

**RUTGERS**

New Jersey Agricultural  
Experiment Station

## ***The BLUEBERRY BULLETIN***

*A Weekly Update to Growers*

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**March 31, 2009**

**Vol. XXV, No. 1**

### **AT A GLANCE...**

#### **'Blueberry Twilight Meeting'**

**Thursday, April 30th @ 5:30 PM**

**Variety Farms**

**548 Pleasant Mills Rd.**

**Hammonton, NJ 08037**

**For directions call 609/561-0612**

Problem - Solution

Weeds - Pre-Emergent Herbicides applied

Scale Insects & Phomopsis -

Lime Sulfur, 5 gal./A

Mummy Berry -

200 Lbs. of Urea 50%

Disk between rows

### **Dear Blueberry Grower:**

As we begin the new season I hope you had a great winter. This first edition of *The Blueberry Bulletin* contains the Spray Schedule for 2009.

Also, 'AT A GLANCE...' will continue, and is a summary of each week's information. I hope it is something you can and will use.

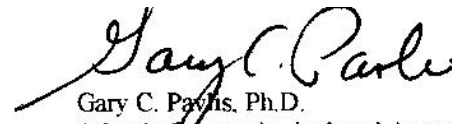
If you have a problem during the season, please call me.

Any comments, suggestions, constructive criticism about *The Blueberry Bulletin* newsletter would be greatly appreciated. Also if you have any specific problems which you feel should be addressed, please let me know.

Help me to serve you better.

Here's hoping for all a very successful 2009.

*Sincerely,*

  
Gary C. Pavlis, Ph.D.  
Atlantic County Agricultural Agent

*Editor - Blueberry Bulletin*

*GP/slp*



**Phomopsis Twig Blight:**

*By Peter V. Oudemans, Ph.D.  
Associate Professor and Extension Specialist  
Plant Pathology*

Buds are beginning to break and it is time to start disease control. Phomopsis twig blight has been seen with increasing prevalence over the past few years and it is highly recommended that appropriate controls be implemented for this disease **if** it is present in a particular field. Yield losses due to Phomopsis Twig Blight as high as 40% have been recorded in New Jersey. Susceptibility varies among cultivars and Sierra, Weymouth and Elliott seem to be most susceptible. It is a relatively easy disease to identify during flowering when infected buds begin to dieback. At this stage of development it is impossible to know if the pathogen is present unless it was identified last year.

This is also the time for mummy berry to strike. The plants are now susceptible but I have not spotted any cups. Scout in wet areas of the field and start looking for the half inch diameter cups.

For fields where the Phomopsis was a problem in 2008, an application of Lime Sulfur or Sulforix may be of benefit. Follow the labeled rates for this treatment and be sure to pay careful attention to the warning labels.

Applications of Indar 2F or 75WSP will provide excellent control for both Phomopsis and mummy berry and Orbit will provide excellent control mummy berry. It is recommended to wait until buds vegetative have elongated and the flower buds have begun to crack open. Remember with applications of fungicides at this time of year should be made with sufficient volume to maximize coverage of the plants.

**Insects**

*Dr. Cesar Rodriguez-Saona, Extension Specialist in Blueberry Entomology, Rutgers University  
Mr. Dean Polk, IPM Agent – Fruit*

**RUTGERS** New Jersey Agricultural Experiment Station **INSECT PEST ACTIVITIES**

	dormant	budbreak- prebloom	bloom	1 <sup>st</sup> post - pollination	later post- pollination	fruit maturation	post-harvest
Scale	■						
Cranberry weevil		■					
Leafrollers		■	■	■	■	■	■
Spanworms		■	■	■			
Gypsy moth		■	■	■			
Thrips			■	■	■		
BB gall midge			■	■	■		
Plum curculio				■	■		
Cranberry FW				■	■		
Aphids				■	■	■	■
Leafhoppers				■	■	■	■
Leafminers				■	■	■	■
Oriental beetle					■	■	■
BB maggot					■	■	■
Japanese beetle						■	■
BB bud mite							■

Sampling Time	Pest	Method of Detection	Sampling Method	Threshold per MPA <sup>1</sup>
Dormant & Pre-bloom	Scales	Visual examination	10 bushes	None Available
	Cranberry weevil	Beating Tray Sampling Visual examination	10 bushes 100 VC & FC <sup>2</sup>	≥ 5 weevils / bush ≥ 20 % of clusters damaged
	Leafrollers, Spanworms, Gypsy moth	Visual examination	100 VC & FC <sup>2</sup>	1 larva / 100 clusters (combine all 3 pests)
Bloom	Thrips	Visual examination Sticky white traps	100 VC & FC <sup>2</sup> .	Avg 1 per cluster Timing
	Cranberry fruitworm	Pheromone trap	.	Timing
Post-bloom	Plum curculio	% injured fruit (scars)	.	None available
	Blueberry Aphid	Lower shoots	100 CS <sup>3</sup>	None available
	Blueberry Maggot	Baited Pherocon AM Traps Boil Test	Canada Protocol 2 Liters	1 adult Zero Tolerance
	Oriental beetle	Pheromone traps	.	Timing

1. MPA = monitored production area
2. 100 VC & FC = 10 clusters (vegetative and flower) of each from 10 bushes
3. 100 CS = 10 new cane shoots from 10 bushes

Timing	Target Pest	Organophosphates, Carbamates, and Pyrethroids	OP alternatives / Reduced-Risk Insecticides <sup>1</sup>
Budbreak- Prebloom	Cranberry weevil	Guthion, Imidan, Lannate, or Asana	
	Leafrollers	Lannate	Intrepid, Confirm, or Delegate
Bloom	Leafrollers, Spanworms	DO NOT USE	<i>B.t.</i> , Confirm, or Intrepid
Post-Pollination	Cranberry fruitworm	Diazinon, Guthion, Danitol, or Lannate	Intrepid, Confirm, Delegate, Esteem, or Assail
	Plum curculio	Diazinon, Danitol, or Guthion	
	Aphids, Leafhoppers	Lannate	Assail, Provado, or Actara
	Thrips		Assail, Provado, or SpinTor
Fruit Maturation	Blueberry maggot	Malathion, Imidan, Sevin, Asana, Danitol, or Lannate	Assail or Provado
	Japanese Beetle	Sevin or Danitol	Assail or Provado
	Oriental Beetle		Admire
Post-harvest	Leafhoppers	Malathion, Imidan, or Lannate	Assail, Actara, or Provado
	Oriental beetle		Admire

<sup>1</sup> Actara, Assail and Provado, along with generics, Gallant, Nuprid, Impulse, and Couraze are all neonicotinoids (Group 4A) insecticides. For resistance management, make no more than 2 consecutive applications of any group 4A product, then rotate to another chemical class. If a long residual soil applied 4A product (Admire, Alias, Nuprid, Advise, Macho, or Couraze) was used, then try to avoid additional foliar applied applications of group 4A insecticides.

**RUTGERS**

New Jersey Agricultural  
Experiment Station

E265

**Cooperative Extension**

**Bulletin**

**2009 COMMERCIAL  
BLUEBERRY PEST CONTROL  
RECOMMENDATIONS FOR  
NEW JERSEY**

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# 2009 BLUEBERRY INSECT AND DISEASE CONTROL RECOMMENDATIONS FOR NEW JERSEY

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All spray formulations are presented in amount of formulated product per acre. Apply sprays so that good foliage coverage is achieved without excessive runoff. 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. **Follow all label instructions when using pesticides.**

See current recommendations for Section 18 materials:

<http://www.pestmanagement.rutgers.edu/NJinPAS/PesticideRegistration/NJ18s.htm>

Additional information is available at [http:// PESTWEB.rutgers.edu/](http://PESTWEB.rutgers.edu/)

PESTS	REMARKS	MATERIALS	RATE/A
<b>Dormant (November - January)</b>			
<b>Black shadow</b>		Lime sulfur	5.0 gal
<b>DORMANT (Leaf fall to bud swell)</b>			
<b>Scale insects</b>	Dormant to 0.25 inch leaf opening	Lime sulfur, OR Superior oil, OR Knack AND Superior Oil, OR Esteem 35WP AND Superior Oil	5.0 gal 3.0 gal 16 oz 3.0 gal 5.0 oz 3.0 gal
	For effective scale control, use 75 to 100 gal/A and ensure thorough coverage. (See Note 8 for minimum specifications for oil.) Pruning out old canes prevents heavy scale infestations. See Notes 1 and 2		
<b>Botrytis, Stem blight</b>	Pruning out old canes will reduce inoculum. Heavy nitrogen fertilization induces higher disease incidence.		
<b>Phomopsis twig blight</b>	See Note 3	Lime sulfur Sulforix	5.0 gal 1.0 gal
	Use lime sulfur only once in the spring. DO NOT use within 14 days of an oil spray or when temperature is above 75°F. May be used again in autumn where <i>Phomopsis</i> is a problem. <b><u>DO NOT tank mix other insecticides or fungicides with lime sulfur.</u></b>		
<b>Mummy berry</b>	Burial of mummies in one inch or greater will greatly reduce germination. Consider mulching to bury mummies. See Note 4		

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## **BUDBREAK (when leaf buds show green; blossom buds show white and are separating in the cluster) to PREBLOOM**

<b>Phytophthora root rot</b>	When roots begin active growth. Have an accurate diagnosis before any treatments are made. (See Note 5)	Ridomil Gold EC, OR Phosphite Product	In a 3 ft band:0.25 pt/1000 lin ft Follow label for specific product
<b>Mummy berry</b>	Primary infection: Apply when leaf buds show green and repeat once in 10 days.	Indar 2F, OR Tilt, OR Pristine, OR Switch 62.5WG	6 oz 6 oz 18.5 to 23 oz 11 to 14 oz

PESTS	REMARKS	MATERIALS	RATE/A
<b>Cranberry weevil</b>	Make applications based on scouting data.	Adjourn, OR	4.8 to 9.6 fl oz
		Asana XL, OR	6.0 to 8.0 fl oz
		Azinphos-M 50W, OR	1.0 to 1.5 lb
		Guthion 2L, OR	2.0 to 3.0 pt
		Guthion 50WP, OR	1.0 to 1.5 lb
		Imidan 70WSB	1.33 lb
<b>Leafrollers, Spanworms, Gypsymoth</b>	See Note 6	Intrepid 2F, OR	4.0 to 16.0 fl oz
		Confirm 2F, OR	8.0 to 16.0 fl oz
		Crymax, OR	0.5 to 2.0 lb
		Delegate WG, OR	3.0 to 6.0 fl oz
		Deliver, OR	0.5 to 1.5 lb
		DiPel DF, OR	0.5 to 1 lb
		Javelin DWG, OR	0.25 to 1.0 lb
		Mustang, OR	4.3 oz
		Mustang Max, OR	4 oz
SpinTor 2SC	4.0 to 6.0 fl oz		
<b>IMMEDIATE PREBLOOM</b>			
<b>Anthracnose</b>	Make applications in sufficient water to cover emerging flowers and bud scales	Omega 500F	1.25 pt
<b>BLOOM</b>			
<b>Leafrollers, Spanworms, Gypsymoth</b>	See Notes 6, 7, and 8  During bloom, to control leafrollers, only <i>Bacillus thuringiensis</i> products and Intrepid or Confirm 2F should be used. These insecticides will not cause harm to bees.	Intrepid 2F, OR	4.0 to 16.0 fl oz
		Confirm 2F, OR	8.0 to 16.0 fl oz
		Crymax, OR	0.5 to 2 lb
		Deliver, OR	0.5 to 1.5 lb
		DiPel DF, OR	0.5 to 1.0 lb
		Javelin DWG	0.25 to 1.0 lb
<b>Thrips</b>	See Note 8	SpinTor 2SC	4.0 to 6.0 fl oz
<b>Anthracnose</b>	Apply at mid-bloom. Repeat in 7 to 10 days. See Notes 9 and 10	Abound, OR	6.2 to 15.4 fl oz
		Captan 50WP, OR	5.0 lb
		Captan 80WP, OR	3.1 lb
		Captec 4L, OR	2.5 qt
		Pristine, OR	18.5 to 23 oz
		Ziram 76DF	4.0 lb
<b>Botrytis blossom blight</b>	Apply at mid-bloom. Repeat on a 7- to 10-day intervals through petal fall if <i>Botrytis</i> is a problem. See Note 11	Captan 50WP, OR	5.0 lb
		Captan 80WP, OR	3.1 lb
		Captec 4L, OR	2.5 qt
		Captevate 58WDG, OR	3.5 to 4.7 lbs
		Elevate 50WDG, OR	1.5 lb
		Pristine, OR	18.5 to 23 oz
		Switch 62.5 WG, OR	11 to 14 oz
		Ziram 76DF	4.0 lb
<b>Mummy berry</b> Secondary infection	See Notes 9 and 10	Abound, OR	6.2 to 15.4 fl oz
		Pristine, OR	18.5 to 23 oz
		Switch 62.5 WG	11 to 14 oz

