass).	Kerb 50WP Kerb	2 to 4 lb 2.5 to 5 pt

DORMANT (Leaf fall to bud swell)

PESTS	REMARKS	MATERIALS	RATE/A
Scale insects	Dormant to 0.25-inch leaf opening For effective scale control, use 75 to 100 gal/A and ensure thorough coverage. (See note below for minimum specifications for oil.) Do not spray oil on very cold days when spray will freeze before drying.	Lime sulfur Superior oil Knack AND Superior Oil Esteem 35WP AND Superior Oil	5 gal 3 gal 16 oz 3 gal 5 oz 3 gal
Phomopsis twig blight	**CAUTION** Use lime sulfur or Sulforix only once in the spring. DO NOT use within 14 days of an oil spray or when temperature is above 75°F. DO NOT tank mix other insecticides or fungicides with lime sulfur.	Lime sulfur Sulforix	5 gal 1 gal
Mummy berry	Cultivation reduces survival of overwintering mummies when buried more than 1 inch. Prior to mummy cup formation disk between rows and rake, sweep, or hoe under plants. This practice also aids in control of blossom weevils, cranberry fruitworms, and plum curculio. Urea may be applied to kill open cups however this is a very inefficient method. In fields where this disease is usually severe, fungicide should be used following budbreak (see next section).		

Superior Oil Specifications – The minimum specifications of a 70-second and a 100-second spray oil include:

Specification	70 Second	100 Second
Viscosity	66 to 74 seconds	90 to 120 seconds
Gravity (A.P.I. degrees)	33 to 34	32 minimum
Unsulfonatable residue	92% or higher	92%

Late Fall Herbicide Applications

Fall applications should all include a residual broadleaf herbicide. Consider spot treating with a labeled glyphosate product if perennial weeds are present and treatment is recommended in the fall.

In recent years, Princep, Karmex and Direx have not performed as reliably as in previous years at some sites. Reasons may include weed species shifts to annual broadleaf weeds that are less susceptible to these herbicides such as groundsel, the development of triazine resistant biotypes, or the establishment of perennial broadleaf weeds. Apply Casoron in late fall to control these weeds. Use Casoron 4G at 100 to 150 pounds per acre to control early season annual grasses, but a residual annual grass herbicide should be applied in the spring for full season control.

The use of a grass herbicide in the fall depends on the product chosen. Kerb 50-W or Kerb SC are the only grass herbicide that must be applied in the fall. Choose Kerb to control cool season perennial grasses such as quackgrass. An additional residual annual grass herbicide is needed in the spring to provide full season summer annual grass control following a fall application of Kerb.

DORMANT (Leaf fall to bud swell) - continued			
PESTS / WEEDS	**REMARKS**	**MATERIALS**	**RATE/A**
Annual grass and broadleaf weeds (residual)	Apply **ONLY** as a dormant application. Add an appropriate postemergence herbicide to kill existing vegetation. See use restrictions on Page 36	Alion	3.5 to 5 fl oz
Annual grasses and small-seeded broadleaf weeds (residual)	Apply in spring before buds' break. At least ½-inch of rainfall or irrigation is necessary within 48 hours of application for activating the herbicide.	Devrinol DF-XT Devrinol 2-XT Surflan Dual Magnum Solicam DF	8 lb 8 qt 2 to 4 qt 0.67 to 1.3 pt 2.5 lb
	Tank-mix with Princep plus a POST herbicide in late fall or reduced rates of Princep, Karmex, or Sinbar in the spring, if planting has been established for at least one year, to control annual broadleaf weeds.		
Annual broadleaf weeds and some annual grasses (residual)	Apply half the maximum annual application in the spring before buds break and weeds emerge, and half in fall.	Karmex Direx Princep Caliber 90 Princep	2 to 2.5 lb 1.6 to 2 qt 1.1 to 4.4 lb 1 to 4 qt
	Tank-mixing at 1 lb a.i./A with Surflan, Solicam, Devrinol, or a reduced rate of Sinbar will improve crop safety and the range of weeds controlled.		
Annual broadleaf weeds, some annual grasses, and yellow nutsedge suppression (residual)	Apply in spring before buds break. At least ½-inch of rainfall or irrigation is necessary within 1 to 2 weeks of application for activation. Avoid direct or indirect spray contact to foliage and green bark.	Zeus XC Shutdown Zeus Prime XC Sinbar WDG	8 to 12 fl oz 8 to 11.8 fl oz 7.7 to 15.2 fl oz 1.25 to 3 lb
	Tank-mix with Surflan, Solicam, or Dual Magnum to improve residual control of grasses and with non-selective POST herbicide for control of emerged weeds.		
Annual broadleaf weeds (residual)	At least ½-inch of rainfall or irrigation is necessary within 1 to 2 weeks of application for activating the herbicide.	Trellis SC Trellis DF	1.9 pt 1.33 lb
	Tank-mix with Surflan, Solicam, or Dual Magnum to improve residual control of grasses and with non-selective POST herbicide for control of emerged weeds.		
Annual broadleaf weeds (residual + POST)	At least ½-inch of rainfall or irrigation is necessary within 1 to 2 weeks of application for activating the herbicide.	Solida / Matrix SG Callisto / Motif Chateau SW	4 oz 3 to 6 fl oz 6 to 12 oz
	Tank-mix with an appropriate residual grass herbicide (Dual Magnum, Devrinol, or Solicam) to improve annual grass control. Solida, Matrix SG: When applied as a banded treatment (50% treated band or less), rimsulfuron may be applied twice per year with a minimum of 30 days between applications.		

Residual (preemergence) Herbicides

- ⇨ *These herbicides are applied to a vegetation-free soil surface before weeds germinate.*
- ⇨ *Rainfall or overhead irrigation before weeds emerge is needed to move the herbicide into the soil.*

Residual soil-applied herbicides remain in the soil and kill weeds through their roots for up to several months. Use a preemergence herbicide in combination with a postemergence herbicide if weeds have emerged, unless the preemergence herbicide also controls weeds postemergence.

Residual herbicide rates must be matched with soil type and percentage of organic matter to obtain good weed control and crop safety (see the label). Adjust by changing tractor speed and maintaining pressure when spraying a field with soil that requires different herbicide rates. Determine type and percentage of organic matter for each soil on the farm with a separate soil test for each soil.

New Plantings

Weed control in a newly planted field should be planned to provide a maximum margin of crop safety. Tillage and/or herbicides prior to planting should control established biennial and perennial weeds. Apply a combination of herbicides to control annual grasses and broadleaf weeds. Surflan plus Trellis DF has been a safe and effective residual herbicide combination for newly planted blueberries. Apply in early spring after 1 to 2 inches of rainfall or irrigation has settled the soil around the roots of the new plants, but before weeds emerge or the blueberry bud's break. Waxed paper "milk" cartons are effective and recommended shields. The use of shields adds an additional margin of safety when installed prior to herbicide application. An alternative to shields is the use of granular formulations of Surflan and Trellis, often available as a "premixed" product for the ornamentals industry. Granular formulations fall through the blueberry canopy to the soil surface, provided applications are made when the foliage and shoots are dry. The use of nonselective postemergence herbicides such as a paraquat or glyphosate product should be avoided the year of planting unless shields are in place.

Established Fields

Apply herbicides to the blueberry row in established fields in late fall and in late spring. Herbicides applied in late fall or when the soil temperature has dropped to between 40 and 50 degrees to control winter annuals, certain perennials, and early season summer annuals. The spring herbicide application extends summer annual weed control through harvest.

- ⇨ *Late Fall Herbicide Applications* should all include a residual broadleaf herbicide. Use Princep in fields that are not irrigated or are watered with overhead irrigation. If trickle irrigation is used, apply Karmex or Direx in the fall. Small seedling annual broadleaf weeds will be controlled by the residual herbicide, but if well-established annuals are present, add a postemergence herbicide such as a paraquat product to the tank. Consider spot treating with a labeled glyphosate product if perennial weeds are present and treatment is recommended in the fall.
- ⇨ *Spring Herbicide Applications* should include a different residual broadleaf weed herbicide and a residual grass herbicide. Add a postemergence herbicide only if needed. Include a paraquat product if seedlings of annual weeds are observed. Spot treat with a labeled glyphosate product to control established perennial grasses.

