University of Massachusetts - Amherst
ScholarWorks@UMass Amherst

Cranberry Chart Book - Management Guide

Cranberry Station Outreach and Public Service Activities

3-1-2012

2012 Chartbook: Weeds

H. A. Sandler
Cranberry Station, hsandler@umass.edu

Follow this and additional works at: http://scholarworks.umass.edu/cranchart

Sandler, H. A., "2012 Chartbook: Weeds" (2012). *Cranberry Chart Book - Management Guide.* Paper 151.
http://scholarworks.umass.edu/cranchart/151

This Public Service and Outreach is brought to you for free and open access by the Cranberry Station Outreach and Public Service Activities at ScholarWorks@UMass Amherst. It has been accepted for inclusion in Cranberry Chart Book - Management Guide by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact scholarworks@library.umass.edu.

WEED MANAGEMENT 2012

Prepared by Hilary A. Sandler

NEW HERBICIDES AND UPDATES. Check our web site and upcoming newsletters for further information about any new uses or products. The manufacturer of Devrinol 10G has discontinued production of this formulation. It is still legal to use Devrinol 10G, so please check with local ag suppliers for availability. Cranberries have been removed from the Princep label; recommendations for its use have been deleted. The tolerance is still in place, so use remaining stock now.

WEED LIFE CYCLES. *ANNUAL PLANTS* complete their life cycle in one year and reproduce by seed (e.g., dodder). *PERENNIAL PLANTS* can live for many years and may reproduce by seed, runners, rhizomes, etc. Most of the weeds in cranberry production are perennials. With the exception of dodder, annual weeds are much less common and easier to control than perennials. However, infestations of annual weeds should not be taken lightly, especially on new plantings. Annual plants are designated with an (A). Unless otherwise noted, all other weeds are perennials.

WEED MAPPING. Weed maps can help you organize the management of your weed problems, especially with perennial weeds. Weed maps should be done every few years, depending on weed pressure and management objectives. Several steps are involved: 1) Correctly identify the weeds, 2) Document the location of the weeds (by drawings or photographs), and 3) Designate a priority number to the weed. Weeds are grouped into priorities (1=no tolerance; 2=serious concern; 3=less concern; and 4=lowest concern) based on their likelihood to cause yield loss, ability to spread, and the difficulty of control. Deal with the most yield-threatening weeds first. Recommended priority groupings are noted in the right-hand margin for each weed. Growers may change and adapt weeds into priority groups to best fit their own management program.

CLIPPER APPLICATORS. Roundup products are the only products currently labeled for use in clipper application (Section 2ee-'Cut Stump'). No other glyphosate products may be used in clipper applicators. Using the correct technique is critical for maximizing the performance of this herbicide application. Roundup must be applied to the stem as it is cut! Good stem coverage and adequate flow without dripping on the vines is essential. Concentrated solutions (50-100% Roundup) work best. Notations are made within each weed management description below if field studies have demonstrated clippers to be effective in giving partial or good weed control.

TIMING OF PREEMERGENCE HERBICIDES. Spring applications are typically done from March through mid-April. Fall applications are typically done 1-2 weeks after harvest but at least 2-3 weeks prior to the winter flood. See the dodder section for specifics of using PRE herbicides for dodder control.

FLAME CULTIVATION (FC) or THERMAL WEEDING. We have preliminary evidence that the use of hand-held propane torches can provide control of some weeds (e.g., dewberry, rushes, and dodder). Applications (in test studies) have been made in the summer months. FC is a good option on organic farms or as an option to continual POST herbicide use. Several torches (open flame, OF or infrared, IR) are available. Cranberry vines can be injured during a FC application but the vines will recover. Short exposures (~5 sec) provide control when using OF; longer exposures are needed (~15-30 sec) with IR.

DODDER (A) ***Cuscuta gronovii*** **PRIORITY 1**

Biology and Control. Dodder is an abundant seed producer. All management efforts should be directed towards minimizing or eliminating seed production. A single plant can produce 1,000's of seeds in one season. The seed bank is very long-lived (>13 yr), so do everything possible to eliminate seed production and/or reduce seed viability.

Dodder is an obligate parasite and must have a host plant to survive. Woody cranberry stems are somewhat less appealing to dodder, so control of succulent weeds (such as goldenrod, loosestrife and

asters) early in the season may be important. Seedlings continue to emerge over a period of 2 to 3 months, so postemergence controls are usually needed in addition to preemergence herbicides. Where dodder infestations are just beginning, careful scouting and hand removal of seedlings prior to infection is a good practice. Weeds that are infected with dodder should be completely removed from the bed; dodder stems will re-grow if haustoria (the part of the parasite that penetrates the host) remain embedded in the weed. Infected cranberry vine tips can be cut off and thrown away.