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**FIRST POST-POLLINATION - Remove bee hives before spraying pesticides that are toxic to bees**

**May 25 to June 7:**

**Cranberry fruitworm,  
Blueberry leafminer,  
Leafrollers**

See Notes 6, 8, 10, 12, and 13

Delegate, OR	3 to 6 oz
Asana, OR	4.8 to 9.6 fl oz
Azinphos-M 50W, OR	1.0 to 1.5 lb
Confirm 2F, OR	8.0 to 16.0 fl oz
Intrepid 2F, OR	4.0 to 16.0 fl oz
Danitol 2.4EC, OR	10.6 to 16 fl oz
Diazinon 50W, OR	2.0 lb
Diazinon AG600, OR	25.5 fl oz
Guthion 50WP, OR	1.0 to 1.5 lb
Guthion 2L, OR	2.0 to 3.0 pt
Imidan 70WSB, OR	1.33 lb
Lannate 90SP, OR	0.5 to 1.0 lb
Lannate LV, OR	1.5 to 3.0 pt

**Cranberry fruitworm**

Assail 30SG, OR	4.5 to 5.3 oz
Danitol 2.4EC, OR	10 2/3 to 16 fl oz
Delegate WG, OR	3.0 to 6.0 fl oz
Esteem 35WP, OR	5.0 oz
Knack	16 fl oz

**Plum curculio**

See Note 10

Danitol 2.4EC, OR	10.6 – 16 fl oz
Diazinon 50W, OR	2.0 lb
Diazinon AG600, OR	25.5 fl oz
Guthion 50WP, OR	1.0 to 1.5 lb
Guthion 2L	2.0 to 3.0 pt

**Thrips**

Assail 30SG, OR	4.5 to 5.3 oz
Imidacloprid, OR	6. to 8 oz
SpinTor 2SC	4 to 6 fl oz

**Early to mid-June:**

**Sharp-nosed leafhoppers,  
Blueberry aphids**

See Notes 14 and 15

Actara, OR	3.0 to 4.0 oz.
Adjourn, OR	4.8 to 9.6 fl oz
Asana, OR	4.8 to 9.6 fl oz
Assail 30SG, OR	2.5 to 5.3 oz
Diazinon 50W, OR	2.0 lb
Diazinon AG600, OR	25.5 fl oz
Imidacloprid, OR	3.0 to 4.0 oz
Lannate LV, OR	1.5 pt

**Scale crawlers**

Esteem 35WP	5 oz
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**Anthracnose**

See Notes 9,10

Abound, OR	6.2 to 15.4 fl oz
Cabrio, OR	14.0 oz
Captan 50WP, OR	5.0 lb
Captan 80WP, OR	3.1 lb
Captan 4L, OR	2.5 qt
Ziram 76DF	4.0 lb

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**Mid-June to July:**

<b>Cranberry tipworm</b>		Diazinon 50W, OR Diazinon AG600	2.0 lb 25.5 fl oz
<b>Oriental beetle</b>	See Note 16	Admire Pro, OR Other imidacloprid formulations	7.0 to 14.0 oz 16 to 32 oz

**OTHER POST-  
POLLINATION SPRAYS**

<b>Sharp-nosed leafhopper, Cranberry fruitworm, Blueberry leafminer, Leafroller</b>	7 to 10 days after first cover	Azinphos-M 50W, OR Diazinon 50W, OR Diazinon AG600, OR Guthion 2L, OR Guthion 50WP, OR Imidan 70WSB, OR Lannate 90SP, OR Lannate LV, OR Sevin 80WSP, OR Delegate	1.0 to 1.5 lb 2.0 lb 25.5 fl oz 2.0 to 3.0 pt 1.0 to 1.5 lb 1.33 lb 0.5 to 1.0 lb 1.5 to 3.0 pt 1.8 to 2.5 lb 3 to 6 oz
	Delegate is not effective against sharp-nosed leafhopper.		
<b>Blueberry aphids, Sharp-nosed leafhoppers</b>	see Note 17	Assail 30SG, OR Actara, OR Imidacloprid	2.5 to 5.3 oz 3 to 4 fl oz 3 to 4 fl oz
<b>Anthracnose</b>	Do not use Ziram or other compounds that will interfere with harvest (PHI) and See Note 9	Abound, OR Cabrio, OR Captan 50WP, OR Captan 80WP, OR Captec 4L	6.2 to 15.4 fl oz 14.0 oz 5.0 lb 3.1 lb 2.5 qt
<b>Phytophthora root rot</b>	Repeat at 14-21 day intervals. See note 5	Phostrol, OR Prophyte Rampart	2.5-5pt 2.5-5pt 2.5-5pt

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**FRUIT MATURATION (July and August)**

<b>Stem blight</b>	New plantings of Duke are very susceptible to this disease. Wherever possible avoid stress to young plants. One major control strategy is to minimize nitrogen fertilization in August and September to promote hardening off and reduce winter injury.		
<b>Blueberry maggot</b>	Treatments should be initiated 10 days after the first maggot adult catch in the traps. Repeat every 10 days through harvest.  See Note 18	Assail 30SG, OR Asana, OR Adjourn, OR Danitol 2.4EC, OR Imidacloprid, OR Imidan 70WSB, OR Lannate LV, OR Malathion 8 Aquamul, OR Sevin 4F	4.5 to 5.3 oz 9.6 fl oz 9.6 fl oz 10.6 to 16 fl oz 6.0 to 8.0 fl oz 1.33 lb 0.75 to 1.5 pt 1.5 to 2.0 pt  3.0 to 4.0 pt
	<i>Use of Aircraft</i> - For aircraft sprays, apply at least 5 gal/A of spray mix. Use a jar test to check for compatability of pesticides.		
<b>Leafroller, Leafminer, Fall webworm</b>	When spraying for blueberry maggot alone, note that Lannate LV is applied at the lower rate of	Imidan 70WSB, OR Lannate LV, OR Malathion 8Aquamul	1.33 lb 1.5 to 3.0 lb 1.5 to 2.0 pt

0.75 to 1.5 pt.  
See Notes 18, 19, 20,21, and 22

<b>Japanese beetle and other scarab beetles</b>	The use of Sevin may be detrimental to aphid predators, allowing aphid population to increase.	Assail 30SG, OR Danitol 2.4EC, OR Imidacloprid, OR Sevin 80WSP, OR Sevin 4F	4.5 to 5.3 oz 10.6 – 16 fl oz 6.0 to 8.0 fl oz 1.25 to 2.5 lb 3.0 to 4.0 pt
	See Note 23		
<b>Oriental beetle</b>		Admire Pro	7.0 to 14.0 oz See Note 7
<b>Anthracnose</b>		Abound, OR Aliette 50WDG, OR Cabrio, OR Captan 50WP, OR Captan 80WP	6.2 to 15.4 fl oz 5.0 lb 14.0 oz 5.0 lb 3.1 lb

**POST-HARVEST**

<b>Oriental beetle</b>	See Note 15	Admire Pro Other imidacloprid formulations	7.0 to 14.0 oz 16 to 32 oz
<b>Anthracnose</b>	August 1 to August 20	Ziram 76DF	4 lb
<b>Blueberry bud mite</b>	September 15 to 30 See Note 2	Phaser 3EC, OR Superior oil, OR Thionex 50W	2.0 qt/A 3.0 gal 3.0 lb

Use oil spray where Putnam scale is also a problem. Use Phaser or Thionex spray where bud mite is the only concern. Pruning out old canes and twiggy wood helps reduce bud mite populations.

<b>Sharp-nosed leafhopper</b>		Actara, OR Assail 30SG, OR Imidacloprid, OR Lannate LV, OR Malathion LV, OR Malathion S 7EC, OR Malathion 8Aquamul, OR Platinum	3-4 fl oz 2.5 to 5.3 oz 3 to 4 fl oz 1.5 pt 10 oz 2.8 to 3.2 pt 1.5 to 2.0 pt 5 to 8 fl oz
	<b>Powdery Mildew</b>	<u>This is not normally an important disease unless pressure becomes very high</u>	Indar 2F, OR Tilt

**Phomopsis twig blight and Black Shadow** Late October until mid-January Lime sulfur 5.0 gal  
DO NOT use Lime Sulfur within 14 days of an oil spray or when temperature is above 75°F. May be used again in autumn - winter where Black Shadow is a problem. This treatment may also reduce Phomopsis. DO NOT tank mix other insecticides or fungicides with lime sulfur.

## BLUEBERRY PEST CONTROL NOTES

1. **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
Unsulphonatable residue	92% or higher	92%

Do not spray oil on very cold days when spray will freeze before drying.

2. **Putnam scale and blueberry bud mite**— Pruning styles have changed to accommodate the mechanical harvester. The retaining of older canes is making conditions more favorable for Putnam scale and blueberry bud mite. Heavy Putnam scale infestations requiring oil sprays are now appearing in some Bluecrop blocks. The retention of old canes is also likely to cause an increase in the amount of *Phomopsis*, *Botrytis*, and anthracnose.
3. **Phomopsis**—*Phomopsis* is a fungus that attacks the buds of flower clusters and more rarely, the wood of large canes. The disease is most prevalent after severe winters, especially when there is little snow cover, or after winters during which mild spells of weather are interspersed with extreme cold temperatures. The most common symptom is the drying up of fruit and flowers as the wood below turns brown, cutting off moisture and nutrients. Weymouth, Sierra, Earliblue, Coville, and Berkeley often have severe infections and are rarely entirely free of this disease, whereas Jersey is occasionally moderately damaged by it. Thorough pruning out of all small twiggy wood is very helpful in controlling *Phomopsis* as well as the other fungal problems of blueberry.
4. **Mummy berry control**—Cultivation reduces overwintering mummies when mummies are buried more than 1 inch. Urea can be applied to kill open cups. In fields where this disease is usually severe, fungicide should be used. Prior to mummy cup formation, about March 20. Disk between rows and rake, sweep, or hoe under plants. Also aids in control of blossom weevils, cranberry fruitworms, and plum curculio.
5. **Phytophthora root rot** is rare on well drained soils. Before beginning a fungicide control program, get an accurate diagnosis. If *Phytophthora* is present, improve drainage in the field before applying fungicides. Aliette is labeled for both root and fruit rots; however, a maximum of 20 lb/A per year is allowed. Aliette, Phostrol and Propylate are systemic fungicides with downward mobility. Therefore, those products should be applied as either a foliar spray drench whereas Ridomil should be applied to soil as a drench
6. **Use of Confirm 2F**—This is a selective insecticide effective against most caterpillar pests. It has no activity against honeybees and therefore can be used safely during pollination period.
7. **Gypsy moth control**—Gypsy moth has become a problem in some Ocean, Burlington, and Atlantic County fields where oak trees are prominent along edges. The normal blueberry schedule has controlled most infestations, but in certain heavily infested areas, larvae, which are blown into fields at flowering time, may cause a problem. Since the larvae feed in the blossom cluster and especially on the main stem of the cluster, they can be very destructive. If the larvae are abundant, *Bacillus thuringiensis* or Confirm 2F spray during bloom is necessary to prevent significant damage.
8. **Use of SpinTor 2SC and Delegate WG**—SpinTor and Delegate are effective against most caterpillars, thrips, and blueberry maggot. They are toxic to bees when they are directly exposed to the material or wet residue. SpinTor and Delegate may be applied during bloom only if applied at dusk after bees have stopped foraging for the day. SpinTor and Delegate should be applied at least 3 hours before bee activity resumes.

- 9 **Fungicide comparison**— No one fungicide controls adequately all fungal diseases of blueberry. In some situations where more than one disease is active, more than one fungicide will be needed. The labeled blueberry fungicides should be used according to labeled target disease. A comparison of activities for fungicides used to control major blueberry diseases.