BUDBREAK (T3) to PREBLOOM (when leaf buds show green; blossom buds show white and are separating in the cluster)			
PESTS	**REMARKS**	**MATERIALS**	**RATE/A**
Phytophthora root rot	When roots begin active growth. Make sure to have the disease verified before initiating a fungicide program. (See Note below)	Ridomil Gold EC In a 3 ft band Phosphite fungicide	0.25 pt/1000 lin ft See Label
Mummy berry	Primary infection: Apply when leaf buds show green and repeat once in 5-7 days.	Indar 2F Orbit Pristine Quash Switch 62.5WG	6 oz 6 oz 18.5 to 23 oz 2.5 oz 11 to 14 oz
Phomopsis Twig Blight	Apply only in fields where this disease is problematic. See note below.	Indar 2F Orbit Proline Quash	6 oz 6 oz 5 oz 2.5
Cranberry weevil	Make applications based on scouting data.	Adjourn Asana XL Avaunt Brigade WSB Hero Imidan 70WSB Mustang Max	4.8 to 9.6 fl oz 6 to 8 fl oz 6 oz 5.3 to 16 oz 4 to 10.3 oz 1.33 lb 4 fl oz
Leafrollers, Spanworms, Gypsymoth	Avoid all bee-toxic insecticides while bees are present (see in-bloom section) *BT products	Altacor Intrepid 2F Confirm 2F *Crymax Delegate WG *Deliver *DiPel DF Entrust SC *Entrust *Javelin DWG Mustang Mustang Max	3 to 4.5 oz 4 to 16 fl oz 8 to 16 fl oz 0.5 to 2 lb 3 to 6 fl oz 0.5 to 1.5 lb 0.5 to 1 lb 4 to 6 fl oz 1.25-2 oz 0.25 to 1 lb 4.3 oz 4 oz
Plum curculio (larvae)	Apply at pre-bloom to the newly Expanded foliage and unopened blooms and buds. Adult females will deposit non-viable eggs after contact with, and feeding on, treated plants providing control of eggs and larvae on early season harvested blueberry varieties. See notes below	Rimon 0.83EC	20 to 30 fl oz

Phytophthora root rot is uncommon on well drained soils. Before beginning a fungicide control program, be sure to get an accurate diagnosis. If *Phytophthora* is present, improve drainage in the field as a first step. Aliette is labeled for both root and fruit rots; however, a maximum of 20 lb/A per year or 4 applications is allowed. Phosphites (same active ingredient as Aliette) are systemic fungicides with both downward and upward mobility. In other words these products may be applied as a foliar spray and the active ingredient will move into the root zone when leaves are present. These products may also be applied to the soil whereas Ridomil should only be applied to the soil.

Phosphites are **not** fertilizer and DO NOT provide a significant source of P. Other products marketed as fertilizer do not have sufficient active ingredient to provide disease control and may cause phytotoxicity if concentrations are increased. Phosphites will have phytotoxic effects when not sufficiently diluted (50 gallons/acre) and if the spray water is below pH5.5. There are several materials available (Prophyt, Reveille, K-Phite, Rampart, Confine-Extra, Fungi-Phite, Phostrol, etc.) and the best way to compare these is by examining the label to determine the pounds of phosphorous acid per gallon since this is the standard by which all products labelled. Two examples are provided below with the concentration highlighted in yellow.

ACTIVE INGREDIENTS:

Mono- and dibasic sodium, potassium, and ammonium phosphites*	53.6%
OTHER INGREDIENTS:	46.4%
TOTAL:	100.0%

* Contains 6.27 lb/gallon of the active ingredients mono- and dibasic sodium, potassium, and ammonium salts of phosphorus acid. Equivalent to 4.17 lb/gallon of phosphorus acid or 35.6 % by weight.

Active Ingredients

ACTIVE INGREDIENTS:

Mono- and dipotassium salts of Phosphorous Acid*	56%
OTHER INGREDIENTS:	44%
TOTAL:	100%

*Contains 7.03 lbs./gallon of active ingredients, mono- and dipotassium salts of Phosphorus Acid. Equivalent to 4.41 lbs. Phosphorus Acid/gallon.

Leafrollers—At least five species of leafrollers attack blueberries. The most abundant of these are the oblique-banded leafroller and red-banded leafroller. Both insects feed on a wide variety of plants commonly found around blueberry fields. Red-banded leafroller and oblique-banded leafroller, sometimes become numerous enough to cause problems, especially where mechanical harvesters are used. Where red-banded leafroller or oblique-banded leafroller is abundant, it may be necessary to use a bacterial insecticide or Intrepid 2F or Confirm 2F during mid-bloom to control the early hatching leafrollers. At the time of the post-pollination spray, many leafrollers may be too thoroughly webbed up to be controlled.

Plum curculio larvae —Rimon will not control adult stages. A subsequent post-bloom spray using an adulticide (e.g. Imidan or Avaunt) is recommended to achieve optimum control of all life stages. Some phytotoxic symptoms to foliage in the form of mottled chlorosis may be observed when Rimon 0.83EC is applied to blueberries, particularly during periods of new, tender shoot growth. Such phytotoxic symptoms will not affect fruiting or yields. Higher spray volumes and lower spray concentrations will minimize the risk of transient phytotoxic symptoms.

BLOOM (When blossoms open and pollinators are present)			
PESTS	**REMARKS**	**MATERIALS**	**RATE/A**
Leafrollers, Spanworms, and Gypsy Moth	During bloom, to control leafrollers, only *Bacillus thuringiensis* products* and Intrepid or Confirm 2F should be used. These insecticides will not cause harm to bees.	Confirm 2F *Crymax *Deliver *DiPel DF Intrepid 2F	8 to 16 fl oz 0.5 to 2 lb 0.5 to 1.5 lb 0.5 to 1 lb 4 to 16 fl oz
Thrips		Delegate *Entrust	3 to 6 fl oz 1.25 to 2 fl oz
Anthracnose (See note Page 22)	Apply at mid-bloom. Repeat in 7 to 10 days. Choose fungicides to match the spectrum of disease problems present. Use the Table on Page 7 to help with decision making	Abound Captan 80WP Omega Pristine Ziram 76DF	6.2 to 15.4 fl oz 3.1 lb 1.25 pt 18.5 to 23 oz 4 lb
Botrytis blossom blight (See note Page 22)	Apply at mid-bloom. Repeat on a 7 to 10-day intervals through petal fall if *Botrytis* is a problem. Captevate, Elevate, Pristine and Switch are the most effective materials for Botrytis control. The others are for suppression only.	Captan 80WP Captevate 58WDG Elevate 50WDG Pristine Switch 62.5 WG Ziram 76DF	3.1 lb 3.5 to 4.7 lbs 1.5 lb 18.5 to 23 oz 11 to 14 oz 4 lb
Mummyberry Secondary infection	Target open, unpollinated flowers	Abound Pristine Switch 62.5 WG Proline Quadris Top Quash	6.2 to 15.4 fl oz 18.5 to 23 oz 11 to 14 oz 5.7 fl oz 12-14 fl oz 2.5 oz
Leaf Drop This is a relatively new disease and should be diagnosed before starting a treatment program	Begin applications towards the end of bloom when spores are being released. This spray can be used as part of the anthracnose management plan	Quadris Top Proline Quash Luna Tranquility	12 to 14 fl oz 5.7 fl oz 2.5 oz 16 to 27 fl oz

Use of Confirm 2F and Intrepid 2F—This is a selective insecticide effective against most caterpillar pests such as leaf rollers. It has no activity against honeybees and therefore can be used safely during pollination period.

Use of Confirm 2F and Intrepid 2F—This is a selective insecticide effective against most caterpillar pests such as leaf rollers. It has no activity against honeybees and therefore can be used safely during pollination period.

Gypsy moth control— The larvae (caterpillars) feed in the blossom cluster and especially on the main stem of the cluster, destroying the crop. Gypsy moth is a problem in fields where oak trees are prominent along edges. The normal blueberry insect management schedule will control most infestations. Additional management may be necessary in heavily infested areas where larvae are blown into fields at flowering time. If the larvae are abundant, *Bacillus thuringiensis* or Confirm 2F or Intrepid 2F spray during bloom may be necessary.

Botrytis control—Botrytis fruit and cluster blight can be extremely severe in wet years. Slow pollination and aging blossoms create optimal conditions for disease. The fungus is present every year but causes serious economic loss only during years when the weather is cool and damp for several consecutive days. The most critical period for infection occurs during bloom. Frost-injured blossoms are particularly susceptible to infection. **A typical anthracnose program will also suppress Botrytis blossom blight**

Anthracnose – This is the most critical period to begin anthracnose sprays. Initiating applications during early bloom have been demonstrated to be most effective. Choice of materials should be determined by efficacy. Recent research has shown that Abound, Omega, Proline, Quash, Quadris Top, Switch, or Ziram applied during bloom will reduce infection of developing fruit. For susceptible cultivars such as Bluecrop apply effective fungicides at least twice during bloom and follow at least two post-bloom applications. Captan is also an effective fungicide but has a short residual and can be phytotoxic under some conditions.