Prevention. The best management strategy for dodder control is prevention of infestation. This is best accomplished through good sanitation. Dodder seed is easily moved in harvest water and on equipment. When possible, dodder-infested beds should be harvested after clean beds. Floats used to corral berries should be inspected for the presence of dodder seed before they are placed in beds that are dodder-free. This is especially important for custom harvest operations. A good trash flow after harvest is also helpful in removing seed capsules from the bed, but is not a replacement for prevention since subsequent infestation occurs. Sometimes, growers could consider multiple trash flows if seed production is high.

Dodder may also be spread vegetatively; pieces of stem can be moved on equipment and become attached to healthy plants. Care should be taken when moving any piece of equipment from a bed infested with dodder to one that is not. Equipment should be sanitized in these situations!

Scouting. Scout in areas where infestation has occurred in the past and in bare areas in beds infested previously with dodder. Often, dodder seed will accumulate in the areas where berries are removed from the beds at harvest. Dodder seedlings may also be seen in warm, bare areas or newly sanded areas. Newly emerged seedlings are usually yellow in color, very slender, and 0.5 to 3 inches long. If the vine cover is good, move the vines aside so that you can see the duff layer; this is where early emerging seedlings will be seen.

Begin scouting for dodder in early-mid April (unless your bog history or unusual weather conditions indicates otherwise). Mild winter temperatures may promote earlier emergence of dodder. Recent research indicates that dodder populations in MA emerge slowly at first, but then quickly peak and subside. In these studies, 50% and 90% of the seedlings emerged from about 30 and 45 days after first emergence, respectively. In addition, as the seeds accumulate year after year in the soil, seedlings emerge later and later, creating overlapping generations. The most vigorous population is the one most recently seeded (from last year). It is not known how variable dodder populations are from bog to bog but variation from farm to farm is likely. Growers should consider previous successful experiences, along with scouting, and plan applications of preemergence herbicides accordingly.

Preemergence Herbicide Use. To minimize the loss of Casoron due to volatilization, apply when air temperatures are below 60°F. Apply water immediately to incorporate the herbicide into the soil and to limit volatilization loss. If frequent frost events and/or spring rains occur after application, the water may move herbicide below the dodder seed zone and reduce the effectiveness of the herbicide. Application of Casoron to vines that are stressed for other reasons may cause yellow vine syndrome symptoms or other injury. Vine injury is likely with mid to higher rates if the buds have begun growth.

We do not know if Callisto will control dodder populations when applied preemergence, though some growers have experimented with this application timing. Please contact Hilary at (508) 295-2212 x21, and let her know your observations.

Postemergence Control. For light to moderate dodder infestations, raking is not recommended. Yield and quality are reduced and dodder growth is unaffected. For heavy infestations, raking can prevent the onset of upright dieback caused by infection. It can also prevent leaf-drop due to shading of the cranberry by the dodder canopy. Raking prior to seed set is not as effective in reducing dodder seed production as raking after seed set. Raking should be done before the seed capsules begin to dry. No benefit is provided from raking earlier as the dodder stems re-grow from the portions embedded within the cranberry. No benefit is gained from raking more than once.

Trash flows after harvest are also helpful in removing seed pods (capsules) from the bog.

POST applications of Callisto seem to control dodder, especially if the host is a weed that Callisto can damage. Callisto is not effective when dodder is attached to cranberry. Dodder will turn white after application, and may re-grow. Applications made before dodder flowers seem more effective than those made after flowering; higher rates are better. There is evidence that thermal weeding may control dodder with minimal injury to cranberry. Call the Weed Specialist if you want to try this control option.

Resistance Management Concerns. Resistance to Callisto has been reported in other crops after only 7 years of use. It is important that we do not lose this tool for dodder management. Consider rotating Casoron and Callisto for dodder management and use cultural methods of control. Do not use Callisto repeatedly year after year.

CHEMICAL RECOMMENDATIONS FOR DODDER CONTROL

Preemergence		
Casoron 4G	30-60 lb/A	Apply within 10-14 days of early seedling emergence. Follow with 0.2" water to incorporate herbicide. Split applications can be used (up to a total of 100 lb/A in a 12-month period). Allow at least 3 weeks between applications. See Notes on Casoron.
Postemergence		
Callisto	4-8 oz/A	Two applications (separated by at least 14 days) of Callisto are permitted each growing season (not to exceed 16 oz/A total). As a spot application, use in 20-30 gal water. Mix 0.8 teaspoon in 1 gal water for 4 oz/30 gal water rate. Add a nonionic surfactant (NIS) at 0.25% v:v or 1.9 tsp per gallon or crop oil concentrate (COC) at 1% v:v or 2.5 Tbsp per gallon with all postemergence applications, regardless of Callisto rate. If chemigating, see Notes on Callisto at end of this section. **See Resistance Management Concerns above**.

Spring Floods. Recent research and grower experience has shown that short (24-48 hr) floods in early to mid-May may be effective for reducing dodder infestations. Research is on-going to determine the best timing for maximum efficacy. Floods should cover vine tips adequately. No adverse vine or yield impact has been reported when growers have held these spring floods. Dodder floods may coincide with floods used to control black-headed fireworm. Flooding dodder 3-4 weeks after early seedling emergence appears to be more effective (compared with flooding 1-2 weeks after early seedling emergence).