FUNGICIDE	ANTHRACNOSE	BOTRYTIS	MUMMY BERRY	ALTERNARIA
ABOUND	EXCELLENT	GOOD	GOOD	FAIR
CABRIO	EXCELLENT	GOOD	POOR	FAIR
CAPTAN	GOOD	GOOD	POOR	FAIR
CAPTEC	GOOD	GOOD	POOR	FAIR
CAPTEVATE	GOOD	EXCELLENT	POOR	FAIR
ELEVATE	POOR	EXCELLENT	POOR	FAIR
INDAR	POOR	UNKNOWN	EXCELLENT	UNKNOWN
OMEGA	EXCELLENT	UNKNOWN	UNKNOWN	UNKNOWN
ORBIT	POOR	UNKNOWN	EXCELLENT	UNKNOWN
PRISTINE	EXCELLENT	EXCELLENT	GOOD	FAIR
SWITCH	MODERATE	EXCELLENT	GOOD	UNKNOWN
ZIRAM	EXCELLENT	GOOD	POOR	POOR

- 10 **Compatibility of pesticides in tank-mixtures**—Confirm physical compatibility of tank-mix partners by employing a jar test. Using a quart jar, add proportionate amounts of each product to 1 quart of water. After thoroughly mixing, let stand for at least 5 minutes. If the combination remains mixed or can be readily mixed, the products are compatible.  
**Phytotoxicity of insecticide and fungicide tank-mixtures**—Pesticide mixtures that are physically compatible may still cause crop injury. New chemicals and formulations should always be evaluated for crop safety in a small area, prior to spraying on a larger area. Mixing formulations of diazinon with captan or captec may cause crop injury. Therefore, diazinon and captan formulations should not be tank-mixed.
- 11 **Botrytis control**—Botrytis fruit and cluster blight can be extremely severe in wet years. Slow pollination can result in large numbers of open blossoms. As the blossoms age, infection will ensue. The common name of the disease is gray mold, and it is a problem on many crops. The fungus overwinters on dead twigs and organic matter in the duff. 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.  
Chemical control should be directed towards preventing infection of the flower petals. Since bloom occurs over an extended period several sprays may be needed for satisfactory control. The first application should be made at mid-bloom, with subsequent sprays on a 7- to 10-day interval through petal fall.
- 12 **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.
- 13 **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 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.
- 14 **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, Provado, 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.

- 15 Use of neonicotinic insecticides**—There are 2 neonicotinoid compounds registered for blueberries, imidacloprid (Provado/Admire) and thiamethoxam (Actara/Platinum). These are both 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, combined, of these products. Provado 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 is a newer generation neonicotinic that is labeled for control of aphids and leafhoppers. Platinum is the soil-applied version of thiamethoxam, but is still labeled for only aphids and leafhoppers. Both products are toxic to bees. Both Provado and Actara have a 3-day PHI. Admire has 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
- 16 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 2F, 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 1<sup>st</sup> and 2<sup>nd</sup> instar grubs, so waiting until the 3<sup>rd</sup> 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.
- 17 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.
- 18 Malathion resistance**—Malathion still gives good control of blueberry maggot. However, some fringe insects that were formerly well suppressed by the malathion treatments to control maggots have now developed resistance to it. These insects include leafminer, leafrollers, and fall webworm. Where these insects have become a problem, a switch to Lannate may be necessary in the maggot sprays.
- 19 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 vibrated off the bushes into the mass of blueberries where they may become trapped and end up in the fresh blueberry pints. Where the berries are run over a belt preliminary to packaging, the insects can be eliminated, but when picking is done directly into pints, they may go to the consumer in the packaged blueberries. Where this type of harvesting is contemplated, the fringe insects (leafrollers, leafminer, and fall webworm) must be controlled. Malathion is no longer effective against these insects and Lannate should be substituted for it in the maggot treatments where the fringe insects have become problems.
- 20 Caution in the use of Guthion**—The use of Guthion during the harvest season requires the utmost caution in the observance of safety precautions and label requirements.\* Exact records must be kept of dates and time of spray of the various blocks so that the grower may know when the proper interval has elapsed before harvesting. Protective clothing and respirators and other safety precautions must be used in the application of Guthion. Regardless of the formulation used, only two Guthion sprays per season are allowed. Guthion has a 7 day pre-harvest interval and a 7 day re-entry time.
- Re-entry (REI) for Guthion/azinphos-methyl is longer for people not covered under worker protection standards (WPS). This applies to pick-your-own operations where the general public comes on the farm to enter treated areas. Under these conditions the REI is extended to 30 days when the last application is .5 lb ai/A (1.0 lb or less of product/A), 35 days when the last application is .51 to .625lb ai/A (1.02 to 1.25 lb of product/A), and 42 days when the last application is .626 to .75 lb ai/A (1.252 to 1.5 lb of product/A).
- 21. Plum curculio** infestations are increasing, especially in some areas in Atlantic County. Plum curculio infestations are more common in weedy fields. Weymouth, Earliblue, Duke and Bluetta are among the varieties heavily attacked. In these varieties, the curculio larvae may be present in ripe fruit at harvest time. Later varieties are very rarely infested and when they are, the berries usually drop to the ground before harvest.
- 22 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.
- 23 Japanese beetles**—These insects can be a problem in weedy fields. The larvae (white grubs) feed mostly on the roots of blueberries, grasses, and other weeds. The adult Japanese beetles emerge at blueberry harvest time and feed on blueberry fruit as well as leaves. These beetles sometimes end up in packages. They are more of a threat in mechanical harvesting since they are easily vibrated off the bushes into the berry mass. A more careful watch at the cleaning belt is needed. Malathion in the maggot sprays is not effective against these beetles. Either Imidacloprid (foliar), Danitol or Sevin must be used where these insects are abundant.

## PESTICIDE USE RESTRICTIONS – NEW JERSEY – BLUEBERRY

PESTICIDE	REI	PHI	IMPORTANT NOTES
Abound	4 hrs	0 days	3 applications maximum; utilize resistance management strategies
Actara	12 hrs	3 days	
Adjourn	12 hrs	14 days	Do not apply more than 38.4 fl oz per acre per season
Admire Pro	12 hrs	7 days	maximum of one application per growing season; maximum of 0.5 lb a.i. combined Admire and Provado per growing season
Aliette	12 hrs	0 days	4 applications maximum; DO NOT mix with copper compounds
Asana	12 hrs	14 days	Do not apply more than 38.4 fl oz per acre per season
Assail	12 hrs	1 days	Do not make more than 5 applications or exceed 0.5 lb. a.i. per acre per growing season.
Bravo	48 hrs	42 days	maximum 15 pt/A per growing season generally not a good fit for blueberry
Cabrio	24 hrs	0 days	4 applications maximum; utilize resistance management strategies
Captan (many formulations)	3 days	0 days	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.
Captevate	72 hrs	0 days	Contains both Captan and Elevate therefore an application of this material counts as both Captan and Elevate
Confirm 2F	4hrs	14 days	maximum of 64 fl oz/A per season
Crymax	4 hrs	0 days	
Danitol 2.4EC	24 hrs	3 days	maximum 32 fl oz per acre per season
Delegate WG	4 hrs	3 days	maximum of 19.5 oz per acre or 6 applications per calendar year
Deliver	4 hrs	0 days	
Diazinon	5 days	7 days	DO NOT tank mix with any Captan formulations. A maximum of 2 applications per year, with only one application as an in-season foliar application.
Dipel	4 hrs	0 days	
Elevate	12 hrs	0 days	found in Captevate also
Esteem 3.5WP	12 hrs	7 days	maximum of two applications, 10 oz per growing season
Guthion, azinphos-methyl	7 days  For u-pick operations 30,35, 42 days	7 days	Maximum single application rate is .75 lb. ai/A or 1.5 lb of product/A. Minimum of 7 days between applications. Yearly maximum use of 1.25 lb. ai/A or 2.5 lb of product/A.  REI is extended for u-pick (see note 20)
Imidacloprid (foliar application)	12 hrs	3 days	maximum allowed per season: 40.0 fl. oz/acre; minimum interval between applications: 7 days
Imidacloprid (soil application)	12 hrs	7 days	maximum of 32 fl oz per acre per season
	Imidacloprid (foliar application): Provado 1.6F, Couraze 1.6F, Gallant 1.6F, Nuprid 1.6F, Impulse 1.6F Imidacloprid (soil application): Admire Pro, Couraze 2F, Macho 2F, Alias 2F, Nuprid 2F, Advise 2FL, Widow 2F		
Imidan	24 hrs	3 days	5 applications maximum
Indar	12 hrs	30 days	
Intrepid	4 hrs	7 days	Do not apply more than 64 fl. oz, or more than 3 applications per acre per calendar year
Javelin	4 hrs	0 days	
Knack	12 hrs	7 days	Do not exceed 2 applications per season
Lannate	48 hrs	3 days	4 applications maximum
Lime Sulfur	48 hrs	--	dormant applications only
Malathion	12 hrs	1 day	
Mustang Max	12 hrs	1 day	Do not apply more than 0.15 lb a.i. per acre per season
Oil	dry	pre-bloom	

<b>PESTICIDE</b>	<b>REI</b>	<b>PHI</b>	<b>IMPORTANT NOTES</b>
Omega 500F	72hr	30 days	Excellent for fungicide resistance management
Orbit	12hr	30 days	
Phaser	24 hrs		Post harvest only
Phostrol	4 hrs	0 days	Use in a minimum of 50 gallons/acre and spray water pH above 5.0
Prophyte	4 hrs	0 days	Use in a minimum of 50 gallons/acre and spray water pH above 5.0
Platinum	12 hrs	75 days	
Pristine	24 hrs	0 days	This material contains Cabrio and must be counted as a strobilurin (Abound, Cabrio). Do not make more than 2 sequential applications of these materials
Rampart	4 hrs	0 days	Use in a minimum of 50 gallons/acre and spray water pH above 5.0
Ridomil	12 hrs	pre-bloom/post harvest	
Sevin	12 hrs	7 days	
SpinTor	4 hrs	3 days	Maximum 29 fl oz or 6 site applications per acre per season
Switch	12 hrs	0 days	
Thionex	24 hrs	---	Post harvest only
Ziram	48 hrs	14 days	4 applications maximum. Use a PHI of 20-30 days to avoid visible residues on fruit

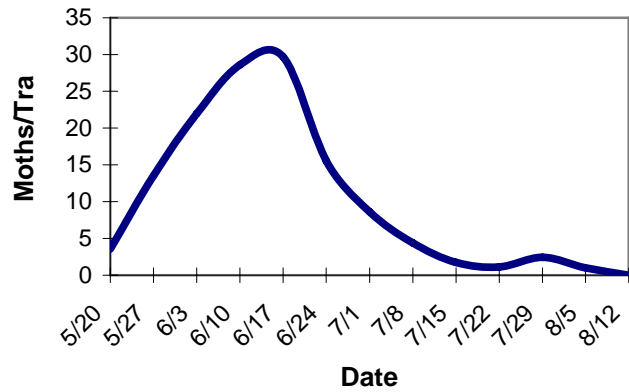
**Notes on the Timing of Insect Activity**

The following graphs summarize average trap counts of selected pests from 3 years of data collection in the Blueberry IPM Program. These graphs are only averages, since they represent about 50 traps per insect averaged over 35-38 farms for 3 years. The trap records are included here as an aide to help in the timing of insecticide applications, and to help you judge 'where you are' in relation to 'the average population.'

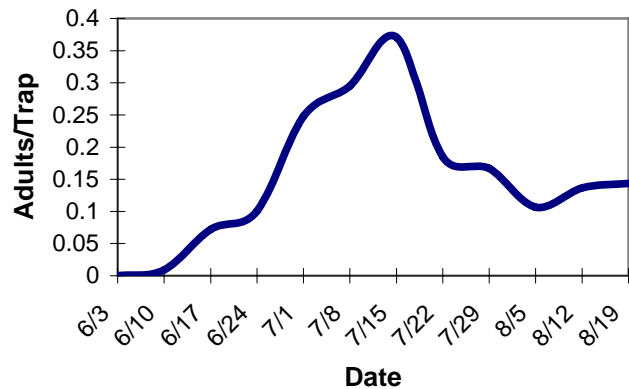
**Cranberry Fruitworm (CBFW):** Insecticides are usually applied just after the flight peak, unless you have a very high population. In this case you may wish to make 2 applications that bracket the flight peak by 7 to 10 days.

<p><b>Cranberry Fruitworm (CBFW):</b> Insecticides are usually applied just after the flight peak, unless you have a very high population. In this case you may wish to make 2 applications that bracket the flight peak by 7 to 10 days.</p>	
<p><b>Redbanded Leafroller:</b> There are 3 flights per season of this insect. In relation to the blueberry season the graph starts during the first flight, and continues just prior to the third flight. One of the most common 'worms' present during bloom are larvae from the RBLR first brood. Later during mid to late June, second brood larvae may become visible. These are produced by second flight adults. Scouting for larvae should be concentrated in the mid June period and insecticides applied if needed.</p>	

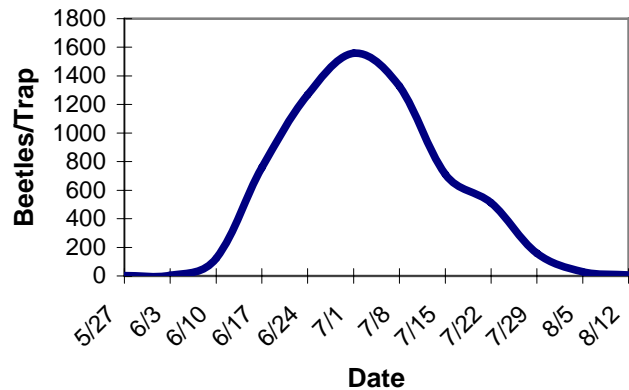
**Obliquebanded Leafroller (OBLR):** There are 2 generations per year. The insect overwinters as a partially grown larva. As the spring temperatures warm, the larvae begin to feed on fresh green tissue. These can be some of the first and biggest 'worms' present early in the season and during bloom. When the surviving larvae mature, they can produce a summer flight (small curve in late July), the larvae of which are seldom a problem.