Fungicide Resistance

Fungi can develop resistance to fungicides if they are overused or improperly used. Some fungicides are considered high risk since a relatively simple genetic change in the fungus can lead to resistance. Other fungicides are considered low risk since it would require complex genetic changes for resistance to develop. The best strategy to reduce the chance of resistance is to use effective low-risk fungicides between applications of high-risk fungicides. In blueberry we have two fungicides which are considered high risk. These two fungicides are related, and this means resistance to one results in resistance to the other. It is critical therefore to never use these fungicides more than twice in a row and preferably only once. Abound, and Pristine all contain a strobilurin fungicide as an active ingredient. Therefore, these materials should not be used in succession in a spray program. The Table below gives some examples of spray regimes and the related risk for resistance.

EXAMPLES OF FUNGICIDE USE AND RESISTANCE MANAGEMENT

Spray 1	*Spray 2*	*Spray 3*	*Spray 4*	*Assessment*
Abound	Pristine	Abound	Pristine	Very bad all high risk with the same mode of action
Abound	Pristine	Ziram	Abound	Better, but still heavy emphasis on high-risk materials
Abound	Ziram	Abound	Ziram	Best, high risk materials separated by low-risk

POST-BLOOM - postemergence weed control			
WEEDS	**REMARKS**	**MATERIALS**	**RATE/A**
Annual and some the perennial grasses at seedling stage (postemergence)	Fusilade: NON-BEARING CROP ONLY. Consult the label for additional information on recommended size of grasses for treatment. Use high rate to control perennial grasses.	Poast Intensity One Select Shadow Fusilade DX	1 to 2.5 pt 9 to 16 fl oz 6 to 8 fl oz 4 to 5.33 fl oz 12 to 24 oz
	Select, Intensity, Shadow: add nonionic surfactant (NIS) at 1 qt/100 gal Poast, Fusilade: add crop oil concentrate (COC) at 1 gal/100 gal		
Broadleaf weeds up to 4 inches tall or 3 inches in diameter (postemergence)	Apply as a hooded spray to the base of the crop to burn down emerged broadleaf weeds.	Aim	1 to 2 fl oz
	Add nonionic surfactant (NIS) to be 0.25% v:v or a crop oil concentrate (COC) or methylated seed oil (MSO) at 1 to 2% v:v.		
Yellow nutsedge and some broadleaf weeds (postemergence)	Apply as a directed treatment to avoid contact with the crop.	Sandea	0.75 to 1 oz
	Apply to nutsedge at the 3 to 5 leaf stage. Re-apply for secondary nutsedge emergence with a minimum of 45 days between applications. See label for specific broadleaf weeds controlled by Sandea		
Bindweeds, Canada thistle, crabgrass (postemergence)	Add crop oil concentrate (COC) at 2 pt/A.	Quinstar	12.6 fl oz
Annual plus some perennial broadleaf weeds (postemergence)	Carefully check the label to minimize spray drift that could injure bushes.	Embed Extra	3 pt
	First application should be made in the spring as a direct, shielded spray to the vegetative strip between blueberry rows, avoiding contact with the blueberry plant foliage. Embed Extra can be applied after harvest to control weed regrowth.		
Emerged annual grasses and broadleaf weeds (postemergence)	Best results occur when weeds are 2 inches tall or less. Regrowth may occur from the roots of established weeds	Gramoxone SL 2.0 Gramoxone SL 3.0 Firestorm	2.4 to 4 pt 1.3 to 2.7 pt 1.7 to 2.7 pt
	Add nonionic surfactant (NIS) at 1 qt/100 gal or a crop oil concentrate (COC) or methylated seed oil (MSO) at 1 gal/100 gal. Using shields, such as grow tubes or paper milk cartons greatly reduces the risk of injury in young plantings.		
Most emerged annual broadleaf weeds and grasses plus some perennial weeds (postemergence)	DO NOT SPRAY GREEN BARK OR FOLIAGE. See glyphosate herbicide label for specific rate and surfactants.	glyphosate Interline Rely 280	see label 48 to 82 fl oz 48 to 82 fl oz
	Rely, Interline: the addition of a spray grade ammonium sulfate will enhance activity on difficult to control weeds. The use of additional surfactants or crop oil is not needed and/or may increase potential for crop injury. Apply as a directed shielded spray to base of established plants		

Postemergence herbicides kill weeds through the leaves. They are used by carefully applying the herbicide to the weeds without allowing it to contact the blueberries. The best time to apply is when weeds are growing rapidly. Do not treat weeds that are dormant or under stress. Most herbicides that enter the plant through the leaves need a minimum rain-free period of at least 1 to 8 hours after application for maximum effectiveness. Postemergence herbicides may be selective or nonselective. They may work only where they contact the weed or they may translocate and work systemically throughout the plant.

- Selective postemergence herbicides kill only certain susceptible weeds. Poast, Select, and Fusilade DX are examples that kill only grasses, and will not control broadleaf weeds or harm the blueberries.
- Nonselective postemergence herbicides (glyphosate, Rely, Gramoxone) kill or injure any treated plant.

Use of glyphosate herbicide — glyphosate is a translocated, slow-acting herbicide with no residual activity. Optimum rate and time of application depend on weed species and growth stage.

- Broadcast application: 0.56-3.0 lb ae (acid equivalent)/A. See your product's label for the rate per acre. Apply as a directed shielded spray to base of established plants. Apply lower rates to control seedlings and annual weeds and to suppress established perennial weeds**.**
- Spot treatment: See your product's label for rate. Wet weed foliage thoroughly.
- Ropewick applicator: See your product's label for rate (water to product mixing ratio). Fill pipe only one-half full to prevent excessive dripping. One gallon of glyphosate will wipe 10 to 100 acres, depending on weed density. Repeated wiping may be needed to provide control equal to broadcast or spot applications. See factsheet FS017 on Ropewick applicator construction and use warnings below.

Herbicide-Resistant Weeds

A number of weed species that once were susceptible to and easily managed by certain herbicides have developed resistance. These weeds are no longer controlled by applications of previously effective herbicides. In the United States, resistance has developed in all herbicide modes of action in about 165 weed species (more information available at weedscience.org).

In New Jersey, marestail/horseweed is known to be globally resistant to group 2 (Sandea, Matrix) and group 9 (glyphosate) herbicides whereas some populations of common ragweed have evolved resistance to group 2 (Sandea, Matrix), group 9 (glyphosate), and group 14 (Aim, Chateau, Zeus) herbicides.

Growers, consultants, and those working with herbicides should know which herbicides are best suited to combat specific resistant weeds. The Herbicide Resistance Action Committee (HRAC) and the Weed Science Society of America (WSSA) developed a grouping system to help with this process.

Reducing the risk of developing herbicide-resistant weeds requires incorporating a number of guidelines in managing your fields. These guideline include:

- Scout fields for applying the right herbicide for the right weed at the right weed growth stage.
- Use alternative methods of control whenever possible (cover crops, mechanical cultivation, mowing, and seeding sod between rows)
- Rotate HRAC group numbers
- Limit the number of herbicide applications with the same WSSA group number in a given growing season.
- Use mixture or sequential herbicide treatments with different WSS group numbers that will control the weeds of concern.
- Clean equipment before leaving fields infested with or suspected to have resistant weeds**.**

FIRST POST-POLLINATION - Remove bee hives before spraying pesticides that are toxic to bees			
PESTS	**REMARKS**	**MATERIALS**	**RATE/A**
Cranberry Fruitworm, Blueberry Leafminer, Leafrollers		Altacor	3 to 4.5 oz
		Asana	4.8 to 9.6 fl oz
		Confirm 2F	8 to 16 fl oz
		Danitol 2.4EC	10.6 to 16 fl oz
		Delegate	3 to 6 oz
		Diazinon AG600	12.75 fl oz
		Diazinon 50W	1 lb
		Entrust	1.25 to 2 fl oz
		Hero	4 to 10.3 oz
		Imidan 70WSB	1.33 lb
		Intrepid 2F	4 to 16 fl oz
		Lannate 90SP	0.5 to 1 lb
		Lannate LV	1.5 to 3 pt
Anthracnose	Repeat in 7 to 10 days for susceptible cultivars. Do NOT apply strobilurin fungicides (italics) if two applications were used previously	Abound	6.2 to 15.4 fl oz
		Captan 50WP	5 lb
		Omega	1.25 pt
		Pristine	18.5 to 23 oz
		Proline	5.7 fl oz
		Quadris Top	12 to 14 fl oz
		Quash	2.5 oz
Cranberry Fruitworm **To control a broader spectrum of pests additional materials may be found in the section above**		Assail 30SG	4.5 to 5.3 oz
		Avaunt	3.5 to 6 oz
		Bifenture DF	5.3 to 16 oz
		Brigade WSB	5.3 to 16.0 oz
		Cormoran	20 fl oz
		Esteem 35WP	5 oz
		Exirel	10 to 13.5 oz
		Knack	16 fl oz
		Mustang Max	4 fl oz
		Rimon 0.83EC	20 to 30 fl oz
		Verdepryn	8.2 to 11 fl oz
Plum Curculio		Pyrethroids	See Page 25
		Apta	27 fl oz
		Avaunt	6 oz
		Diazinon 50W	1 lb
		Diazinon AG600	12.75 fl oz
		Exirel	13.5 to 20.5 oz
		Imidan 70WSB	1.33 lb
		NemAttack™	See Page 25
Thrips		Assail 30SG	4.5 to 5.3 oz
		Delegate	3 to 6 fl oz
		Entrust	1.25 to 2 fl oz
		Imidacloprid	See Page 27