BRISTLY & PRICKLY DEWBERRY *Rubus hispidus, R. flagellaris* *(Running brambles)* PRIORITY 1

Dewberries spread rapidly on bogs by rooting at the tips of canes. Both types will kill vines if allowed to spread. The most effective way to manage dewberries is to eliminate them as they invade the bog. Remove young plants by pulling or digging out by the roots. Control of established plants with glyphosate products is difficult because the weed grows close to vine level. Sparse or moderately colonized spots can be hand wiped with glyphosate products. Clipping stems with Roundup-dispensing applicators may offer partial control.

NON-CHEMICAL OPTIONS

Late water floods reduce numbers of dewberry crowns and offspring plants in that year. Summer refloods (May 10-12 through July 15-20) may be used in desperate circumstances. This will eliminate the crop for that year! It is particularly helpful to hand pull or hand wipe remaining dewberry plants after the flood has been withdrawn. Fall floods may suppress populations of *R. hispidus*; results have varied from no impact to reduced crown density. Start the flood as early as possible (mid-September) and hold for 4 weeks for best dewberry management. Consider starting a fall flood in early-mid September, if possible. It is important to remove the flood by early November to allow the vines time to become dormant prior to winter.

Recent research indicates that using flame cultivation (FC) or thermal weeding (hand-held flame cultivators or torches) reduce dewberry growth when compared to untreated plants. One short duration (3-6 sec/yd^2 if using an open flame torch; longer times, 15-30 sec are needed with infrared torches) exposure made mid-summer seems effective (reduces shoot and root biomass). Cranberry vines will be injured when exposed to thermal weeding but they will recover. Typically, however, few cranberry vines are present in heavy dewberry infestations, so the risks are much lower than in well-vined areas. Contact the IPM Lab (x21 or x27) if you have interest or questions about thermal weeding.

Knife-raking or pruning in the fall may help uproot offspring plants. Significant dewberry patches should be scraped and replanted with new vines.

DEWBERRIES - CHEMICAL RECOMMENDATIONS

Roundup WeatherMAX	Mix 1 part glyphosate with 4-9 parts water (10-20% solutions). No additional additives, buffers, or surfactants are needed. However, the addition of ammonium sulfate may sometimes improve performance.
+ **A marker dye** (e.g., Blazon Blue)	Add according to manufacturer's recommendations.
Glyphosate products	Mix 1 part glyphosate with 4-9 parts water (10-20% solutions).
+ **Surfactant**	1 oz (2 tablespoons) per gallon of glyphosate mixture.
+ **Ammonium sulfate**	3 oz (6 tablespoons) per gallon of glyphosate mixture.
+ **A marker dye** (e.g., Blazon Blue)	Add according to manufacturer's recommendations.
Weedar 64	Mix 1 part Weedar to 2 parts water for hockey stick application. Best results are obtained when used in late June and July. Do not drip or touch vines.
Callisto	Two applications (separated by at least 14 days) of Callisto are permitted each growing season (not to exceed 16 oz/A total). As a spot application, use in 20-30 gal water. Mix 0.8 teaspoon in 1 gal water for 4 oz/30 gal water rate. Add nonionic surfactant (0.25% v:v or 1.9 tsp per gallon) or COC (1% v:v or 2.5 Tbsp per gallon) with all postemergence applications, regardless of Callisto rate. **If chemigating, see Notes on Callisto at end.**

Callisto will discolor and injure dewberries, however, the long-term management of this weed with Callisto is not yet known. Use 2 applications of Callisto (at least 14 days between applications) to manage dewberry infestations. Repeated annual applications will likely be necessary to reduce infestations. If dewberries are in a mixed canopy with tall weeds, target the spray to reach the lower portion of the canopy (where the dewberries are).

GLAUCOUS GREENBRIER *Smilax glauca* *(Silverleaf sawbrier)* PRIORITY 1

Greenbriers are very difficult to control because they have extensive underground storage organs. Glaucous greenbrier (silverleaf) is more difficult to control than common greenbrier (greenleaf). Glaucous grows in dense patches, spreads rapidly, and usually reaches just above vine level. It significantly impacts fruit production. Digging up the root system is not practical and will cause significant vine and bog damage. Infestations of sawbrier are more likely to occur on high edges or in locations where the bed is out of grade.

S. glauca may be managed by hand wiping if sufficient coverage is obtained. Summertime wipes of Roundup may offer partial control. Clipping stems with Roundup-dispensing applicators in August may offer an additional partial control. Severe infestations of *S. glauca* may necessitate bog renovation. Weedar 64 and Callisto may be used on sawbrier as per dewberry recommendations. Flooding is not

effective against sawbrier. Recent research indicates that one exposure of a mid-summer thermal weeding (hand-held flame cultivators or torches) treatment may not be effective for reducing sawbrier growth.