**Blueberry Maggot (BBM):** The blueberry maggot has one generation per year, and usually starts to emerge by early to mid June. In some locations there is a late emergence which explains the late tail on the graph. Note that on average, the populations are extremely low. Even though BBM may need to be treated for the entire season, it seldom is present over the entire farm at levels that need to be treated. Trapping can be used to determine if treatments are necessary.



**Oriental Beetle (OB):** This insect has one generation per year. Overwintering larvae pupate in the spring, with adults starting to emerge in early June. Currently, the only method of control is to treat the young 1<sup>st</sup> and 2<sup>nd</sup> instar larvae, or as they emerge from eggs. Most egg laying occurs under the peak flight period, and insecticide should be applied before mid to late July. OB populations will vary greatly from farm to farm, or even within a single farm. Monitor with Japanese beetle can traps baited with OB pheromone. Experience has shown that trap catches that peak below 100-200 beetles per trap indicate low populations.



# 2009 BLUEBERRY WEED CONTROL RECOMMENDATIONS FOR NEW JERSEY

## Introduction

Weeds harm blueberries by:

1. Competing for light, water, nutrients, and space.
2. Acting as hosts for harmful insects, diseases, and nematodes, and cover for undesirable animals.
3. Reducing quality and/or yield.
4. Impeding harvest.

## Weed Control Measures

**Weed identification** is the first step in a successful weed control program. Knowledge of the weed species is needed for control measures to be successful and economical. Plan control measures when the weed is most susceptible.

Weeds can be divided into three groups.

**Annuals** are weeds that live less than 1 year. There are summer annuals and winter annuals. Summer annuals germinate in the late spring and early summer, flower and set seed in late summer or early fall and die when it gets cool. Winter annuals germinate in the fall or early spring, flower and set seed in late spring, and die when it gets hot. **Biennials** are weeds that live longer than 1 year, but less than 2 full years. Biennials often grow during the first year, then flower and die during the second year. **Perennials** are weeds that live longer than 2 years, often reproducing by horizontal shoots, roots, nutlets or rhizomes, as well as by seed.

**Grasses** are a single botanical plant family with jointed stems, leaves with parallel veins that are divided into a blade and a sheath that wraps around the stem. The seedhead is a single spike or a divided panicle, with many branched spikelets.

**Sedges** appear similar to grasses at a glance. Leaves are narrow with parallel veins, but they are not divided into a blade and sheath. The seedhead is in the form of a panicle, but sedges have a distinctly triangular stem.

**Broadleaf weeds** are a large collection of diverse plant families that have wide leaves, showy flowers, and seeds that are divided into two halves. Flower petals are generally a number that is a multiple of four or five.

Complete eradication of any weed is difficult or impossible. Established perennial weeds are among the most difficult to kill. One application of an herbicide may not provide complete control, but regrowth should be limited and competitive ability reduced. Follow-up spot treatments will improve the long-term result of the initial herbicide application, but knowledge of the life cycle of the target weed can be even more valuable.

Yellow nutsedge, a perennial, may be the most

serious weed in agriculture worldwide. Although the weed can reproduce from seed, where it is established, annual re-infestation is primarily due dormant nutlets in the soil. Nutlets are small, about the size of a pea, and are tan to reddish brown in color. They sprout in the spring and establish a plant about eight to twelve inches tall with narrow leaves and parallel veins (figure 1). At a glance the plant may appear to be a grass, but close inspection of the plant would reveal that the leaves are not divided into two parts, a blade and a sheath. Further inspection would reveal that just below the soil, the triangular stem could be detected by rolling the shoot between two fingers. Nutlets can re-sprout six to eight times if cultivation kills the shoot. After the plant becomes established, rhizomes, which are horizontal underground stems, begin to grow in late spring or early summer (figure 2). By early to mid summer, the rhizomes curve upward and produce additional plants (figure 3). The vegetative spread of the weed continues until late summer. By August in most locations, the weed can sense the approach of fall by the longer nights, and a burst of rhizome growth follows (figure 4). These rhizomes do not curve up and produce more daughter plants. They grow out and down. By early fall, a pronounced swelling can be observed at the tip of each rhizome, which matures into a new dormant nutlet (figure 5). Later in the fall, the still longer night signals that it is time for the mother plant to die, effectively separating the nutlets from the mother plant and each other (figure 6.)

Yellow nutsedge can be controlled and eventually eliminated from a field by preventing new nutlet production. This can be done by persistent control of nutsedge from late summer through early fall. The results of the effort will not be evident after one year. Too many "old" nutlets remain dormant in the soil for several years before they sprout, but after several years, success will be evident.

Good **cultural practices** can reduce many weed problems. Control difficult perennial weeds before planting a perennial crop such as blueberries. Consider sowing areas in the field where bare ground is not desired to a cool season perennial grass that will not compete vigorously with the crop, but will suppress weeds. Where a perennial grass sod is not used, consider sowing a small grain as a winter cover crop to suppress annual weeds.

**Prevent weed seed production.** Many weeds can produce 10,000 to over 100,000 seeds per plant. Most will be "hard" seed that will not germinate for several years. One good year of weed seed will last many years. Preventing seed production of new and "hard-to-control weeds" is very important. Use repeated tillage or a postemergence translocated herbicide such as a glyphosate product to control weeds the year before planting.

**Recommended vegetation management** of the floor of a blueberry field includes the separate consideration of the in-row and between-row areas.

**Between the rows**, use herbicides and/or cultivation to control weeds, or establish a perennial grass sod such as tall or hard fescue to suppress weeds. It is essential to integrate the vegetation management program with insect and disease control programs.

When cultivation is used between the rows, it should be shallow and frequent during the growing season. Annual weeds are easily controlled by cultivation when they are less than one inch tall. Weeds that are more than two inches tall are more difficult to control and may have already competed with the blueberries.

Sod between the rows prevents soil erosion, provides traction for equipment and people, increases soil organic matter, improves soil structure and water permeability, and furnishes shelter for beneficial insects. Sod also creates a friendlier environment for pick-your-own fields. The sod should not include plants that are an alternate host for insect pests, or diseases and nematodes that attack the crop. In addition, the sod should be easily maintained, tolerant to drought, low pH, require little or no fertilization, and compete very little with the blueberries.

Tall fescue or hard fescue perennial grass sods are recommended for *row middles*. Both types of fescue are tolerant to disease, drought, low pH and low fertility. They compete effectively with weeds, do not spread or creep into the row by rhizome or stolon growth, and are semi-dormant during the hot dry summer months. Tall fescue is more vigorous and is more easily established, but requires more frequent mowing. Newly developed “turf type” tall fescue varieties are vigorous, and have a lower mowing requirement than the traditional ‘Kentucky 31’ tall fescue, but have not been evaluated in blueberries. Hard fescue grows more slowly and close to the ground, and has a minimal mowing requirement, but is moderately slow and difficult to establish.

The addition of clover or other legumes is not recommended.

Prepare for sod establishment before the blueberries are planted. Control perennial weeds and nematodes, correct soil pH and nutrient deficiencies first. Complete primary tillage operations the summer before planting. Build gently sloping raised ridges for blueberry rows to improve drainage **before** sowing grass or planting blueberries.

The success of a sod planting will depend on accurate seeding and timing. Sow tall or hard fescue in late summer into a well-prepared seedbed. Use 50 to 75 pounds of seed per broadcast acre to establish tall fescue, or 25 to 50 pounds of seed per broadcast acre to establish hard fescue. Blend up to five pounds of perennial ryegrass per one hundred pounds of hard fescue seed to provide a fast, thin cover while the hard

fescue gets established. The perennial ryegrass will be eliminated from the stand by disease and drought in a few years.

Use a seeder that will ensure good seed placement in a firm seedbed with good seed and soil contact. Failure to use adequate equipment for seeding frequently results in poor establishment. In an area like New Jersey, complete seeding by September first in the northern counties of New Jersey, and by September twentieth in the southern counties. Apply 50 pounds of nitrogen (N) per acre at seeding and repeat in late fall or early spring to encourage rapid establishment.

Excellent results have been obtained by seeding perennial grass in-the-row as well as between the rows. Use perennial ryegrass rather than fescue. Rapid establishment and growth, and susceptibility to herbicides make perennial ryegrass a better choice than fescue for seeding in-the-row. Kill the sod in the row before the blueberries are planted and “no-till” the plants into the dead sod. Use recommended herbicides to control weeds. The sod’s roots increase soil organic matter, and improve soil structure and water permeability, and the sod acts as a mulch to conserve water and prevent erosion during the establishment year. By fall, the dead sod deteriorates and is not attractive to rodents.

**In-the-row**, a weed free zone should be maintained where weed competition with the crop is severe. Control in-row weeds with herbicides or mulch. The use of mechanical cultivation equipment in the row is seldom recommended due to risk of damaging the shallow roots of the blueberries.

The width of the weed free zone should be about 36 to 48 inches wide, or about 18 to 24 inches on each side of the row. This weed free strip should be about forty percent of the distance between the rows. The width may vary, however, depending on soil fertility, water holding capacity and exposure to erosion. Do NOT reduce the width of the weed free zone in young nonbearing fields. Maintain the full width of the vegetation free zone in new plantings to achieve maximum growth of the blueberries.

## Mulches

**Mulches** control annual weeds and provide additional horticultural benefits in many fields. When using mulch for weed control, apply the mulch three to four inches thick when the rows are weed free. Thinner layers of mulch may not smother emerging weeds. All organic mulches break down over time tie up important nutrients, so the use of mulch may require additional fertilizer. Reapply mulches annually or when needed to maintain weed suppression. Choose mulch products such as sawdust or wood chips. Avoid mulches such as straw that provide a favorable environment for rodents such as field mice and voles that may damage blueberries.

## Weed Control with Herbicides

A good weed management program is needed in blueberries.

**Chemical weed control** has many advantages.

1. It is effective.
2. It is economical.
3. It is safe, when used correctly.
4. It eliminates bark injury from close cultivation.
5. It eliminates root pruning from cultivating too deep.
6. It reduces rodent injury by eliminating cover.

Choose herbicides for use in the row that are labeled, have adequate crop safety (Table 1), and control the weeds in your field (Table 2). Use the correct amount of residual herbicides for each soil type (Table 3).

Table 1. Crop Safety of Blueberry Herbicides

	New	Establish
	ed	
<b>Incorporated (residual)</b>		
Treflan	L	L
<b>Preemergence (residual)</b>		
Devrinol	G	G
Callisto	G	G
Chateau	F	G
Gallery	G	--
Karmex/diuron	--	F/G
Casoron/Norosac	L	G
Princep/simazine	--	F/G
Sinbar	--	F
Solicam	F/G	G
Surflan	G	G
Velpar	P	P/F
<b>Postemergence (selective)</b>		
Fusilade DX	G	--
Kerb	--	G
Poast	G	G
Select/Select Max	G	--
<b>Postemergence (nonselective)</b>		
Paraquat products	G	G
Glyphosate prod. <sup>1</sup>	G <sup>1</sup>	G <sup>1</sup>

G = Good

L = Labeled (data insufficient or not

F = Fair (use with care - recommended)

P = Poor (not rec.)

-- = NOT LABELED (**DO NOT USE**)

<sup>1</sup>Do NOT allow spray to contact young or green (living) bark or leaves.

The use of a single herbicide repeatedly will lead to an increase in resistant weeds. Use herbicide combinations, herbicide rotations, and sequential or spot treatments in a well-managed weed control program to eliminate or minimize problems. The recommended herbicides have been evaluated for crop safety and effectiveness. Information on all varieties is incomplete. Use herbicides with care on new varieties.

## Herbicides

### Residual

Residual herbicides remain in the soil and kill weeds through their roots for up to several months. Apply before weeds germinate. Weeds begin to compete with most crops within 2 to 4 weeks. Some products are effective only on germinating seeds. If weeds are present, a postemergence herbicide can be combined with a residual herbicide. Residual herbicides are applied incorporated or preemergence.

### Incorporated

Incorporated herbicides are mechanically mixed with the soil. This application method is NOT well suited to blueberries. It is difficult or impossible to incorporate herbicides near the crown of the blueberry plant, and shallow roots may be pruned by the incorporation equipment.

### Preemergence

Preemergence herbicides are applied to the soil surface. Rainfall or overhead irrigation before weeds emerge is needed to move the herbicide into the soil. Use a preemergence herbicide in combination with a postemergence herbicide if weeds have emerged, unless the preemergence herbicide also controls weeds postemergence.

### Postemergence

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 kill or injure any treated plant. They may be *contact* or

*translocated.*

*Contact* herbicides work only where they are placed. Thorough spray coverage is essential for good results. Roots of established annual weeds and perennial weeds often survive.