Leafminer—This insect (*Caloptilia porphyretica*) is both a leafminer and leafroller. In the early larval instars, it is a true leafminer, feeding between the upper and lower epidermis of the leaf. It then migrates out of the mine and becomes a leafroller,forming a neat triangular tent within which it feeds. This tent resembles a teepee, which has suggested the name of "teepeemaker" for this insect. There is no feeding on blueberries, but the triangular "teepee" is easily vibrated off the bush during mechanical picking. There are three generations a year and by autumn tremendous numbers of these insects can be found in some fields. Ordinarily, the blueberry can sustain a very high population of these insects without appreciable reduction of the crop potential. The tendency of the larvae to get into the pints makes it a problem. As with leafrollers, passage of berries over a cleaning belt is recommended. Diazinon is the preferred insecticide when leafminer is the main problem in the post pollination spray.

Pyrethroids – There are 5 pyrethroid insecticides registered for blueberries: Asana, Brigade, Danitol, and Mustang/Mustang Max. Only Brigade, Hero, Mustang Max, and Danitol are registered for control of plum curculio (PC) in blueberries. Testing and experience in NJ has shown that as a class, pyrethroids are not the strongest materials to use for PC control. This is especially true if temperatures get too hot. If temperatures exceed 85^0F within 7 days after application, efficacy is reduced. However, under cooler temperatures when used at the upper label rates they will give satisfactory PC control. The following table outlines the rates suggested for PC control in blueberries.

Material	**Rate for PC Control - oz/acre**
Brigade WSB	12 – 16
Bifenture	12 – 16
Danitol 2.4EC	14 – 16
Hero	4.5 – 10.3
Mustang Max	4

Please REMEMBER – Repeated use of pyrethroid insecticides can harm natural enemies and lead to increased scale and aphid numbers.

NemAttack™ - Sr Beneficial Nematodes – This product contains the beneficial nematode *Steinernema riobrave*. These nematodes are naturally occurring, soil dwelling ambush predators that control a wide range of insect pests. Studies in apples, peaches, and blueberries show that *S. riobrave* is effective at controlling plum curculio larvae that exit fruit to pupate in the soil. Applications in blueberries should be targeted around early-mid June. See label instructions for method and rate of application.

SECOND POST-POLLINATION			
PESTS	**REMARKS**	**MATERIALS**	**RATE/A**
Sharp-nosed leafhoppers, Blueberry aphids	See note Page 26	Actara	3 to 4 oz
		Adjourn	4.8 to 9.6 fl oz
		Asana	4.8 to 9.6 fl oz
		Assail 30SG	2.5 to 5.3 oz
		Bifenture DF	5.3 to 16 oz
		Brigade WSB	5.3 to 16 oz
		Cormoran	20 fl oz
		Diazinon 50W	1 lb
		Diazinon AG600	12.75 fl oz
		Hero	4 to 10.3 oz
		Imidacloprid	See Page 27
		Lannate LV	1.5 pt
		Movento	10 fl oz
Blueberry aphids		Exirel	13.5 to 20.5 oz
		Movento	8 to 10 fl oz
		Sivanto	7 to 10.5 oz
		Senstar	16 to 20 fl oz
Scale crawlers		Brigade WSB	5.3 to 16 oz
		Diazinon 50W	1 lb
		Diazinon AG600	12.75 fl oz
		Esteem 35WP	5 oz
		Hero	4 to 10.3 oz
		Mustang Max	4 fl oz
Anthracnose		Abound	6.2 to 15.4 fl oz
		Captan 50WP	5 lb
		Proline	5.7 fl oz
		Quadris Top	12 to 14 fl oz
		Quash	2.5 oz
Spotted wing drosophila	See note Page 26	Asana	9.6 oz
		Brigade/Bifenture DF	16 oz
		Danitol	16 fl oz
		Delegate	6 oz
		Diazinon 50W	1 lb
		Entrust	2 oz
		Exirel	13.5 to 20.5 oz
		Hero	10.3 oz
		Lannate	1lb
		Malathion	(see label)
		Mustang Max	4 oz
		Verdepryn	8.2 to 11 fl oz

Aphid control—Aphids have recently become abundant in some fields. This is probably the result of the destruction of natural enemies by Guthion and the poor coverage of very low volume airplane spraying. Where aphids are a problem, Admire Pro, Couraze, Lannate, or Diazinon should be used. These insecticides are also effective against blueberry maggot, and sharp-nosed leafhopper. Please contact your Rutgers Cooperative Extension County Agricultural Agent for the latest information on chemicals available for managing blueberry aphids.

Use of neonicotinoid insecticides—There are 3 neonicotinoid compounds registered for blueberries, acetamiprid (Assail), imidacloprid (Admire Pro) and thiamethoxam (Actara/Platinum). These are all similar chemistries with the same mode of action. Therefore, in consideration of resistance management practices, they should not be overused. Do not make more than 4 to 5 applications, of neonicotinoid insecticides. Admire Pro is labeled for and will control aphids, leafhoppers, thrips, Japanese beetle adults, and blueberry maggot. Admire will control the larval stage of the Oriental beetle, and will secondarily control aphids. Actara and Assail are a newer generation neonicotinoids that are labeled for control of aphids and leafhoppers. Assail is also labeled for cranberry fruitworm, thrips and blueberry maggot. Platinum is the soil-applied version of thiamethoxam, but is still labeled for only aphids and leafhoppers. Both products are toxic to bees. Foliar applied Admire Pro and Actara have a 3-day PHI whereas soil applied Admire and Assail both have a 7-day PHI, and Platinum has a 75-day PHI. If using Platinum for aphid control, it would have to be applied pre-bloom only on mid-season and late varieties

Insecticides for Control of Brown Marmorated Stink Bug in Blueberries. Based on laboratory and field research, the following insecticides registered for in-season highbush blueberries are rated in order of effectiveness. If a registered product is not listed, then it is not recommended for BMSB use. This list represents a summary from 4 different institutions, and is from lab work only. Field results may be different in individual situations.

Ranking	Material
1	Bifenture 10DF
2	Hero EW
3	Lannate SP
4	Danitol 2.4 EC
5	Mustang Max

Ranking	Material
6	Actara
7	Assail 30SG
8	Admire Pro
9	Malathion 5EC

Insecticides for Control of Spotted Wing Drosophila in Blueberries. This insect is new to New Jersey and the Northeastern U.S. There are many insecticides that work at the present time, but since the neonicotinoids (imidacloprid, Actara, and Assail) are not very effective for this insect, growers need to move away from the repeated use of these materials. The following table is derived from research at Oregon State and Michigan State Universities:

Rating	Material
Excellent	Lannate
Very Good	Imidan
Excellent	Diazinon
Excellent	Malathion
Excellent	Mustang Max
Excellent	Hero
Excellent	Verdepryn

Rating	Material
Excellent	Delegate
Very Good	Entrust
Excellent	Asana
Excellent	Brigade/Bifenture
Excellent	Danitol
Excellent	Exirel

FRUIT MATURATION (mid-June to July)			
PESTS	**REMARKS**	**MATERIALS**	**RATE/A**
Cranberry tipworm		Diazinon 50W	1 lb
		Diazinon AG600	12.75 fl oz
		Movento	8 to 10 fl oz
Oriental beetle	See note Page 29	Admire Pro	7 to 14 oz
		Other imidacloprid formulations	16 to 32 oz
		Mating disruption	See Page 29
Sharp-nosed leafhopper, Cranberry fruitworm, Leafminer, Leafroller	7 to 10 days after first cover	Brigade/Bifenture	5.3 to 16 oz
		Diazinon 50W	1 lb
		Diazinon AG600	12.75 fl oz
		Imidan 70WSB	1.33 lb
		Lannate 90SP	0.5 to 1 lb
		Lannate LV	1.5 to 3 pt
		Sevin 80WSP	1.8 to 2.5 lb
Delegate is not effective against sharp-nosed leafhopper.		Delegate	3 to 6 oz
Blueberry aphids, Sharp-nosed leafhoppers	These materials are effective against sucking insects	Assail 30SG	2.5 to 5.3 oz
		Actara	3 to 4 fl oz
		Cormoran	20 fl oz
		Imidacloprid	See Page 27
Spotted wing drosophila	Treat every 7-days after fruit begins to color	See list Page 27	
Anthracnose	Do not use Ziram or other compounds that will interfere with harvest (PHI). There are many formulations of Captan.	Captan	See label
		Proline	5.7 fl oz
		Quadris Top	12 to 14 fl oz
		Quash	2.5 oz
Phytophthora root rot	Repeat at 14-21 day intervals.	K-Phite	
		Phostrol	2.5 to 5pt
		Prophyte	2.5 to 5pt
		Rampart	2.5 to 5pt