POISON IVY *Toxicodendron radicans* PRIORITY 1

Poison ivy is getting worse on many bogs. Treat small infestations early and eradicate! Control is very difficult because the weed grows close to the vines. Glyphosate wipes will control this weed, but the potential for vine damage is high. Use of specialized applicators that minimize drip is recommended. Research has shown that clipping the stems with Roundup-dispensing applicators may offer partial control. Early-mid September applications may give better control than August applications. Again, late applications can be used on bogs that will not be harvested due to crop-destruct floods (or very late harvested bogs). Rates as low as 5-10% solutions gave decent control. Control for significant infestations of poison ivy is post-harvest spot treatments with Roundup sprays or mechanical spot renovation followed by replanting. Adding 1 part Weedar 64 to 4 parts of the Roundup mixture may be helpful but will likely increase the possibility of crop injury. See 2,4-D cautions.

Reports of control with Callisto are variable; some growers have had good luck and others reported no control. If using this herbicide, make 2 applications of Callisto against this tough weed (see dewberry recommendations). Earlier applications (May) seem better than later applications (July). Tank mixes of Poast and Callisto have been reported to control PI patches (repeated annual applications usually needed). Call extension specialist for rates. Consider resistance management concerns when using Callisto.

DO NOT USE thermal weeding or burning for poison ivy control. The toxic plant components can become air-borne and cause significant health problems.

Many people are highly allergic to poison ivy. Protective lotions and soaps are available that minimize the irritation caused by the poison ivy oils; these work very well when applied according to label instructions. Lotions are usually applied prior to exposure and soaps are used to remove oils after exposure to the plant. Rinse with a lot of cool water; small amounts of water may only spread the oils.

YELLOW LOOSESTRIFE *Lysimachia terrestris* PRIORITY 2

Yellow loosestrife can cause moderate yield reductions. It may also serve as an early-season host for dodder and tips may harbor *Sparganothis* larvae. Loosestrife may be wiped with glyphosate during the season. Fall applications of Casoron may also offer some control of loosestrife. Since loosestrife is difficult to control, efforts should begin while patches are still small and before they have a chance to spread. Efficacy of Callisto on yellow loosestrife seems low and/or variable.

Biological Control? We have good evidence that there is a fungus that is killing YLS plants. If you notice dying plants on your farm, please contact Hilary (x21) or Frank (x18) so we can collect samples.

CHEMICAL RECOMMENDATIONS

Casoron 4G	up to 100 lb/A	Spring or fall application. Offers partial control. See Notes on Casoron.
Roundup WeatherMAX	Apply anytime weeds are present except 30 days before harvest.	
Glyphosate products	See Notes on Roundup.	
Weedar 64	Mix 1 part Weedar to two parts water for hockey-stick application. Best results are obtained when used in late June and July. Do not drip or touch vines.	

WILD BEAN *Apios americana* *(Ground Nut)* PRIORITY 2

Wild bean can be well controlled with Stinger applications. Repeated annual applications may be needed for large or severe infestations. Nuts may be dug out and removed from the bog. When using wipes, stake the wild bean vines to make wiping easier. Some growers have reported good wild bean control with Callisto; Stinger provides superior control but carries a greater risk of vine injury.

WILD BEAN - CHEMICAL RECOMMENDATIONS

Preemergence Options		
Casoron 4G	75 lb/A	Apply as two separate applications. Time applications before rain or irrigate within one day. Apply late March to early April. For best results, allow 10 days between applications.
FOLLOWED BY		
Devrinol 50DF	15 lb/A or	
Devrinol 10G	75 lb/A	
Postemergence Options		
Stinger	*Spray*: 0.06-0.12 oz/gal	0.37-0.75 tsp (1.8-3.6 ml) per gallon. Wild bean is very sensitive to Stinger (rates are lower than usual label rates).
	Wipe: 2.5 oz/gal	5 Tbsp per gallon (2% solution). See Notes on Stinger.
Salt	1 lb/gal water	Apply during the summer months after berry set. Never spray more than 200 gal/A. This practice keeps bean tops burned off. Repeat as necessary. Wash equipment with soap and water immediately after use.
Glyphosate products		Apply anytime weeds are present except 30 days before harvest.
Roundup WeatherMAX		For rates, see below and Notes on Roundup.

ASTERS *Aster spp.* PRIORITY 2

The impact of asters on cranberries is variable. Asters are usually found in bare patches on the bog. Once the patch becomes established, asters are much harder to control. Applications of Casoron in March-April or November offer some suppression but will probably not eradicate this weed. Higher rates of Stinger offer the best option; apply to minimize any vine injury. Glyphosate wipes in the summer may be helpful. Thorough coverage and repeat applications are necessary. Some growers report efficacy with Callisto against asters, but results were not always compelling.

CHEMICAL RECOMMENDATIONS FOR ASTERS

Preemergence Options		
Casoron 4G	up to 100 lb/A	Apply Spring or Fall. See Notes on Casoron.
Postemergence Options		
Iron sulfate	3 oz/sq. ft	Apply during Summer. See Notes on Iron Sulfate.
Weedar 64		Mix 1 part Weedar to two parts water for hockey stick application. Best results are obtained when used in late June and July. Do not drip or touch vines.
Stinger	*Spray*: 0.33-0.5 oz/gal *Wipe*: 2.5 oz/gal	2-3 tsp (9.8-14.8 ml) per gallon. See Notes on Stinger. wipe: 5 Tbsp per gallon (2% solution).