*Translocated* herbicides move systemically in the weed after treatment. Application at the proper growth stage will often result in good control of the roots as well as tops of established annuals and perennial weeds. Results of translocated herbicides may not be evident for several days or weeks.

**CAUTION:** Strict rate control is necessary.

Improperly applied herbicides or herbicides applied above recommended rates may cause damage to blueberries.

Residual herbicide rates must be matched with soil type and percentage of organic matter to obtain good weed control and crop safety (see Table 5.3). 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.

**Be aware** that most herbicide labels are written for “typical agricultural soils”, and that many common blueberry fields are not “typical”. Most coarse textured soils, such as loamy sands and sandy loams, are low in organic matter, often less than 2 percent. Medium textured soils, such as loams, may have 2 to 4 percent organic matter. Fine textured soils such as silt loams and clay loam soils typically have 4 to 8 percent organic matter. Many traditional “black” blueberry soils may be classified as loamy sands, but may have organic matter contents over 8 percent. Have your soil analyzed for percent organic matter. This is a separate test that must be requested from most soils laboratories. If your soil has an organic matter content higher than the choices listed on the herbicide label for your soil texture, choosing the correct rate may be difficult. **Consult your Local Cooperative Extension Service for assistance in determining the correct herbicide rate to use on your soil if needed.**

**Herbicide application** should be accomplished with a “conventional” fixed-boom sprayer calibrated to accurately deliver 20 to 60 gallons of water per acre using flat fan nozzles at 30 to 40 psi, unless otherwise stated. **Herbicide rate recommendations are made on a broadcast basis** (amount of herbicide applied per sprayed acre, or 43,560 ft<sup>2</sup>).

**Good agitation** is needed for uniform distribution of the chemical in the spray solution. It is most important when wettable powder, flowable or water dispersible granules/dry flowable formulations are sprayed. Good agitation can be achieved mechanically with paddles or hydraulically with spray material from a bypass line. Do not use the pressure regulator bypass

for agitation. If hydraulic agitation is used, be sure the pump has the capacity to spray and agitate at the same time. Tank shape also affects agitation. Corners and edges in tanks increase the agitation requirement. The boom should be modified to reach under the crop canopy. The outside nozzle may be of the offset type to reach into the middle of the row.

**Nozzle tips** may be made from many materials. Plastic and brass tips wear more rapidly and should be replaced annually. Use **ONLY** stainless steel or tungsten carbide nozzles with wettable powder, flowable or water dispersible granules/dry flowable formulations. These products are abrasive and wear other tips too quickly.

**Flat fan nozzle tips** are designed for herbicide application. Most herbicides should be applied with an 8002 to 8004 nozzle. Most herbicides can be applied effectively with flat fan nozzles using between 15 and 50 gallons of water per acre.

**Flood jet nozzle tips** are economical to use but do not provide the uniform coverage obtained with flat fan nozzles.

## “Between Row” Weed Control

Establishment of a dense sod that is competitive with weeds will require fifteen to twenty months. Some additional effort during this period will ensure success.

Broadleaf weeds are undesirable in a sod growing between blueberry rows. Competition with the crop and mowing requirements may be increased. Many weeds may be alternate hosts for diseases, insects, or nematode pests. The flowers of dandelion, clover, mustard species and other weeds may coincide with bloom and are preferred by pollinating insects. The same weeds, and others, may also bloom before or after the crop blooms and attract bees into the field when insecticides must be sprayed. The seedheads of dandelion clog tractor radiators and cause overheating, which can interfere with crop maintenance operations.

Apply Gallery 75DF to the sod early each spring, after the sod is at least six months old and while the field is nonbearing, to control large crabgrass and other summer annuals. Use 1.0 pound of Gallery (0.75 pounds of active ingredient) per acre. This is the same rate of Gallery rate recommended for use in the row on newly planted non-bearing blueberries.

Clover is difficult to control, but can be suppressed or controlled in a sod with good management practices and herbicides. Manage fertilizer applications to favor grass rather than the clover. Nitrogen fertilizer stimulates grass growth, and phosphorus and potassium stimulate clover growth in a mixed grass and legume sod. Do not apply fertilizer containing phosphorus or potassium to sod if clover control is a problem. Rather apply fertilizer for blueberry growth in the vegetation free strip. Mowing height also influences the composition of a mixed grass and clover sod. Close

mowing favors the clover. Taller sod will favor the grass. Mow no closer than four inches if clover control is a problem in the sod.

## **“In Row” Weed Control**

### **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 Gallery 75DF 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 buds 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 Gallery, 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 also 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 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.

In recent years, Princep and Karmex 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 or the sprayable formulation, Casoron SC, at 2.8 gallon per acre. Casoron will control early season annual grasses, but a residual annual grass herbicide should be applied in the spring for full season control.

Consider spot treating with a labeled glyphosate product if perennial weeds are present and treatment is recommended in the fall.

The use of a grass herbicide in the fall depends on the product chosen. Kerb 50WP is 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 50WP.

Solicam 90DF, Surflan 80WP, and Devrinol 50WP are annual grass herbicides that should be applied in late fall or as a split application, half in the fall and the second half in the spring. Use the split application when grass pressure is heavy for best results. The use of these herbicides in spring only has resulted in inconsistent weed control when dry weather followed the application.

Sinbar 80DF applications for annual grass control should be applied only in the spring. The relatively high solubility of Sinbar 80WP results in leaching when applied in the fall. Increased risk of crop injury and poor weed control can result.

**Follow up Spring Applications** should include a different residual broadleaf weed herbicide and a residual grass herbicide. Add a postemergence herbicide only if needed. Use Karmex 80DF for residual broadleaf weed control if Princep was used in the fall, or use Princep if Karmex was used in the fall. Apply Sinbar 80DF or the second half of a split herbicide treatment of Solicam 80PF, Surflan 80WP, or Devrinol 50DF for annual grass control. Include a paraquat product *if* seedling annual weeds are observed.

In recent years, Princep, Karmex, and Sinbar 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, a shift toward biotypes of the same species that germinate later in the summer when the herbicide is less effective, or the development of triazine resistant biotypes. Add Callisto or Chaeau to your spring tank-mix to improve control of summer annual broadleaf weeds in these fields.

Spot treat with a labeled glyphosate product to control established perennial grasses and broadleaf weeds. Sinbar 80DF is also effective for seedling weed control postemergence. No other postemergence herbicide may be needed if no established weeds are present and seedling annual weeds are sprayed with Sinbar before they exceed 1 inch in height.

**Table 2A. Herbicide Effectiveness on Major Summer Annual Weeds**

Herbicide	Barnyardgrass	Crabgrass, large	Fall panicum	Foxtail spp.	Goosegrass	Johnsongrass (seedlings)	Annual Sedge	Carpetweed	Cocklebur, common	Galinsoga, hairy	Jimsonweed	Lambsquarter, common	Morning glory spp.	Nightshade, eastern black	Shepherdspurse	Pigweed spp.	Purslane, common	Ragweed, common	Smartweed, Pennsylvania	Velvetleaf
<b>Pre-emergence (residual)</b>																				
Devrinol	G	G	G	G	G	G	P/F	G	N	F/P	N	F/G	N	N	-	G	F	P/F	P	N
Callisto	P	P	P	P	P	P	F	G	G	G	G	G	F	G	G	G	-	F	F/G	G
Chateau	F	F	F	F	F	F	P	G	-	-	G	G	G	G	G	G	G	G	G	G
Gallery	N	N	N	N	N	N	N	F	-	G	G	G	G	G	G	G	G	G	G	G
Karmex	G	F/G	G	G	F/G	N	F/G	G	-	G	G	G	G	G	G	G	G	G	F	G
Kerb	G	G	G	G	G	-	N	G	N	P	N	G	-	-	-	G	G	P	-	Kerb
Norosac/Casoron	F/G	F/G	F/G	F/G	F/G	F/G	G	-	-	-	-	G	-	-	G	G	-	G	-	-
Princep	F	F/F	F	G	F/G	P	F/G	-	F/G	G	G	G	G	G	G	F	G	G	G	-
Sinbar	G	G	G	G	G	-	G	G	-	G	G	G	G	G	G	F	G	G	G	G
Solicam	G	G	G	G	G	-	F/G	P	P	-	F	F	-	-	-	F	G	F/G	-	F
Surflan	G	G	G	G	G	G	N	F/G	N	N	N	F/G	N	P	N	F/G	F/G	N	P	P
Velpar	G	G	G	G	G	-	G	G	G	G	G	G	G	-	G	G	G	G	G	G
<b>Post-emergence (selective)</b>																				
Fusilade DX	G	F/G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Poast	G	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Select	G	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N
<b>Post-emergence (non-selective)</b>																				
Paraquat products	F/G	F/G	F/G	G	F/G	-	G	-	G	G	G	F/G	F/G	-	-	G	F/G	G	-	-
Glyphosate products	G	G	G	G	G	G	F	G	G	G	G	G	F	G	G	G	G	F	G	G

Herbicide performance is affected by weather, soil type, herbicide rate, weed pressure, and other factors. These ratings indicate ONLY relative effectiveness in tests conducted by the University of Maryland and Rutgers, The State University of New Jersey, on coarse- to medium-textured soils. Actual performance may be better or worse than indicated in this chart.

G = Good    F = Fair    P = Poor    N = None    - = Insufficient data

**Table 2B. Herbicide Effectiveness on Major Winter Annual & Perennial Weeds**

Herbicide	Annual Bluegrass	Annual Bromegrass	Chickweed spp.	Corn Chamomile	Groundsel	Henbit	Horseweed	Mustard spp.	Bermudagrass	Quackgrass	Yellow Nutsedge	Aster sp.	Bindweed spp.	Canada Thistle	Goldenrod spp.	Hemp Dogbane	Red Sorrel	Mulberry	Poison Ivy	Virginia Creeper
Pre-emergence (residual)	Winter Annuals								Perennials											
Devinol	G	G	F	P	N	P	N	P	N	N	P	N	N	N	N	N	N	N	N	N
Callisto	P	P	G	P	-	-	G	G	N	N	F	P	P	P	P	P	P	P	P	P
Chateau	P	P	G	-	-	G	F/G	G	N	N	N	F	P	P	P	P	F	P	P	P
Gallery	G	G	G	G	G	G	-	G	N	N	P	P	P	P	P	P	P	N	N	N
Karmex	G	F	G	G	P	G	G	G	N	P	P	P	P	P	P	P	P	N	N	N
Kerb	G	G	N	N	N	N	N	N	P	G	N	N	N	N	N	N	N	N	N	N
Norosac/Casoron	F	G	G	G	G	G	G	G	F	F	F/G	F/G	F/G	F/G	F/G	F/G	F/G	P	P	P
Princep	F	F	G	G	P	G	G	G	N	P	P	P	P	P	P	P	P	N	N	N
Sinbar	F/G	F/G	G	G	P	G	G	G	N	P	P	P	P	P	P	P	P	N	N	N
Solicam	G	G	F	F	P	F	P/F	F	P	F	F	P	P	P	P	P	P	P	P	P
Surflan	G	G	F	P	N	P	P	P	N	P	P	N	N	N	N	N	N	N	N	N
Velpar	G	G	G	G	-	G	F/G	G	P	F	F	F/G	F	F	F	F	F	P	P	P
Post-emergence (selective)																				
Fusilade DX	P	G	N	N	N	N	N	N	G	G	N	N	N	N	N	N	N	N	N	N
Poast	P	G	N	N	N	N	N	N	G	G	N	N	N	N	N	N	N	N	N	N
Select	G	G	N	N	N	N	N	N	G	G	N	N	N	N	N	N	N	N	N	N
Post-emergence (non-selective)																				
Paraquat products	G	G	G	G	F	G	F	G	P	P	P	P	P	P	P	P	P	P	P	P
Glyphosate products	G	G	G	G	G	G	P/G	G	F	G	G	G	G	G	G	G	G	G	G	G

Herbicide performance is affected by weather, soil type, herbicide rate, weed pressure, and other factors. These ratings indicate ONLY relative effectiveness in tests conducted by the University of Maryland and Rutgers, The State University of New Jersey, on coarse- to medium-textured soils. Actual performance may be better or worse than indicated in this chart.