Oriental beetle and other scarab grubs—Scarab grubs, the larvae of scarab beetles such as the oriental beetle and Asiatic garden beetle, can be found on the roots of weeds and blueberry plants. Imidacloprid (Admire Pro, Couraze 4F, Macho 2F, Alias 2F, Nuprid 2F, Advise 2FL) is the preferred material for controlling the grub stage. The insecticide should be applied from June through mid-July, at least 7 days prior to the first picking of berries. Imidacloprid works only on 1st and 2nd instar grubs, so waiting until the 3rd stage is present in August does little for control. On early varieties, apply imidacloprid just after harvest. On mid-season varieties like Duke and Bluecrop or on late season varieties, apply at least 7 days before harvest. Apply imidacloprid in an 18-inch band on either side of the row. The soil should be moist during application, and the insecticide should be irrigated in with 0.5 to 1 inches of water immediately following the application. Once in the soil, Admire can last up to 100+ days, but it can be broken down by sunlight if exposed for a prolonged period. Therefore, applications are best done in the early evening to avoid exposure to sunlight and photo degradation.

Oriental beetle mating disruption— As an alternative to insecticides, we recommend the use of mating disruption for oriental beetle control. This environmentally-friendly technology uses the insect pheromone, which is specific for each pest, to disrupt mating. Dispensers, containing the oriental beetle sex pheromone, are now available to growers. These dispensers are being sold by AgBio:

Mr. Jan Meneley, Ph.D.
AgBio Inc.
9915 Raleigh St.
Westminster, CO 80031
www.agbio-inc.com
ph 303-469-9221
fx 303-469-9598

To use, simply attach the dispensers to a lower blueberry branch at a density of 20-40 dispensers per acre in a grid pattern, depending on the size of the area to be treated.

Nemagard— This product contains the beneficial nematode *Steinernema scarabaei*. This nematode is effective at controlling oriental beetle larvae, including the hard-to-control third instars. Nemagard can be stored at room temperature or up to 12 weeks and mixes easily into solution. Nemagard is effective in a wide range of soil conditions and in soil temperatures above 14°C, allowing for treatment of grubs throughout September and into October. Follow label instructions for method of application and rate.

JULY AND AUGUST			
PESTS	**REMARKS**	**MATERIALS**	**RATE/A**
Stem blight	New plantings of Duke are very susceptible to this disease. Wherever possible avoid stress to young plants. Minimize nitrogen fertilization in August and September to promote hardening off.		
Blueberry maggot	Treatments should be initiated 10 days after the first maggot adult catch in the traps. Repeat every 10 days through harvest. See Note on Malathion resistance	Assail 30SG Asana Adjourn Brigade/Bifenture Cormoran Danitol 2.4EC Exirel Hero Imidacloprid Imidan 70WSB Lannate LV Malathion 8 Aquamul Rimon Sevin 4F Sivanto Verdepryn	4.5 to 5.3 oz 9.6 fl oz 9.6 fl oz 5.3 to 16 oz 20 fl oz 10.6 to 16 fl oz 13.5 to 20.5 oz 4 to 10.3 oz See Page 27 1.33 lb 0.75 to 1.5 pt 1.5 to 2 pt 20 to 30 fl oz 3 to 4 pt 12 to 14 oz 8.2 to 11 fl oz
Leafroller, Leafminer, Fall webworm	When spraying for blueberry maggot alone, note that Lannate LV is applied at the lower rate of 0.75 to 1.5 pt.	Imidan 70WSB Lannate LV Malathion Aquamul	1.33 lb 1.5 to 3 lb 1.5 to 2 pt
Japanese beetle and other scarab beetles	The use of Sevin may be detrimental to aphid predators, allowing aphid population to increase.	Assail 30SG Danitol 2.4EC Imidacloprid Mustang Max Sevin 80WSP Sevin 4F	4.5 to 5.3 oz 10.6 to 16 fl oz See Page 27 4 oz 1.25 to 2.5 lb 3 to 4 pt
Oriental beetle	See note Page 29	Admire Pro Mating disruption	7 to 14 oz See Page 29
Spotted wing drosophila	Treat every 7-days after fruit begins to color	See list Page 27	
Anthracnose	Phosphites help prolong shelf-life of harvested fruit. Application 1-2 days prior to harvest is most effective. See label for instructions.	Captan 50WP Captan 80WP	5 lb 3.1 lb

Malathion resistance—Malathion still gives good control of blueberry maggot. However, some fringe insects that were formerly suppressed by the malathion treatments have now developed resistance to it. Where leafminer, leafrollers, and fall webworm have become a problem Lannate may be necessary in the maggot sprays.

Impact of mechanical harvesting on insect control— Fringe insects that do not cause significant crop damage have become pests where mechanical harvesters are employed. The insects are sometimes harvested with the blueberries and end up in the final product. The insects can be eliminated when the berries are run over a belt before packaging.

Plum curculio infestations are more common in weedy fields. Weymouth, Earliblue, Duke and Bluetta are among the varieties attacked. In these varieties, the curculio larvae may be present in ripe fruit at harvest time whereas later varieties are rarely infested and when they are, the berries usually drop to the ground before harvest.

Fall webworm—Although these insects cause unsightly messes, they have rarely caused significant damage. They present a problem only in mechanically-harvested fields where berries are not passed over a cleaning belt.

Japanese beetles—These insects can be a problem in weedy fields. The larvae (white grubs) feed mostly on the roots of blueberries

POST-HARVEST			
PESTS	**REMARKS**	**MATERIALS**	**RATE/A**
Stunt and other virus diseases in non-bearing fields	Stunt symptoms are most noticeable during mid-June and late-September. Growers should inspect fields at these times and remove all infected plants. Prior to removal of plants, the fields should be treated with an insecticide. Both the June and September applications are necessary to qualify fields for certification by the NJDA.		
Oriental beetle	See note Page 29	Admire Pro Other imidacloprid formulations Nemagard	7 to 14 oz 16 to 32 oz See Page 29
Black shadow	Only 90% severity and above cause crop loss. See recommendations on Page 34.	Lime sulfur Sulforix	5 gal 1 gal
Blueberry bud mite	September 15 to 30 Use oil spray if Putnam scale is a problem. Use Phaser or Thionex spray where bud mite is the only concern.	Phaser 3EC Portal Superior oil Thionex 50W	2 qt 2 pt 3 gal 3 lb
Sharp-nosed leafhopper		Actara Assail 30SG Cormoran Imidacloprid Lannate LV Malathion LV Malathion S 7EC Malathion 8 Aquamul Platinum	3 to 4 fl oz 2.5 to 5.3 oz 20 fl oz See Page 27 1.5 pt 10 oz 2.8 to 3.2 pt 1.5 to 2 pt 5 to 8 fl oz
Powdery Mildew and Rust	These diseases are not normally important and treatment is not warranted unless pressure becomes very high	Indar 2F Orbit	6 oz 6 oz
Black Shadow	Late August until mid-September	Proline Miravis Prime	5.7 fl oz 13.4 fl oz

BLACK SHADOW MANAGEMENT ON BLUEBERRIES FOR NEW JERSEY


Fig. 1

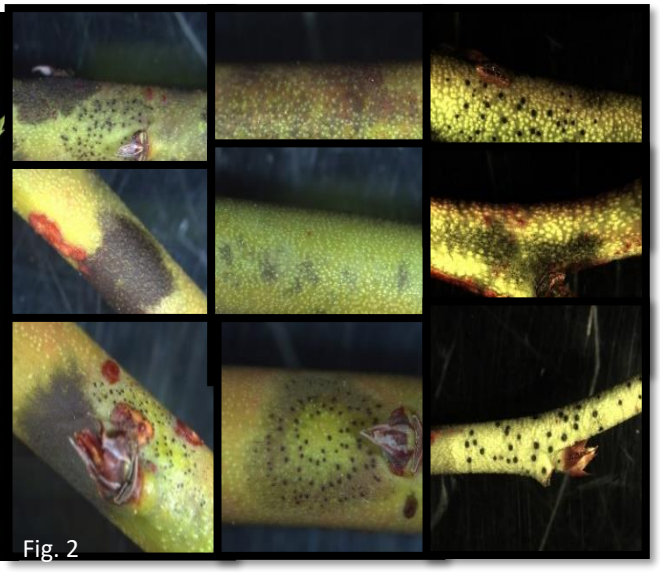


Fig. 2

Black shadow commonly known as sooty blotch is a widespread disease of the cultivated blueberry in New Jersey (Fig. 1). The symptoms generally appear as a discoloration of the stem, however, there are a number of different fungal species involved and each one produces consistent differences in symptomology (Fig. 2). At this stage we do not know which ones are the most destructive.