NARROW-LEAVED GOLDENROD *Euthamia tenuifolia* PRIORITY 2

Narrow-leaved goldenrod causes little direct yield loss, but is extremely difficult to control and spreads rapidly. For this reason, every effort should be made to control patches before they spread. Preemergence and postemergence herbicides can provide partial control of this weed. Clipping the stems with Roundup-dispensing applicators in August may offer partial control.

Stinger applications should also offer reasonable control of NLGR. Use the lowest effective rate of Stinger as cranberry vine injury is likely with over-application or off-target coverage. Data indicate that Callisto works very well against NLGR.

CHEMICAL RECOMMENDATIONS

Roundup WeatherMAX / Glyphosate products		Apply anytime weeds are present except 30 days before harvest. See Notes on Roundup.
Weedar 64		Mix 1 part Weedar to two parts water for hockey stick application. Best results are obtained when used in late June and July. Do not drip or touch vines.
Stinger	*Spray*: 0.33-0.5 oz/gal	2-3 tsp (9.8-14.8 ml) per gallon. See Notes on Stinger.
	Wipe: 2.5 oz/gal	wipe: 5 Tbsp per gallon (2% solution).
Callisto		Two applications (separated by at least 14 days) of Callisto are permitted each growing season (not to exceed 16 oz/A total). As a spot application, use in 20-30 gal water. Mix 0.8 teaspoon in 1 gal water for 4 oz/30 gal water rate. Add nonionic surfactant (0.25% v:v or 1.9 tsp per gallon) or COC (1% v:v or 2.5 Tbsp per gallon) with all postemergence applications, regardless of Callisto rate. **If chemigating, see Notes on Callisto at end.**

CINQUEFOIL *Potentilla canadensis, P. simplex* (*Five-finger*) PRIORITY 2

The impact of cinquefoil is variable, but infestations seem to be getting worse, thus its classification as a Priority 2 weed. Colonization of cinquefoil may indicate a problem with vine growth and high pH (too basic, alkaline). Improvement of fertilizer program may help control this weed. Callisto seems to work well on this weed, but it takes a while for symptoms to appear and for the weed to die; be patient! Hand wiping or hand pulling can also be used to eliminate small patches. If the soil is considered alkaline, the use of sulfur may help improve the soil condition such that the cranberry vines become more competitive. See Notes on Sulfur. Growers report using 60 lb Casoron in early May (as a spot-treatment) with very good results.

CHEMICAL RECOMMENDATIONS FOR CINQUEFOIL

Callisto		Two applications (separated by at least 14 days) of Callisto are permitted each growing season (not to exceed 16 oz/A total). As a spot application, use in 20-30 gal water. Mix 0.8 teaspoon in 1 gal water for 4 oz/30 gal water rate. Add nonionic surfactant (0.25% v:v or 1.9 tsp per gallon) or COC (1% v:v or 2.5 Tbsp per gallon) with all postemergence applications, regardless of Callisto rate. **If chemigating, see Notes on Callisto at end.**
Iron sulfate 20%	3 oz/sq. ft	Apply during the summer months. Several formulations and percent active ingredient of iron sulfate are available. Granular forms are easier to apply (drop-spreader), but take longer to act than finely powdered formulations. See Notes on Iron sulfate.

COMMON GREENBRIER *Smilax rotundifolia* *(Greenleaf sawbrier, bullbrier)* PRIORITY 2

Common greenbrier is bushier and spreads more slowly than glaucous greenbrier and grows well above the cranberry vines. It is easier to control with glyphosate wipes than glaucous greenbrier. Thorough coverage is important. Repeat applications in successive years may be needed for total control. See Notes on Roundup. Digging up the root system is not practical and will cause significant vine and bog damage.

SEDGES PRIORITY 3

Management of sedges combines cultural and chemical controls. Hand dig, pull small patches or spot-treat with one of the preemergence herbicides listed below. Encourage vine growth in the bare areas so the sedges will not re-colonize. Refer to the table below to locate the target weed and recommended control options and related information. TIMING: Spring applications are typically done from March through mid-April; Fall applications are typically done 1-2 weeks after harvest but at least 2-3 weeks prior to the winter flood. (S) or (F) following the weed name indicates 'Spring only' or 'Fall only' applications are preferred.