G = Good      F = Fair      P = Poor      N = None      — = Insufficient data

**Table 3. Preemergence Herbicide Rates (in Active Ingredients) for Common Soil Types**

Soil Type % Organic Matter	Sand		Loamv Sand		Sandy Loam			Loam		Silt Loam		Clay Loam	
	0-1	1-2	0-1	1-2	0-1	1-2	2-4	1-2	2-4	1-2	2-4	1-2	2-4
<b>Preemergence</b> (residual)													
Devrinol <sup>1</sup>	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4
Callisto <sup>1</sup>	.09-.19	.09-.19	.09-.19	.09-.19	.09-.19	.09-.19	.09-.19	.09-.19	.09-.19	.09-.19	.09-.19	.09-.19	.09-.19
Chateau <sup>1</sup>	.19-.38	.19-.38	.19-.38	.19-.38	.19-.38	.19-.38	.19-.38	.19-.38	.19-.38	.19-.38	.19-.38	.19-.38	.19-.38
Gallery	<sup>3</sup> / <sub>4</sub>	<sup>3</sup> / <sub>4</sub>	<sup>3</sup> / <sub>4</sub>	<sup>3</sup> / <sub>4</sub>	<sup>3</sup> / <sub>4</sub>	<sup>3</sup> / <sub>4</sub>	1	<sup>3</sup> / <sub>4</sub>	1	1	1	1	1
Karmex <sup>2</sup>	—	—	—	1	—	1½	1½	1½	2	2	2	2	2
Kerb	2	2	2	2	2	2	2	2	2	2	2	2	2
Norosac/Casoron	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6
Princep <sup>2</sup>	—	—	—	—	—	2	2	2	3	2	3	3	4
Sinbar <sup>2</sup>	—	—	—	—	—	1	1½	2	2	2½	2½	2½	2½
Solicam	—	—	—	2	—	2	2½	2½	2½	2½	3	3	4
Surflan <sup>1</sup>	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4
Velpar <sup>1</sup>	—	—	—	—	—	—	0.5	—	0.5	0.5	0.75	0.75	1.0

<sup>1</sup>Use the lower recommended rate when tank-mixing with another preemergence herbicide, unless annual grass pressure is severe.

<sup>2</sup>Use one-half the recommended rate when tank-mixing with another preemergence herbicide.— = NOT LABELED (DO NOT USE).

### **Influence of Soil and Water (rainfall & irrigation) on Herbicides**

Most weed control programs rely on non-residual postemergence (knockdown) herbicides, and residual preemergence herbicides to control weeds. Applications are typically sprayed once a year in the spring, or twice a year, in late fall and late spring. Residual herbicides applied at these times are relied on to control weeds through the summer months and harvest.

After application to the soil surface, most residual herbicides must be moved into the soil by rainfall or overhead irrigation to be effective. The amount of rain or overhead irrigation needed depends on weeds targeted, soil properties, and the chemical properties of the herbicide.

**Weeds Targeted:** Many weeds, such as pigweed species, produce huge numbers of tiny seeds. Small seeds must germinate at or very near the surface of the soil. Other weeds, such as morninglory seeds or yellow nutsedge tubers, can germinate or sprout from deeper in the soil. Early in the season, herbicides must be moved further into the soil to control weeds that germinate or sprout from deeper in the soil. Later in the season, shallow germinating weeds may become established and escape control if the herbicide has moved too deep into the soil to be available during weed emergence and establishment.

**Soil Properties:** Soil can have a strong influence on weed growth and residual herbicide effectiveness. The soil characteristics that influence herbicide effectiveness include texture, percent organic matter and pH. Soil maps list soil texture and standard soil tests use the "feel" method and may be inaccurate. A

mechanical analysis of your soil will determine the amounts of sand, silt and clay in the mineral portion of the soil. Have soil texture determined by mechanical analysis one time. The texture will not change unless soil is lost by erosion or other means. Sand particles are the largest, silt is medium in size, and clay particles are the smallest. Soils with a large percentage of large sand particles are considered to be coarse in texture and are called sand, loamy sand, or sandy loam. Soils with a moderate amount of each size soil particle are considered to be medium in texture, and are called loam, or silt loam. Soils with a large percentage of small clay particles are considered to be fine in texture and are called silty clay loam, clay loam, or clay.

Soil particles are negatively (-) charged. The negative charge of soil particles attracts positively (+) charged fertilizer molecules such as H<sub>2</sub>PO<sub>4</sub><sup>+</sup>, K<sup>+</sup>, Ca<sup>++</sup>, Mg<sup>++</sup> and many herbicides. The attraction of the positive charge to the negative charge of the soil particles slows leaching. Other fertilizer molecules, such as NO<sub>3</sub><sup>-</sup> and a few herbicides, have a negative charge. Negatively (-) charged molecules are not bound to the soil and are more subject to leaching, especially if they are highly soluble in water. Since substances that are positively (+) charged are called cations, the measure of a soil's ability to hold onto cations is called the **Cation Exchange Capacity** or **CEC**. Sand is the largest particle in size and has the lowest CEC value, less than one. Silt is intermediate in size and has an intermediate CEC value, near five. Clays are the smallest soil particles and have the highest CEC value of the mineral component of soil, near thirty-five, depending on the type of clay.

**Organic matter** makes up only a small part of most soils, usually between 0.5 and 5.0 percent in soils across the northeastern United States, but it has the highest CEC value, near two hundred. Traditional

“black” blueberry soils may have organic matter contents well over 5 percent. Even small changes in the percent organic matter in soils, especially sandy soils, can have a strong influence on herbicide performance. That is the reason small changes in percent organic matter may require herbicide rate changes. Rate tables may have several columns with different herbicide rates for different levels of organic matter in each soil type.

Soil pH also affects the performance of some herbicides by influencing the degree of attraction to soil particles. The pH of soils suited to blueberry production is lower than the recommended soil pH levels for many crops, which range between 6.0 and 7.0. Low pH, below 6.0, or high pH, above 7.0, may affect the availability of certain herbicides by changing the positive (+) charge of the molecule. Weed control may be reduced and/or herbicide carryover may be increased if the herbicide is more tightly bound to the soil. The risk of crop injury may increase if an herbicide is less tightly bound to the soil, and more available. Herbicides that are affected by pH may have **DO NOT USE** warnings on the label if the soil pH is above or below a value that increases the risk of crop injury, herbicide carryover, or poor weed control.

**Chemical Properties of the Herbicide:** The solubility, or the ease with which an herbicide dissolves in water affects the rate of movement through the soil (Table 4). A herbicide that is more soluble in water may be “activated” by less rainfall or irrigation, but may not provide the length of control that could be obtained with a less soluble herbicide, especially in a coarse textured soil low in organic matter.

In addition, most residual herbicides can become bound to soil particles. When attached, or bound to the soil, these individual molecules of herbicide are not available to the weeds or the crop.

Herbicides can be held onto by the soil to varying degrees (Table 4). The degree of binding is influenced by the chemistry of the herbicide and the **Cation Exchange Capacity (CEC)** of the soil. Lower herbicide rates are needed to prevent crop damage in soils with a low CEC. Plant nutrients, such as NO<sub>3</sub><sup>-</sup>, and herbicides with a negative (-) charge are not held by the soil, leach more rapidly, and are less affected by soil texture than those with a positive (+) charge.

**Table 4. Residual Herbicide Water Solubility and Soil Adsorption Characteristics<sup>1</sup>.**

Herbicide	Solubility	Soil Adsorption
Devrinol (napropamide)	Moderate	Strong
Callisto (mesotrione)	Moderate	Moderate/Strong
Chateau (flumioxazin)	Very Low	NA
Gallery (isoxaben)	Very Low	Strong
Karmex (diuron)	Low	Strong
Kerb (pronamide)	Low to Moderate	Strong
Norosac/Casoron (dichlobenil)	Low	Moderate
Princep (simazine)	Very Low	Moderate
Sinbar (terbacil)	Moderate	Weak
Solicam (norflurazon)	Low to Moderate	Strong
Surflan (oryzalin)	Very Low	Strong
Velpar (hexazinone)	High	Weak

<sup>1</sup> Herbicide Handbook, Weed Science Society of America, Eighth Edition - 2002

Non-residual postemergence herbicides have no activity after application for one of two reasons (Table 5). Some herbicides are too tightly bound to the soil to be available to plants after application. Care must be exercised in soil-less growing environments, where surprising residual activity can be observed from these herbicides. Other herbicides are highly soluble in water and are not bound to soil particles. Residual activity from these herbicides can be observed in the soil, but it often lasts only a few days. They are rapidly leached out of the zone of weed seed germination and degraded by soil microorganisms.

Glyphosate products, including Roundup products, Touchdown products, Glyphomax Plus and other labeled glyphosate formulations, and paraquat products, including Gramoxone Inteon, Firestorm, and other labeled paraquat products, are too tightly bound to the soil to have residual activity. These herbicides are completely unavailable to plants after application. They remain tightly bound to the soil until broken down. Glyphosate can be degraded or digested by soil microorganisms. Residual activity from glyphosate has been observed when used in greenhouses, on plastic mulch, and near hydroponic growing systems. Paraquat is degraded by sunlight, and is less likely to

cause problems when used on plastic mulch, in greenhouses, or near soil-less growing systems.

**Table 5. Non-Residual Herbicide Water Solubility and Soil Adsorption Characteristics.**

Herbicide	Solubility	Soil Adsorption
Fusilade 2000 (fluazifop butyl)	Very Low	Very Strong
paraquat products	Very High	Very Strong
Poast (sethoxydim)	Moderate to Very High <sup>1</sup>	Moderate
Select products (clethodum)	NA	Weak
glyphosate products	Very High	Very Strong

<sup>1</sup> pH dependant

## Trickle Irrigation

Efficiency, water conservation, and disease control are reasons to consider trickle irrigation. The crop can be irrigated using less water provided by a smaller pump delivered at lower pressure than with traditional overhead sprinkler systems. In addition, evaporation losses are lower. Since trickle lines and micro-sprinklers operate under the crop, the fruit and foliage remain dry, reducing the incidence of many diseases. **Unfortunately, improved weed control is NOT a benefit of trickle irrigation. Expect higher herbicide and application costs, and less effective and less consistent weed control in trickle irrigated fields.**

No herbicide, not even the least soluble in water and most tightly bound to the soil, can withstand leaching from the volume of water that flows from an emitter hole in trickle irrigation tubing. Herbicide failure can be first observed in fields under trickle irrigation by small tufts of weeds growing at each emitter. As the season progresses, the weeds grow more readily, and the spot enlarges as a wider area is leached free of herbicide. Although the irrigation prevents the crop from water stress, weeds can be fierce competitors for nutrients and sunlight, and can interfere with harvest. In many annual crops the increased weed pressure and interference with cultivation observed has restricted trickle irrigation to use with plastic mulch for weed control.

Modifications to the trickle irrigation system can moderate the weed control problem. Any change in the system that reduces the volume of water applied at a point source will reduce herbicide leaching. Unfortunately, reducing the distance between the holes in traditional trickle tubing to increase distribution is not likely to eliminate the weed problem. Burying the tubing more than four inches deep before planting new

fields or under several layers of organic mulch will effectively reduce the adverse affects on residual herbicides, since their effectiveness is usually confined to the upper two to four inches of soil. Switching from trickle tubing that drips, to micro-sprinklers in crops where they can be used also effectively reduces the adverse affects of the irrigation on weed control.

When trickle irrigation will be used, choose herbicides for the residual herbicide weed control program during the irrigation season that are least soluble in water and most tightly adsorbed by the soil (Table 4). On coarse textured sandy soils low in organic matter, Surflan (oryzalin) and Princep (simazine) for annual grass and annual broadleaf weed control respectively, are the best choices, based on very low water solubility of both herbicides. On fine textured soils and soils higher in organic matter, Surflan (oryzalin) and Karmex (diuron) for annual grass and annual broadleaf weed control respectively, are the best choices based on their very low and low water solubility respectively and strong adsorption to the soil. Unfortunately, certain weeds, including yellow nutsedge, escape this herbicide combination. Adjust the application timing in the spring so the herbicides can be “activated” by 1 to 2 inches of rainfall or overhead irrigation before the trickle irrigation is used. This will allow the herbicides to move into and be attached to the soil before being subjected to the intense leaching of the trickle irrigation. Remember that choosing the herbicide(s) that are least soluble in water and most strongly adsorbed to the soil will delay, but not prevent, herbicide failure and weed breakthroughs in trickle irrigated crops. Coarse textured sandy soils and soils low in organic matter that require frequent irrigation, increase the likelihood of weed control failure, especially during prolonged periods of heat and drought stress. Plan to use repeated applications of non-residual postemergence herbicides on a regular schedule, every 2 to 4 weeks during the growing season to control weeds in trickle irrigated crops. Time the application of residual herbicides to derive the maximum benefit from their use when harvest approaches and preharvest interval (PHI) restrictions will not permit the continued use of the non-residual postemergence herbicides.

## Herbicide Recommendations

### Preemergence Herbicides

**Devrinol (napropamide) — 2-4 lb ai (active ingredient)/A.** Use 4-8 lb/A Devrinol 50DF. Apply in late fall and/or early spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Use the high rate for long-term control (4

to 8 months) and the low rate for short-term control (2 to 4 months). Devrinol controls primarily annual grasses. Tank-mix with Princep plus a postemergence herbicide in late fall or with Goal 2XL/Galigan 2E or reduced rates of Princep, Karmex, OR Sinbar in the spring when labeled for the crop to control annual broadleaf weeds.

For newly planted (nonbearing) fields.

For established (bearing) fields.