Fig. 3

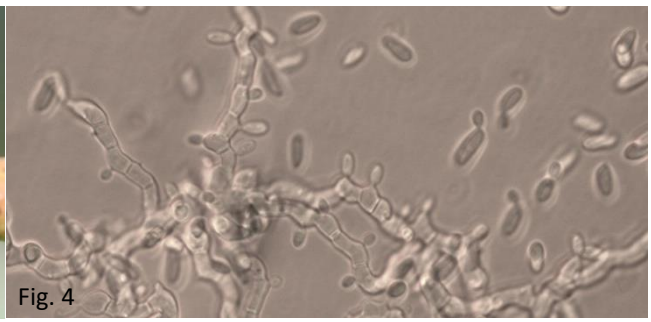


Fig. 4

We have found spores of these pathogens in water droplets inside the canopy (Fig. 3). Since the majority of the pathogens are yeast-like, the spores are produced through budding (Fig. 4) spore production can occur over a long period of time.

The effects of the “black shadow” fungi on blueberry are complex and there is no established threshold for damage. In other words, we do not know what level of coverage or blackening results in a crop loss. However, it is clear that spread begins in late summer and continues throughout the fall and spread occurs from older tissues to the young (current season) tissues or infections may originate from other plant species such as pine, briar and possibly some deciduous species.

For chemical control of “black shadow” we have tested several fungicides against several of the black shadow fungi and have developed a “short list” of effective materials. These are all in field trials at three locations this season. These fungicides have not been used commercially for black shadow control and therefore recommendations are preliminary. The fungicides I have selected are as follows:

Fungicide	Usage information	Rates (approximate cost)
Proline	PHI = 7 days; REI = 12 hr; FRAC 3; 2 apps max/season	5.7 fl.oz./acre ($4.90/fl.oz)

When spraying for black shadow it is very important to understand the target for control. The target includes those tissues in the canopy that you want to protect and achieve maximum coverage with fungicides. For this disease the susceptible tissues include the new growth where the majority of next years crop will be formed.


Fig. 5

In Fig. 5 you can clearly see the fresh green stems produced this growing season (circled in white). If you look carefully you may see some black shadow infection just beginning in some fields. The goal of a spray program targeting this disease is to optimize your spray pattern to cover these tissues and especially the stems. In Fig. 6 you can see how a much of the spray material is on the leaf tissue while in Fig. 7 both leaves and stems are covered. This effect can be achieved through adjusting the pressure and speed that the spray particles are delivered to the canopy. Typically a slower speed (i.e. lower pressure or buffered fan on air assisted sprayers such as air blast) will improved the amount of material covering the stem. This is critical since the materials will only be effective if they reach the stems. It is possible to optimize your sprayer using various fluorescent dyes that are commercially available.
In terms of timing the recommendations will likely change, however, my best estimation at this stage is to apply twice with a 3-4 week interval. Mid-September a second application is recommended mid-October.

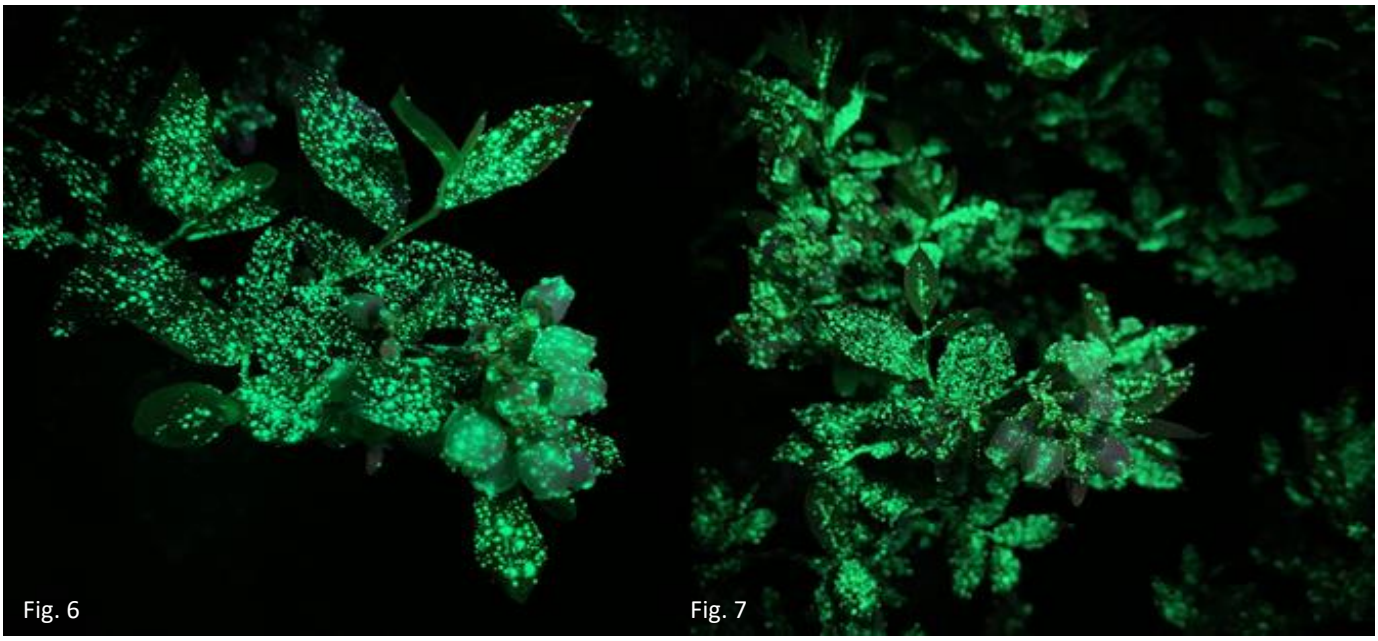


Fig. 6 Fig. 7

We are currently examining the effect of pruning time and fertilizer application on Black Shadow development. These factors will affect the control strategy. Our findings this year suggest that controlling black shadow on the second flush of growth (growth after harvest) will reduce the spread from one season to the next.

IMIDACLOPRID PRODUCTS LABELLED FOR USE ON BLUEBERRY

Pesticide	EPA Reg	Soil Applications (fl oz/acre)	Foliar Applications (fl oz/acre)			
		Japanese Beetle (adult) White grub complex	Aphids/ Leafhopper	Blueberry Maggot	Japanese Beetle (adult)	Thrips
Admire Pro	264-827	7-14	1.0-1.4	2.1-2.8		
Advise 2FL	1381-205	16-32	2.4-3.2	4.8-6.4		
Advise MAX	1381-219	8-16	1.2-1.6	2.4-3.2		
Alias 2F	66222-203	16-32	NO LABEL			
Alias 4F	66222-143	8-16	NO LABEL			
Amtide imidacloprid 2F	83851-12	16-32	2.4-3.2	4.8-6.4		
Amtide imidacloprid 75WDG	83851-7	NO LABEL	0.8-1.1	1.6-2.1		
Arc-imida 4#	84930-2	8-16	1.2-1.6	3.2	2.4-3.2	
Aura 2F	70506-152	16-32	NO LABEL			
Couraze 2F	67760-91	16-32	2.4-3.2	4.8-6.4		
Couraze 4	67760-116	8-16	1.2-1.6	3.2	2.4-3.2	
Couraze 4F	67760-97	8.6-16	1.2-1.6	2.4-3.2		
Dominion 4 LB	53883-225	8-16	1.2-1.6	2.4-3.2		
Gallant 1.6L	1381-206	NO LABEL	3-4	8	6-8	
Gaucho 550SC	264-827	7-14	1.0-1.4	2.1-2.8		
Macho 2FL	42750-110	16-32	2.4-3.2	4.8-6.4		
Macho 4F	42750-140	8-16	1.2-1.6	2.4-3.2		
Malice 75WSP	34704-100	NO LABEL	0.8-1.1	1.6-2.1		
Mana Alias 4F	66222-156	8-16	1.2-1.6	2.4-3.2		
Midash 2SC	83529-4	16-32	2.4-3.2	4.8-6.4		
Montana 2F	83100-7	16-32	2.4-3.2	4.8-6.4		
Montana 4F	83100-21	8-16	1.2-1.6	2.4-3.2		
Nuprid 1.6F	228-488	NO LABEL	3-4	6-8		
Nuprid 2F	228-484	16-32	NO LABEL			
Nuprid 2SC	228-572	16-32	2.4-3.2	4.8-6.4		
Nuprid 4.6F Pro	228-527	7-14	NO LABEL			
Nuprid 4F MAX	228-528	8-16	1.2-1.6	3.2	2.4-3.2	
Pasada 1.6F	66222-228	NO LABEL	3-4	6-8		
Prey 1.6	34704-894	NO LABEL	3-4	8	6-8	
Pronto 70WG	70905-3	NO LABEL	0.9-1.2	1.7-2.3		
Provado 1.6F *	264-763	NO LABEL	3-4	6-8		
Sherpa ™	34704-983	NO LABEL	3-4	6-8		
Torrent 1.6F	60063-32	NO LABEL	3-4	8	6-8	
Torrent 2F	60063-31	16-32	NO LABEL			
Widow ™	34704-893	16-32	NO LABEL			