SEDGES - CHEMICAL RECOMMENDATIONS

HERBICIDE	RATE	WEEDS CONTROLLED	NOTES
Preemergence Options			
Devrinol 50DF	12-18 lb/A 8-12 lb/A	Nut sedge (nutgrass)	Rate for peat-based bogs. Rate for mineral soils.
Devrinol 10G	60-90 lb/A (peat) 40-60 lb/A (mineral)		Works best when applied to a weed free surface.
Casoron 4G	up to 100 lb/A	Cottongrass, Dulichium (S), Fresh meadowgrass (F), Needlegrass, Nut sedge, Spike rush, Woolgrass	
Evital 5G	80-120 lb/A 120-160 lb/A	Needlegrass (S), Nut sedge Broomsedge, Needlegrass (F), Spike rush, Woolgrass	Needlegrass is difficult to hand pull. Broomsedge may be controlled with glyphosate wipes. Dig up clumps.
Postemergence Options			
Callisto	4-8 oz/A	Nut sedge, perhaps others	See use on 'Cinquefoil' above. If chemigating, see Notes on Callisto at end.
Weedar 64		Three-square	Mix 1 part Weedar to two parts water for hockey stick application. Best results when used in late June and July. Do not drip or touch vines.

CHOKEBERRY *Pyrus melanocarpa* PRIORITY 3

Infestations of chokeberry can reduce yields and will spread in the beds. The best management strategy is to treat patches before they get too large. Chokeberry plants do not grow tall on the bog. Take extra care when using postemergence wipes of glyphosate products to minimize vine injury. When chokeberry plants are short, it may be more effective to hand wipe them rather than wiping with a hockey stick wiper.

SHEEP LAUREL *Kalmia angustifolia* PRIORITY 3

Sheep laurel can spread on the bog and reduce yields. Saplings should be pulled by hand. Larger plants can be wiped with glyphosate products (see Notes on Roundup).

LEATHERLEAF *Chamaedaphne calyculata* PRIORITY 3

Leatherleaf is a perennial, woody plant that can spread on the bog and reduce yield. It can be controlled by hand wiping during the summer with a solution of glyphosate products. Weedar 64 can also be used as a wipe as per dewberry recommendations.

RUSHES *Juncus* spp. PRIORITY 3

Rushes grow in clumps and can become quite large when well established. Control of large plants with preemergence herbicides may be difficult except at very high rates. Control may also be possible with hand-digging or repeated hand wiping with glyphosate solutions. TIMING: Spring applications are typically done from March through mid-April. (S) following the weed name indicates if 'Spring only' applications are preferred. Use glyphosate wipes in summer. We have preliminary evidence that flame cultivation (thermal weeding) may help to control rushes. Call Hilary at ext. 21 if interested.

RUSHES - CHEMICAL RECOMMENDATIONS

HERBICIDE	RATE	WEEDS CONTROLLED	NOTES
Preemergence Options			
Devrinol 50DF	12-18 lb/A 8-12 lb/A	Soft rush (*J. effusus*)	Rate for peat-based bogs. Rate for mineral bogs.
Devrinol 10G	60-90 lb/A (peat) 40-60 lb/A (mineral)		Works best when applied to a weed free surface.
Casoron 4G	up to 100 lb/A	Canada (S), Mud, Soft (S)	Offers partial control for Canada rush.
Evital 5G	120-160 lb/A	Canada rush	
Salt	1-3 teaspoons		Apply sodium salt to the base of each rush clump in the spring, prior to bud break.

RED MAPLE and other trees PRIORITY 3

The best management strategy is to pull saplings before the root system becomes established (hopefully less than 1 year old). Larger trees must be dug out. Glyphosate wipes may be used to control small maples and to weaken large trees to facilitate removal. Clipping stems with Roundup-dispensing applicators in August may offer partial control. WI reports best results with early applications of Callisto at high rates with COC.

CHEMICAL RECOMMENDATIONS

Roundup WeatherMAX / Glyphosate products	Apply anytime weeds are present except 30 days before harvest. Good coverage is essential. See Notes on Roundup.
Weedar 64	Mix 1 part Weedar to two parts water for hockey stick application. Best results are obtained when used in late June and July. Do not drip or touch vines. Labeled for red maple only.
Callisto	See recommended use patterns above. If chemigating, see Notes on Callisto at end.

UPRIGHT BRAMBLE *Rubus allegheniensis* (Blackberry) PRIORITY 3

Upright bramble is not as common as the dewberries. It does not trail on the ground. Control may be obtained with glyphosate wipes. Young plants can be pulled or dug out by the roots. Weedar 64 may be used as described for other *Rubus* (dewberries) species. This weed is not common on cranberry farms.

PERENNIAL GRASSES

PRIORITY 3

These grasses often colonize bare areas. Encouraging vine growth may reduce potential for problems. Some species may be difficult to eradicate once established. Postemergence herbicides are now available for grass control on bearing and non-bearing beds. TIMING: Spring applications are typically done from March through mid-April; Fall applications are typically done 1-2 weeks after harvest but at least 2-3 weeks prior to the winter flood.

Do you have Poverty Grass? Growers are reporting that poverty grass is becoming more of a problem on many bogs. It is not known if the weed is the grass known as little bluestem (*Schizachyrium scoparium)* or another grass species that is just referred to as poverty grass. If you suspect you have poverty grass, please contact Hilary (x21) so specimens can be collected and identified.