Callisto (mesotrione) - .094 to 0.188 lb ai/A. Use 3 to 6 fluid ounces/A of Callisto 4F. Apply in the late fall after leaf drop and/or in early spring, before bud break as a directed spray toward the base of the bush.. Add oil concentrate to be 1% of the spray solution. Callisto controls many annual broadleaf weeds including horseweed and common lambsquarter. Tank-mix with an appropriate postemergence herbicide for broad spectrum control of emerged weeds. Tank-mix with a residual grass herbicide to improve annual grass control. Do not apply Callisto after the onset of bloom. Do not apply more than 6 fluid ounces of Callisto per acre in one year.

For newly planted (nonbearing) fields.

For established (bearing) fields.

**Chateau (flumioxazin) — 0.19 to 0.38 lb ai/A.**

Use 6 to 12 dry ounces/A of Chateau 51WDG. Apply in the late fall after leaf drop or in early spring, before bud break. Chateau controls many annual broadleaf weeds, and controls or suppresses annual grasses. Tank-mix with an appropriate postemergence herbicide for broad spectrum control of emerged weeds. Tank-mix with a residual grass herbicide to improve annual grass control. Do not apply allow spray to contact foliage or new green bark. Do not use more than 6 dry oz/A in orchards where the soil contains more than 80% sand (sands and loamy sands) until the crop has been in the field for three years. Do not apply within 300 feet pears of pears that are not dormant. Read and follow all warnings on the Chateau label. Chateau can be difficult to clean out of a sprayer. Follow tank and sprayer “Clean Out Instructions” on the label if the tank or any part of the sprayer will be used to spray other crops.

For newly planted (nonbearing) fields.

For established (bearing) fields.

**Gallery 75DF (isoxaben) — 0.75–1.0 lb ai/A.**

Use 1.0 to 1.33 lb/A Gallery 75DF. Apply in late fall or early spring to weed-free soil to control many broadleaf weeds. In newly planted trees, allow the soil to settle and fill any depressions around the tree before application. Add a postemergence herbicide to improve the control of emerged weeds. Gallery primarily controls annual broadleaf weeds. Tank-mix

with Surflan to control annual grasses.

For newly planted (nonbearing) fields.

CAUTION: Gallery is NOT labeled for BEARING BLUEBERRIES.

**Karmex (diuron) — 1.0-2.0 lb ai/A.** Use 1.25-2.5 lb/A Karmex 80DF. Apply in late fall or spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Primarily for annual broadleaf weed control. Tank-mix with Surflan, Solicam, Devrinol, OR a reduced rate of Sinbar. Tank-mixing will improve crop safety and the range of weeds controlled.

For established (bearing) fields.

**Kerb (pronamide) — 2 lb ai/A.** Use 4 lb/A Kerb 50WP. Apply in late fall when soil temperatures are between 35° and 55°F (1.67° and 12.8°C). Spring transplants should be at least six months in the field, and fall transplants should be in the field for twelve months prior to treatment. Primarily controls perennial grasses, including quackgrass, bluegrass, ryegrass sp., fescue sp., and also provides early control of annual grasses the following spring.

Apply Surflan, Solicam, or Sinbar the following spring for full season annual grass control. Tank-mix Kerb with Princep for residual broadleaf weed control.

For established (bearing) fields.

**Norosac/Casoron (dichlobenil) — 4-6 lb ai/A.**

Use 100-150 lb/A Norosac/Casoron 4G or 2.8 gallons/A of Casoron CS. Apply in late fall/early winter to control labeled perennial, biennial and annual weeds or in late winter/early spring, before weed growth begins and daily high temperatures exceed 50°F to control labeled annual weeds. Perennial weed control following late winter/early spring applications has been less consistent than late fall applications. Norosac/Casoron is volatile in warm temperatures and must be irrigated or mechanically incorporated after application. Significant herbicide loss may occur if applied in warm weather.

For established (bearing) fields.

**Princep (simazine) — 1-4 lb ai/A.** Use 1.1-4.4 lb/A Princep 90DF (or other labeled formulations). Apply in late fall OR spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Primarily for annual broadleaf weed control. Tank-mix with Surflan, Solicam, OR Devrinol at 1 to 2 lb ai/A, depending of soil texture and organic matter. This rate is one-half the labeled Princep rate for use alone for each soil type. Tank-mixing will improve crop safety and the range of weeds controlled.

For established (bearing) fields.

For established (bearing) highbush fields.  
For renovating established lowbush fields.

**Sinbar (terbacil) — 1.0-2.4 lb ai/A.** Use 1.25-3.0 lb/A Sinbar 80DF. Apply in the spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Tank-mix with Surflan, Devrinol, OR a reduced rate of Karmex. Use 1 to 2 lb ai/A Sinbar, depending on soil texture and organic matter. This rate is one-half the labeled Sinbar rate for use alone for the soil type. Tank-mixing will improve crop safety and the range of weeds controlled.

For established (bearing) fields.

**Solicam (norflurazon) — 2-4 lb ai/A.** Use 2.5-5 lb/A Solicam 80DF. Apply in late fall or spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Primarily for annual grass control, Solicam may provide partial control of many broadleaf weeds. Tank-mix with Princep plus a postemergence herbicide in late fall, or with Karmex, OR Sinbar in the spring, when labeled for the crop, to improve the control of broadleaf weeds.

For newly planted (nonbearing) fields.

For established (bearing) fields.

**Surflan (oryzalin) — 2-4 lb ai/A.** Use 2-4 qt/A Surflan 4AS (or other labeled formulations). Apply in late fall and/or early spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Use the high rate for long-term control (4 to 8 months) and the low rate for short-term control (2 to 4 months). Surflan controls primarily annual grasses. Tank-mix with Princep plus a postemergence herbicide in late fall or with Karmex, OR Sinbar in the spring when labeled for the crop to control annual broadleaf weeds.

For newly planted (nonbearing) fields.

For established (bearing) fields.

**Velpar (hexazinone) — 0.5-1.5 lb ai/A.** Use Velpar L (or other labeled formulations) at 1-3 qt/A for highbush blueberries to control briars, wild cherry, goldenrod, aster species, meadowsweet, red (sheep) sorrel, sheep-laurel, and other perennial broadleaf weeds. Apply to pruned blueberries in the early spring before leaf emergence. Observe a 90 day PHI in highbush blueberries.

Warning: The effect of Velpar on blueberries varies with soils, plant vigor, uniformity of application, and rainfall. Most blueberries are resistant to Velpar, but some varieties are susceptible to injury. Use lower rates on poorly drained soils, but do not apply to standing water. Do not use on sands, loamy sand, or sandy loam soils. Do not apply to snow or frozen ground. Do not use on highbush blueberries in the northeastern United States.

## Postemergence Herbicides

### Selective

**Fusilade DX 2EC (fluazifop butyl) — 0.18-0.38 lb ai/A.** Use 12-24 fl.oz./A Fusilade DX 2EC. Add 2 pints crop oil concentrate OR nonionic surfactant to be 0.25% of the spray solution (1 qt. per 100 gallons of spray solution.). Use the lower rate on most annual grasses less than 6 inches tall and to control johnsongrass. Use the higher rate to control other perennial grasses, crabgrass, and annual grasses more than 6 inches tall.

#### WARNINGS:

1. Do NOT tank-mix Fusilade DX 2EC with any other pesticide.
2. Do NOT apply within 1 hour of rainfall.
3. Do NOT apply to grasses suffering from drought, heat, cold, or any other stress condition.

For newly planted (nonbearing) fields.

For established (bearing) fields.

**Poast (sethoxydim) — 0.2-0.5 lb ai/A.** Apply 1-2.5 pt/A Poast 1.53EC. Add 2 pints crop oil concentrate per acre. Use the lower rate to control annual grasses less than 6 inches tall. Use the higher rate to control annual grass 6 to 12 inches tall and to control perennial grasses.

#### WARNINGS:

1. Do NOT tank-mix Poast with any other pesticide.
2. Do NOT apply within 1 hour of rainfall.
3. Do NOT apply to grasses suffering from drought, heat, cold, or any other stress condition.

For newly planted (nonbearing) fields.

For established (bearing) fields.

**Select 2EC & Select Max 0.97EC (clethodim) — 0.125-0.25 lb ai/A.** Apply 8 to 16 fluid ounces of Select 2EC per acre or 16 to 32 fluid ounces of Select Max per acre to control most grass weed species, including certain hard to control grass weeds, such as small grain volunteers and cover crops, and perennials such as hard fescue, tall fescue, Bermudagrass, orchardgrass, quackgrass, Johnsongrass, and wirestem muhly. Use the lower rate to control annual grasses and the perennial grasses listed above. Repeat the application if regrowth occurs. Always add oil concentrate to be 1% of the spray solution, or a minimum of 1 pint per acre, to Select 2EC. Always add oil concentrate to be 1% of the spray solution, or a minimum of 1 pint per acre, OR nonionic surfactant to be 0.25% of the spray solution to Select Max.

#### WARNINGS:

1. Do NOT tank-mix with any other pesticide unless labeled.
2. Do NOT apply within 1 hour of rainfall.
3. Do NOT apply to grasses suffering from drought, heat, cold, or any other stress condition.
4. Select is currently **LABELED** for **NONBEARING** fields only! Do NOT apply within 12 months of harvest.  
For newly planted (nonbearing) fields.

#### Nonselective

**Paraquat (Gramoxone Inteon, Firestorm, or other labeled formulations) — 0.6-1.0 lb ai/A.** Use 2.4 to 4.0 pints/A Gramoxone Inteon or 1.7–2.7 pints/A Firestorm 3SC (or other labeled formulations). Contact killer only; with no translocation or residual activity. Best results occur when weeds are 2 inches tall or less. Regrowth may occur from the root systems of established weeds. Use a surfactant to be 0.25% of the spray solution (1 qt. per 100 gallons of spray solution). Combine with recommended preemergence herbicide(s) for residual weed control. Do not allow spray or drift to contact green bark, leaves, or fruit. Crop damage may result. The use of shields, such as grow tubes or paper milk cartons greatly reduces the risk of injury in young plantings. **DANGER: Do not breathe spray mist. Read safety precautions on the label.**

- For newly planted (nonbearing) fields.  
For established (bearing) fields.

**Glyphosate (Roundup products, Touchdown products, Glyphomax Plus and other labeled formulations)** will control many serious annual and perennial weeds in blueberries. It is a translocated, slow-acting herbicide with no soil or residual activity. Results will become evident 1 to 3 weeks after application. Optimum rate and time of application depend on weed species and growth stage. Weeds should be growing vigorously when treated. Do not treat weeds that are under stress from drought, extreme heat, cold, or other adverse growing conditions.

*Broadcast:* 0.56-3.0 lb ae (acid equivalent)/A. See your product's label for the rate per acre. Apply lower rates to control seedlings and annual weeds and to suppress established perennial weeds. Use shields and do not allow glyphosate to contact the foliage or green shoots. See warnings below.

*Spot Treatment:* See your product's label for rate. Wet weed foliage thoroughly. See warnings below.

*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. The Ropewick applicator offers significant herbicide cost savings. See factsheet FS017 on Ropewick applicator construction and use warnings below.

#### WARNINGS:

1. Do NOT allow Glyphosate to contact the leaves, young green bark, fresh trunk wounds, or root suckers, or severe crop injury may occur.
2. Do NOT allow Glyphosate to contact ANY IMMATURE PART of blueberry plants.
3. Do NOT use GALVANIZED containers. glyphosate may react with the container to produce explosive hydrogen gas.

For newly planted (nonbearing) fields.  
For established (bearing) fields.

### Problem Weeds

**Annual.** A weed that lives less than 1 full year.

**Biennial.** A weed that lives longer than 1 year, but less than 2 full years. The plant often grows vegetatively during the first year, then flowers and dies during the second year.

**Perennial.** A weed that lives longer than 2 full years, often reproducing vegetatively by horizontal shoots, roots, or rhizomes, as well as by seed.

Complete weed control (eradication) of any weed is difficult or impossible. Established perennial weeds are among the most difficult to kill. One application of an herbicide recommended below may not provide complete control, but regrowth should be limited and competitive ability reduced. Follow-up spot treatments will improve the long-term result of the initial herbicide application.

#### Bindweed species (hedge and field)

These perennial weeds have deep vertical roots for food storage, and horizontal roots that spread the weed vegetatively. Shoots emerge from this extensive root system in the spring. Flowers appear in late spring and throughout the summer. They are distinctively trumpet shaped, white, or lightly tinted with lavender. Hedge bindweed flowers are 0.75 to 1.0 inches across the trumpet, while field bindweed flowers are only about 0.5 inches across the trumpet. Bindweed species are often confused with annual morningglories, which have larger bright blue flowers, simple shallower roots, and are easier to control. The leaves of bindweed species are triangular, or arrow-head shaped. The shoots grow as a vine across the ground or twining up the shoots of other plants for support. Control can be difficult due to the deep and extensive root system bindweed develops.