* Provado no longer produced under that name, existing product still labeled for use

HERBICIDE (H), INSECTICIDE (I) AND FUNGICIDES (F) USE RESTRICTIONS – NEW JERSEY – BLUEBERRY

PESTICIDE	CLASS	REI (hrs)	PHI (days)	APPLICATION NOTES
Abound	F	4	0	MAX 3 applications/season; utilize resistance management strategies.
Actara	I	12	3	
Adjourn	I	12	14	MAX 38.4 fl oz/A/season.
Aim 2EC	H	12	1	MAX 6.1 fl oz/A/year or 2 fl oz/A/application. Do not allow contact with foliage or green bark. For field established at least 1 year.
Aliette	F	12	0	MAX 4 applications/season. Do not mix with copper compounds.
Alion 1.67SC	H	12	-	Do not apply more than 7 fl oz/A/year on soils containing ≤ 1% OM. Do not apply more than 10 fl oz/A/year on soils containing ≥ 1% OM. Do not use on sandy soils or soils with greater than 20% gravel content. Water advisory.
Altacor	I	4	1	MAX 3 applications/season or 0.2 lb a.i./A/season.
Apta	I	12	3	Apply by ground only. MAX 3 applications/season or 81 fl oz/A/season.
Asana	I	12	14	MAX 38.4 fl oz/A/season.
Assail	I	12	1	MAX 5 applications/season or 0.5 lb a.i./A/ season.
Avaunt	I	12	7	MAX 4 applications/season or 24 oz/A/season.
Bifenture	I	12	1	MAX 80 oz product (0.5 lb ai)/A/season.
Bravo	F	48	42	MAX 15 pt/A/season generally not a good fit for blueberry.
Brigade	I	12	1	Do not apply more than 80 fl oz/A/season (0.5 lb ai/A/season).
Callisto / Motif	F	12	-	MAX 6 fl oz/A/calendar year. Do not apply after the onset of bloom.
Cannonball	F	12	0	MAX 29 oz/A/year. MAX 7 oz/A/application.
Captan (many formulations)	F	72	0	MAX 70 lb/A of the 50WP or 43.75 lb/A of the 80WP per crop cycle. Do not mix with oil or solvent based pesticides.
Captevate	F	72	0	An application of this material counts as both Captan and Elevate.
Casoron 4G	H	12	-	MAX 150 lb/A/season.
Chateau 51WDG	H	12	7	MAX 12 oz/A/year. MAX 6 oz/A/application for soils ≥ 80% sand. Do not allow contact with foliage or green bark. For field established at least 1 year.
Confirm 2F	I	4	14	MAX 64 fl oz/A per season.
Cormoran	I	12	8	MAX 89 fl oz/A per season.
Crymax/Aza-direct	I	4	0	OMRI approved.
Danitol 2.4EC	I	24	3	MAX 32 fl oz/A/season.
Delegate WG	I	4	3	MAX 19.5 oz/A or 6 applications/calendar year.
Deliver	I	4	0	OMRI approved.
Devrinol DF-XT	H	24	-	MAX 8 lb/A/season.
Devrinol 2-XT	H	24	-	MAX 8 qt/A/season.
Diazinon	I	5	7	MAX 2 applications/year, with only one application as an in-season foliar application. Do not tank mix with Captan formulations.
Dipel	I	4	0	OMRI approved.
Dual Magnum	H	24	28	MAX 1 application/season and 1.3 pt/A/season. 24C Label for NJ ONLY. Water advisory.
Elevate	F	12	0	Found in Captevate also.
Entrust	I	4	3	MAX 9 oz/season. OMRI approved.
Esteem 3.5WP	I	12	7	MAX 2 applications and 10 oz/season.
Exirel	I	12	3	MAX 0.4 lb a.i./season.
Fusilade DX	H	12	365	Non-bearing use ONLY. MAX 72 oz/A/year. Do not mix with other pesticide.
Glyphosate (many formulations)	H	→	14	See label. Do not allow contact with foliage or green bark.
Gramoxone SL 2.0	H	24	0	MAX 5 applications/season.
Grandevo	I	4	0	OMRI approved.
Hero	I	12	1	MAX 0.45 lb a.i./season.
Imidacloprid	I	→	→	See Table on Page 35.
Imidan	I	12	3	MAX 5 applications/season. Do not allow contact with foliage or green bark.
Indar	F	4	30	

PESTICIDE	CLASS	REI (hrs)	PHI (days)	APPLICATION NOTES
Inspire Super	F	12	7	
Intrepid	I	4	7	MAX 64 fl oz/A or 3 applications/A/calendar year.
Javelin	I	12	0	OMRI approved.
Karmex 80DF / Direx 4L	H	12	-	For field established at least 1 year. Do not use on sandy soil or soils with ≤2% OM.
Kerb 5WP / 3.3SC	H	24	-	MAX 1 application/year. MAX 4 lb or 5pt/A/year. For field established at least 1 year.
Knack	I	48	7	MAX 2 applications/season.
Lannate	I	48	3	MAX 4 applications/season.
Lime Sulfur	F	4	-	Dormant applications only. OMRI approved.
Luna Flex	F	12	7	May be useful for leaf drop
Luna Tranquility	f	12	0	May be useful for leaf drop
K-Phite	F	12	0	Use in a minimum of 50 gal/A and spray water pH above 5.0.
M-Pede	I	12	0	OMRI approved.
Malathion	I	12	1	
Miravis Prime	F	12	0	MAX 2 applications/year
Mustang Max	I	dry	1	MAX 0.15 lb a.i./A/season.
Movento	I	24	7	MAX 30 fl oz/A/season.
Omega	F	24	30	MAX 5 applications/season.
Phaser	F	4	-	Post-harvest only.
Phostrol	F	4	0	Use in a minimum of 50 gallons/acre and spray water pH above 5.0.
Platinum	I	24	75	
Poast	H	12	30	MAX 5 pt/A/year and 2.5 pt/A/application. Do not mix with other pesticide.
Portal		12	1	MAX 2 applications/year. Do not apply by air.
Princep 4L / 90WDG	H	48	-	MAX 2 applications/calendar year. MAX 4.4 lb or 4 qt/A/year. Do not apply by air and when fruits are present. For field established at least 1 year.
Pristine	F	12	0	This material contains a strobilurin. Do not make more than 2 sequential applications of these materials.
Proline 480SC	F	12	7	MAX 11.4 fl oz/A/season.
Prophyte	F	12	0	Use in a minimum of 50 gal/A and spray water pH above 5.0.
Pyganic	I	12	0	OMRI approved.
Quash	F	4	7	MAX 3 applications/season. Do not combine with adjuvants.
Quadris Top	F	12	14	MAX 56 fl oz/A/season.
Quinstar	H	12	30	MAX 2 applications/year and 25.2 fl oz/A/year.
Rampart	F	12	0	Use in a minimum of 50 gal/A and spray water pH above 5.0.
Rely 280	H	12	14	MAX 82 fl oz/A/application and 164 fl oz/A/year. Do not allow contact with foliage or green bark.
Ridomil	F	12	→	Apply only pre-bloom or post-harvest.
Rimon	I	12	8	Do not apply more than 90 oz/acre per season.
Sandea	H	12	14	MAX 2 applications/year and 2 oz/A/year. Do not allow contact with foliage or green bark. For field established at least 1 year
Select Max 1EC	H	24	14	MAX 64 fl oz/A/year and 16 fl oz/A/application.
Senstar	I	24	7	MAX 60 fl oz/A/season.
Sevin	I	48	7	
Shutdown	H	12	3	MAX 11.8 fl oz/A/year. For field established at least 3 years. Water advisory.
Sinbar	H	12	-	For field established at least 1 year. Do not use in sandy soils with ≤3% OM.
Sivanto	I	4	3	MAX 28 oz/A/season.
Solicam	H	12	60	MAX 1 application/12-month period.
Solida	H	4	21	MAX 4 oz/A/year. Do not use on sandy soil and in established < 1 year.
Sulforix	F	12	→	May cause phytoxicity – Read the Label.
Superior Oil	I	72	-	OMRI approved.