PREEMERGENCE OPTIONS

Broad-leaved panicgrass	Evital. Gives partial control.
Mannagrass	Use Casoron (Spring).
Poverty grass	Devrinol applications combined with repeated mowing to remove seed heads is the best recommendation we have at this point.
Rattlesnake grass	Casoron (Spring). Clean ditches in infested area. Pulling helps a little.
Rice cutgrass	Best choice is Devrinol applied before April 10. Casoron and Evital can also be used; give partial control. Improve drainage. Can tolerate pH<3.
Smokegrass	Evital (Spring).
Summergrass	Devrinol, Casoron or Evital. Hard to mow.
Switchgrass	Evital (Fall). Difficult to control, repeated mowing helps. Best to dig out plants prior to seed formation.
Velvetgrass	Casoron

PRE HERBICIDE RATES:

Devrinol 50DF	12-18 lb/A	for peat-based beds
	8-12 lb/A	for mineral soils
Casoron	up to 100 lb/A	
Evital	80-120 lb/A	Spring
	120-160 lb/A	Fall

POSTEMERGENCE OPTIONS

Poast and Select only work on Grasses! Contact Weed Specialist for ID if needed.

Poast Use 1-1.5% solution. Mix 2 oz Poast + 0.6 oz Dash HC **or** 1.3 oz crop oil concentrate per gallon (for 1.5%). Repeat applications may be needed. Addition of other adjuvants is not recommended. May be applied by broadcast applicator or air. Chemigation **not** permitted! See Notes on Poast.

Select MAX Chemigation **not** permitted. 9-16 oz/A per application. Add 0.25% v/v non-ionic surfactant (NIS) unless label indicates otherwise. Repeat applications may be needed. Use 10-30 gal water per acre. For each gal, mix 1.3 Tbsp (0.65 oz; 19 ml) + 0.65 Tbsp (0.33 oz; 10 ml) NIS for a mid-range rate. Allow 14 days btw applications. Do not apply between hook and full fruit set.

Callisto Efficacy may be variable. See use pattern recommendations above. If chemigating, see Notes on Callisto at end.

PHRAGMITES ***Phragmites australis*** *(Common reed)* **PRIORITY 3**

This highly invasive species and aggressive weed has been recently sited on a few commercial bogs. It should be treated and controlled immediately!! The best treatment is glyphosate applications in early to mid-summer (before it gets too tall) followed by mowing approximately 4-8 weeks after herbicide application. Control any infestations that are occurring near the bog as well.

PINEWEED ***Hypericum gentianoides*** **PRIORITY 3**

Pineweed is becoming more problematic on bogs, especially new plantings. Sometime, other common names are used for this plant (horsetail, horseweed, or mare's tail), but these are very different plants. This plant may also be known as orangegrass, but we are not encouraging use of this name since this plant is a broadleaf and not a grass. High rates of Casoron should control pineweed but be careful using Casoron on new plantings. In WI, growers reported good control with 30 lb/A Casoron. Some growers are trying fall applications (postharvest) of Poast, but efficacy is not yet verified. There has been a report of efficacy with preemergence applications of Callisto, but this has also NOT been verified. Pineweed can be hand-pulled if infestations are not too large.

MOSSES ***Polytrichum* spp.** *(Haircap moss),* ***Sphagnum* spp.** *(Sphagnum moss)* **PRIORITY 4**

The presence of these plants on the bog may indicate a drainage problem. Evaluate the drainage in the area and improve prior to starting a chemical control plan. Applications of acetic acid made in mid-summer have shown good control of haircap moss. A 20% acetic acid product by Weed Works, Inc., sold as a horticultural biopesticide, received labeling in Fall 2010 for use on food crops. Our lab has no experience with this product. Our experience with acetic acid has indicated that multiple (at least 2) applications may be necessary and that rather weak solutions can still be effective (e.g., 20-40% solutions of 5% acetic acid).

HAIRCAP MOSS - CHEMICAL RECOMMENDATIONS		
Casoron 4G	up to 100 lb/A	See Notes on Casoron. Be judicious in applying high rates for moss control, especially on vines showing signs of stress.
Ammonium sulfate	15 oz/100 sq. ft	21-0-0. Apply in the Spring.
SPHAGNUM MOSS - CHEMICAL RECOMMENDATIONS		
Iron sulfate	3 oz/sq. ft	Apply in March to mid-April. See Notes on Iron Sulfate.
Casoron 4G	up to 100 lb/A	Apply in the Fall only. See Notes on Casoron.

WHITE VIOLET ***Viola lanceolata*** **PRIORITY 4**

Found most often in bare patches on beds, white violet is thought to compete poorly with established vines. Thus, the best management approach is to fill in bare spots on the bog by encouraging runner growth. Otherwise, hand pulling is the next best recommendation, especially on new bogs. No chemical controls are recommended.

Callisto can also control clover (see use pattern recommendations above). However, vine overgrowth has been reported in heavily infested (treated) areas after clover dies back (apparently acts like a green manure, releasing nitrogen into the soil).