**Norosac/Casoron (dichlobenil) — 4-6 lb ai/A.**

Use 100-150 lb/A Norosac/Casoron 4G or 2.8 gallons/A of Casoron CS. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15<sup>th</sup>, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50°F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) fields.

**Glyphosate products.** Apply in late June when Canada thistle has flower buds or flowers, or in the fall after the shoots are 6 to 8 inches tall, but before frost. Roundup translocates into the vertical roots of the plant well, but in less quantity into the horizontal roots. Follow-up spot treatments may be needed to control regrowth from pieces of horizontal roots that were not killed by the initial application. (See warning in the “Herbicide Recommendations” section of this bulletin.)

*Broadcast:* 2.25 lb ae (acid equivalent)/A.

*Spot Treatment:* See your product’s label for rate. Wet the weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50 percent of the weed foliage for effective control. *Ropewick Applicator:* Wipe twice; travel in opposite directions for each wipe.

## Canada Thistle

This perennial weed has deep vertical roots for food storage, and horizontal roots that spread the weed vegetatively. Shoots emerge from this extensive root system in the spring. Flowers appear in late June, and seed is dispersed in July. The shoots die after the seed is dispersed. New shoots appear in late summer and grow vegetatively until frost. These fall shoots make food for the roots and do not flower.

**Norosac/Casoron (dichlobenil) — 4-6 lb ai/A.** Use 100-150 lb/A Norosac/Casoron 4G or 2.8 gallons/A of Casoron CS. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15<sup>th</sup>, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50°F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm

weather to prevent significant loss of the herbicide.

For established (bearing) fields.

**Glyphosate products.** Apply in late June when Canada thistle has flower buds or flowers, or in the fall after the shoots are 6 to 8 inches tall, but before frost. Roundup translocates into the vertical roots of the plant well, but in less quantity into the horizontal roots. Follow-up spot treatments may be needed to control regrowth from pieces of horizontal roots that were not killed by the initial application. (See warning in the “Herbicide Recommendations” section of this bulletin.)

*Broadcast:* 2.25 lb ae (acid equivalent)/A.

*Spot Treatment:* See your product’s label for rate. Wet the weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50 percent of the weed foliage for effective control. *Ropewick Applicator:* Wipe twice; travel in opposite directions for each wipe.

## Goldenrod Species

These closely related weeds are perennials that begin growth in April from rosettes or rootstocks. Typically, yellow blooms appear in late summer and the stems die in the fall. Some regrowth, as short stems or rosettes, often occurs before winter. Strong root systems overwinter and resume growth in the spring. The weeds spread using underground horizontal roots. Once established, control of this weed is difficult, since it is tolerant to most herbicides and the roots can be spread by cultivation or other tillage practices.

**Norosac/Casoron (dichlobenil) — 4-6 lb ai/A.** Use 100-150 lb/A Norosac/Casoron 4G or 2.8 gallons/A of Casoron CS. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15<sup>th</sup>, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50°F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) fields.

**Glyphosate products.** Apply in late spring after spring growth is 8 to 10 inches tall, but before the shoots become too tall for good coverage with the spray solution. Generally, banded or broadcast sprays must be applied earlier in the spring, while spot treatments and ropewick applications can be applied

later in the spring. (See warnings in the “Herbicide Recommendations” section.)

*Broadcast:* 1.5-3 lb ae (acid equivalent)/A.

*Spot Treatment:* See your product’s label for rate.

Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50 percent of the weed foliage for effective control. *Ropewick Applicator:* Wipe twice; travel in opposite direction for each wipe.

## Horseweed (Marestail)

Horseweed is a biennial plant with seed that germinates in late summer or early fall. The seedling grows as a rosette during the fall and early spring. The plant bolts during the summer, flowers, sets seed, and dies during its second late summer and fall season. The common name “marestail” is a misnomer. Herbicide labels that claim “marestail control” may be referring to another weed.

**NOTE: GLYPHOSATE RESISTANT** horseweed, also called marestail or stickweed locally, has been identified in the Mid-Atlantic Region, including New Jersey. Horseweed can behave like a biennial or summer annual weed, but usually behaves like a winter annual. The weed produces a large number of wind distributed seed in late summer and early fall. Due to the wind borne distribution of the seed, it is likely that glyphosate resistant biotypes will spread to your farm despite good integrated weed management by individual growers. Therefore, all horseweed populations should be considered potentially glyphosate resistant. Glyphosate, formulated as Roundup Ultra Max, Touchdown, Glyphomax Plus, and other generic formulations were recommended for horseweed control prior to 2003, but have been removed from the recommendations for horseweed control due to the resistance development.

**Norosac/Casoron (dichlobenil) — 4-6 lb ai/A.** Use 100-150 lb/A Norosac/Casoron 4G or 2.8 gallons/A of Casoron CS. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15<sup>th</sup>, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50°F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) fields.

Callisto (mesotrione) - .094 to 0.188 lb ai/A. Use 3 to 6 fluid ounces/A of Callisto 4F. Apply in the late fall after leaf drop and/or in early spring, before bud break as a directed spray toward the base of the bush.. Add oil concentrate to be 1% of the spray solution. Callisto controls many annual broadleaf weeds including emerged horseweed seedlings. Tank-mix with an appropriate postemergence herbicide for broad spectrum control of emerged weeds. Tank-mix with a residual grass herbicide to improve annual grass control. Do not apply Callisto after the onset of bloom. Do not apply more than 6 fluid ounces of Callisto per acre in one year.

For newly planted (nonbearing) fields.

For established (bearing) fields.

**Karmex (diuron) — 1.0-3.2 lb ai/A.** Use 1.25-4.0 lb/A Karmex 80DF. Apply in late fall to weed-free soil, or tank-mix with a paraquat product to kill existing vegetation. Use 1 to 2 lb ai/A Karmex, depending on soil texture and organic matter.

For established (bearing) fields.

**Princep (simazine) — 1-4 lb ai/A.** Use 1.1-4.4 lb/A Princep 90DF (or other labeled formulations). Apply in late fall weed-free soil, or add a paraquat product to kill existing vegetation. Use 1 to 2 lb ai/A Princep, depending of soil texture and organic matter.

For established (bearing) fields.

**Paraquat (Gramoxone Inteon, Firestorm, or other labeled formulations) — 0.6-1.0 lb ai/A.** Use 2.4 to 4.0 pints/A Gramoxone Inteon or 1.7–2.7 pints/A Firestorm 3SC (or other labeled formulations). Contact killer only; with no translocation or residual activity. Best results occur when horseweed seedlings are treated in late fall or are less than 1 inch in diameter. Two applications, two weeks apart are more effective than a single application. Regrowth may occur from the root systems of established weeds. Use a surfactant to be 0.25% of the spray solution (1 qt. per 100 gallons of spray solution). Combine with recommended preemergence herbicide(s) for residual weed control. Do not allow spray or drift to contact green bark, leaves, or fruit. Crop damage may result. The use of shields, such as grow tubes or paper milk cartons greatly reduces the risk of injury in young plantings. **DANGER: Do not breathe spray mist. Read safety precautions on the label.**

For newly planted (nonbearing) fields.

For established (bearing) fields.

## Poison Ivy

This woody perennial vine or shrub is capable of climbing a trellis. Contact with any part of the plant

may result in an itching, blistering skin rash. Nonselective postemergence herbicides must be used to control this weed. Take control measure before vine grows up the grape trunk or trellis.

**Glyphosate products.** Apply in mid- to late summer, after the weed flowers in late June or early July, or in early fall before fall colors appear. Results of the fall application may not become evident until the following spring. Best results have been obtained in late summer after the fruit has formed. (See warnings in the “Herbicide Recommendations” section of this bulletin.)

*Broadcast:* 3–3.75 lb ae (acid equivalent)/A.

*Spot Treatment:* See your product’s label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50 percent of the weed foliage for effective control.

*Ropewick Applicator:* not recommended.

“Cut Stump” Treatment: See your product’s label for rate. Apply to the cambium (inner bark area) of the stump of woody plants IMMEDIATELY after cutting. Cut and treat stumps only when the target is actively growing and not under stress. Best results are often obtained in late summer and early fall, but before fall color is observed in the foliage. Warning: Injury due to root grafting may occur in adjacent plants. Do not treat cut stumps if there is a possibility of root grafting to desirable vegetation.

## Quackgrass

This perennial plant grows actively in the late spring and early fall when daily high temperatures range between 65° and 80°F (18.3° and 26.7°C). High midsummer temperatures, above 85°F (29.4°C), and/or low soil moisture cause the weed to become dormant or semidormant until moisture and cooler weather return. The weed reproduces by seed and vegetatively by rhizomes, horizontal underground stems that eventually curve upward and make new shoots. The seedhead, which appears in June, resembles ryegrass, except each floret is rotated one quarter turn compared to ryegrass. The rhizomes are about one-eighth inch in diameter and may grow horizontally for up to several feet in length before curving upward and making a new shoot. Ryegrass does not have rhizomes.

**Glyphosate products.** Apply in late spring, May or June, or in the fall, October or November, when the weed has vigorous healthy foliage, a minimum of 4 to 6 leaves, and has begun to tiller. Do NOT till the field or otherwise disrupt the root and rhizome system of the weeds in the soil for a minimum of 8 months before treatment.

*Broadcast:* 1.5 lb ae (acid equivalent)/A.

*Spot Treatment:* See your product’s label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet weed foliage as thoroughly as possible.

*Ropewick Applicator:* Wipe in late May or June after the weed is at least one foot tall. Not recommended in the fall due to the more prostrate growth habit of the weed.

**Kerb (pronamide) — 2-4 lb ai/A.** Use 4-8 lb/A Kerb 50WP. Apply in November when soil temperatures are between 35° and 55°F (1.67° and 12.8°C). Primarily controls perennial grasses, including quackgrass, bluegrass, ryegrass sp., fescue sp., and also provides early control of annual grasses the following spring. Apply Surflan, Prowl (nonbearing only), Solicam, or Sinbar the following May or June for full season annual grass control. Tank-mix Kerb with Gramoxone Inteon or a glyphosate product and with Princep for postemergence and residual broadleaf weed control.

For established (bearing) fields.

## Virginia Creeper

Virginia Creeper is a woody perennial vine capable of climbing a trellis and smothering a grape vine. Nonselective postemergence herbicides must be used to suppress or control this weed. Remove the vine from the trellis during winter pruning and lay it on the ground or plan a “cut stump” treatment during the growing season. Do NOT “prune out” the vine during the dormant season. Good growth and maximum leaf area is needed at the time of herbicide application during the summer.

**Glyphosate products.** Apply in mid- to late summer after vine flowers in early July, but before fall color appears in the foliage. Applications in spring or early summer, before flowering, have been less effective. Repeat applications may be needed. One application may merely suppress Virginia Creeper. (See warnings in the “Herbicide Recommendations” section of this bulletin.)

*Broadcast:* 3–3.75 lb ae (acid equivalent)/A.

*Spot Treatment:* See your product’s label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50 percent of the weed foliage for effective control.

*Ropewick Applicator:* Not recommended; the creeping nature of plant is difficult to wipe.

“Cut Stump” Treatment: See your product’s label

for rate. Apply to the cambium (inner bark area) of the stump of woody plants IMMEDIATELY after cutting. Cut and treat stumps only when the target is actively growing and not under stress. Best results are often obtained in late summer and early fall, but before fall color is observed in the foliage. Warning: Injury due to root grafting may occur in adjacent plants. Do not treat cut stumps if there is a possibility of root grafting to desirable vegetation.

### **White Heath Aster & other Aster sp.**

White Heath Aster is a perennial that begin growth in April from rosettes or rootstocks. (Other asters may be annuals or biennials.) Typically, blooms are about ½ inch in diameter. The flowers have white or slightly tinted purple petals with yellow centers. They appear in late summer, set seed, and the stems die in the fall. Some regrowth, as short stems or rosettes, often occurs before winter. The weed spreads using underground horizontal roots. Once established, control of this weed is difficult since it is tolerant to most herbicides and the roots can be spread by cultivation or other tillage practices.

**Norosac/Casoron (dichlobenil) — 4-6 lb ai/A.** Use 100-150 lb/A Norosac/Casoron 4G or 2.8 gallons/A of Casoron CS. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15<sup>th</sup>, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50°F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) fields.

**Glyphosate products.** Apply in May or June after spring growth is 8 to 10 inches tall, but before the shoots become too tall for good coverage with the spray solution. Generally, broadcast sprays must be applied in May, while spot treatments and ropewick applications can be delayed until June. (See warnings in the “Herbicide Recommendations” section.)

*Broadcast:* 1.5-3 lb ae (acid equivalent)/A.

*Spot Treatment:* See your product’s label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50 percent of the weed foliage for effective control.

*Ropewick Applicator:* Wipe twice; travel in opposite direction for each wipe.

# NOTES

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