PESTICIDE	CLASS	REI (hrs)	PHI (days)	APPLICATION NOTES
Surflan 4AS	H	24	-	MAX 12 qt/A/year.
Surround	I	4	0	OMRI approved.
Switch / Alterity	F	24	0	
Thionex	F	48	-	Post-harvest ONLY.
Trellis 75DF / 4.16SC	H	12	-	75DF formulation for non-bearing plantations ONLY. MAX 2 applications/season. MAX 1.33 lb or 1.9 pt/A/season.
Velpar 2 SL / 75DF	H	48	90	For field established at least 3 years. Do not use on sandy, sandy loam, or loamy sand soils. Do not apply where water is known to stand.
Venerate	I	4	0	OMRI approved.
Verdepryn	I	4	1	MAX 33 fl oz/A/year.
Weedar 64	H	48	30	MAX 6 pt/A/year and 3 pt/A/application. Do not allow to drip or touch blueberry plants. Do not apply if temperature ≥65°F.
Zeus XC	H	12	3	MAX 12 fl oz/A/year. For field established at least 3 years.
Ziram	F	48	14	MAX 8 lb/A/crop cycle. Do not apply by air. 24C Label for NJ ONLY.

Pollinator Safety in Blueberries (updated 2020)

In recent years, colony decline has been observed by contract beekeepers. Although we have not identified any direct cause(s), the following information about pesticide use will help to avoid any toxicity that might arise from farming practices.

There is considerable variation in the toxicity of pesticides to honey bees. The US-EPA has developed pollinator protection program (https://www.epa.gov/pollinator-protection/epa-actions-protect-pollinators) that contains information on this topic.

There are a few key points that are important to understand regarding pollinator safety. First of all, chemical toxicity may be either **acute** and obvious, or **chronic** and less obvious. The following indicators for identifying these types of toxicity are as follows:

Acute toxicity may appear as:

- Large numbers of dead bees near the hive entrance.
- Lack of activity in front of the hive.
- Jerky and abnormal movement like spinning on the back, shaking or vibrating.
- Crawling and not able to fly.
-

Chronic poisoning may appear as:

- Abnormal communication and dance patterns.
- Broken brood patterns with dead and uncapped larvae.
- Poor queen development.
- Queenless hives.
-

Both types of toxicity may occur when bees are foraging outside of the hive and come into contact with chemicals that were:

- Applied close to the time that the bees were brought into the fields.
- Applied to or drifted on to flowering weeds.
- Sprayed on a crop near where bees are foraging.
- Present in water or puddles in or near the foraging area.

Mitigating the Effects of Pesticides on Bees

In order to prevent or reduce exposure of chemicals to bees it is critical to first understand different sources of pesticides contributing to bee exposure.

- Prebloom materials applied prior to bringing bees into the fields (herbicides, insecticides and fungicides)
- In- bloom materials for disease control (fungicides and some insecticides)
- Post-bloom materials applied after bees have been removed (insecticides and fungicides).

Different practices may help to reduce exposure of bees to chemicals. Observing as many of the following practices will help minimize bee contact with pesticides:

- Back off the last prebloom insecticide spray at least 3-4 days from either staging bees on the farm, or placing bees in the fields.
- Apply the first in-bloom fungicide for anthracnose control shortly BEFORE the bees are put into the fields.
- During bloom, make as many applications as possible when bees have stopped foraging after sunset and at night so foraging bees contact only dry residue.

- During bloom, avoid over-spraying the hives and other direct contact with bees. Bees are often 'bearded' on the outsides of the hives, so overs-praying hives directly contacts worker bees with fresh pesticide, and provides for easy pesticide contamination in the hive when bee grooming takes place.
- Use single compound tank applications, and avoid tank mixes and adjuvants. Some adjuvants have been shown to have toxic effects on bees.
- Communicate with your neighbors and your beekeeper. If your neighbor has not yet removed bees, but you have, then your first post pollination insecticide will still kill bees.

Since different pesticides have different effects on bees it is critical to understand the toxicity or risk associated with different chemical pesticides. It is also important to know that mixtures or additives can alter the toxicity of a spray. Therefore during bloom growers should avoid:

The following table lists those materials labeled for blueberries and their associated toxicity ratings for honeybees and native bees. The ratings were derived from multiple references and databases. If several references had different ratings for the same product, or new research suggested negative effects, then a "?" is used in the notes and the rating usually placed under the "Uncertain to Low Toxicity" column.

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INSECTICIDES						
Material	**Active Ingredient**	**High Toxicity**	**Moderate Toxicity**	**Uncertain to Low Toxicity**	**Low to No Toxicity**	**Chem. Class MOA**
Assail	acetamiprid		X			4A
Aza-Direct	azadirachtin		X			UN
Bt Products Includes Crymax, Deliver, Dipel, Javelin	Bacillus thuringiensis				X	11A
Bifenture	bifenthrin	X				3A
Brigade	bifenthrin	X				3A
Hero	bifenthrin + zeta-cypermethrin	X				3A
Venerate	Burkholderia spp.				X	UNB
Sevin	carbaryl	X				1A
ltacor	chlorantraniliprole				X	28
Grandevo	Chromobacterium subtsugae		X			UN
Diazinon	diazinon	X				1B
Asana	esfenvalerate	X				3A
M-Pede	fatty acid salts				X	M
Danitol	fenpropathrin	X				3A
Admire	imidacloprid	X				4A
Avaunt	indoxacarb	X				22
Surround	kaolin clay				X	UNM
Malathion	malathion	X				1B
Lannate	methomyl	X				1A
Intrepid	methoxyfenozinde			X		18
Superior Oil	mineral oil		X			UNM
Rimon	novaluron		X			15
Imidan	phosmet	X				1B
Pyganic	pyrethrins	X				3A
Esteem	pyriproxyfen		X			7C
Delegate	spinetoram		X			5
Movento	spirotetramat		X			23
Confirm	tebufenozide				X	18
Actara	thiamethoxam	X				4A
Platinum	thiamethoxam	X				4A
Mustang Max	zeta-cypermethrin	X				3A

FUNGICIDES						
Material	**Active Ingredient**	**High Toxicity**	**Moderate Toxicity**	**Uncertain to Low Toxicity**	**Low to No Toxicity**	**Chem. Class MOA**
Azoxystrobin	azoxystrobin			X		11
Pristine	pyraclostrobin + boscalid			X		11+7
Elevate	fenhexamid				X	17
Captan	captan		X			M4
Captevate	captan + fenhexamid		X			M4 + 17
Omega	fluazinam					29
Indar	fenbuconazole				X	3
Proline	prothioconazole				X	3
Orbit, Bumper, Tilt	propiconazole				X	3
Quash	metconazole				X	3
Quadris Top	azoxystrobin + difenoconazole			X		11+3
Aliette	al-phosphonate				X	P-07(33)
Phosphites	phosphorous acids				X	P-07(33)
Ridomil	metalaxyl				X	4
Cannonball	fludioxonil				X	12
Serenade	Bacillus subtilis			X		44
Switch	cyprodinil + fludioxonil				X	9+12
Lime Sulfur	calcium polysulfide				X	M2
Oxidate	hydrogen dioxide		X			NC
Sulforix	calcium polysulfide				X	M2
Ziram	ziram		X			M3
Bravo	chlorothalonil			X		M5

HERBICIDES						
Material	**Active Ingredient**	**High Toxicity**	**Moderate Toxicity**	**Uncertain to Low Toxicity**	**Low to No Toxicity**	**Chem. Class MOA**
Gramoxone	paraquat		X			22
Round-up	glyphosate			X		9
Aim	carfentrazone-ethyl				X	14
Rely	glufosinate				X	10
Fusilade	fluazifop-P-butyl				X	1
Kerb	pronamide				X	3
Poast	sethoxydim			X		1
Select	clethodim				X	1
Devrinol	napropamide				X	15
Callisto	mesotrione				X	27
Chateau	flumioxazin				X	14
Trellis	isoxaben				X	5
Karmex	diuron				X	7
Casoron	dichlobenil				X	20
Princep	simazine				X	5
Sandea	halosulfuron				X	2
Sinbar	terbacil				X	5
Solicam	norflurazon				X	12
Surflan	oryzalin				X	3
Velpar	hexazinone				X	5
Zeus	sulfentrazone				X	14
Stinger	clopyralid				X	4
Solida	rimsulfuron				X	2
Alion	indaziflam				X	29

NOTES

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