JOE-PYE WEED ***Eupatorium dubium*** **PRIORITY 4**

This perennial plant generally grows along the ditch areas. Due to its tough stem, it may be difficult to hand-weed. Some growers use pliers to uproot large plants. Glyphosate wipes during the summer offer good control. Stinger should also control this weed.

PITCHFORK, RAGWEED, AND FIREWEED (A) PRIORITY 4

Bidens frondosa, Ambrosia artemisiifolia,* and *Erechtites hieracifolia *(Beggarstick, stick-tights, Spanish needles/Common ragweed, hogweed, bitterweed, Roman wormwood/Cottonweed, pilewort.)*

PITCHFORK, RAGWEED, & FIREWEED – CHEMICAL RECOMMENDATIONS

Preemergence Options		
Casoron 4G	up to 100 lb/A	Apply in Spring. May also be applied in the Fall for control of ragweed. Moderate rates are suggested.
Postemergence Options		
Weedar 64	for ragweed only	Mix 1 part Weedar to two parts water for hockey stick application. Best results are obtained when used in late June and July. Do not drip or touch vines.
Stinger	*Spray*: 0.33-0.5 oz/gal	2-3 tsp (9.8-14.8 ml) per gallon. Pitchfork and ragweed are sensitive to Stinger, so use lowest effective rate. 1/16 oz/A rate= 0.04 tsp or 1.8 ml per gallon.
	Wipe: 2.5 oz/gal	wipe: 5 Tbsp / gal (2% solution). See Notes on Stinger.

JAPANESE KNOTWEED *Polygonum cuspidatum* (Mexican bamboo, Fleeceflower) PRIORITY 4

This is an invasive species that has been seen on bog ditches and rarely on the bog itself. It is common (relatively) on new plantings. JK has heart-shaped leaves that become quite square at the end close to the stem. It produces abundant white flowers in June-July. It is a perennial plant and can form dense patches (large rhizome system underground). It may die back at the end of the season and form a dense mat of dead material. The best control is prevention!! Cutting, mowing and flame cultivation should also provide control of established plants, but it is absolutely best to eradicate before the plant establishes.

MEADOWSWEET *Spiraea latifolia* PRIORITY 4

Meadowsweet is a slow spreader on cranberry bogs. This weed should be pulled out by hand or wiped during the summer.

CHEMICAL RECOMMENDATIONS

Roundup WeatherMAX	Apply anytime weeds are present except 30 days before harvest.
Glyphosate products	See Notes on Roundup.

CLOVER AND VETCH *Trifolium repens, and Vicia* spp. PRIORITY 4

Clover and vetch tend to occur in areas of very high pH (alkaline soils). If soil pH is 5.0 or above, spot treat with two applications of sulfur at the rate of 0.2 oz/sq. ft. Apply in the late spring when soil is drained and frost protecting is over. For more details, refer to Notes on Sulfur. Lower rates of herbicides may be effective when sulfur has been added and the pH is lowered.

Stinger offers good postemergence control of these weeds (use rates similar to asters and narrow-leaved goldenrod). See 'Stinger notes' at the end of the weed section. Control clover early spring prior to budbreak.

Callisto can also control clover (see use pattern recommendations above). However, vine overgrowth has been reported in heavily infested (treated) areas after clover dies back (apparently acts like a green manure, releasing nitrogen into the soil).

ANNUAL GRASSES

PRIORITY 4

Generally, annual grasses are most likely to appear in bare patches and/or on new bogs. Hand pulling and/or treatment with postemergence grass herbicides may be used on new and established bogs. Encourage vine growth to reduce ability of weeds to colonize the bog surface. Preventing seed production may also be important in managing these weeds. TIMING: Spring applications are typically done from March through mid-April. (S) following the weed name indicates if 'Spring only' applications are preferred.

CHEMICAL RECOMMENDATIONS FOR ANNUAL GRASSES - PREEMERGENCE OPTIONS

HERBICIDE	RATE	WEEDS CONTROLLED	NOTES
Devrinol 50DF	12-18 lb/A 8-12 lb/A		Rate for peat-based bogs. Rate for mineral soils.
		Barnyardgrass, Corn grass, Warty panicgrass (S)	Take action to promote vine growth.
Casoron 4G	up to 100 lb/A	Crabgrass (S)	Take action to promote vine growth.
Evital 5G	120-160 lb/A	Barnyardgrass, Corn grass	Take action to promote vine growth. See Notes on Evital for new plantings.

ANNUAL GRASSES - POSTEMERGENCE OPTIONS

Poast	1-1.5% solution +Dash HC (0.5%) OR crop oil concentrate (1%)	**True grasses only!**	For each gallon, mix 2 oz Poast plus 0.6 oz. Dash HC **or** 1.3 oz crop oil concentrate. See Notes on Poast.
Select MAX	9-16 oz/A per application + 0.25% v/v non-ionic surfactant (NIS) in the finished spray volume unless label indicates otherwise. Allow 14 days between applications.		True grasses only. Chemigation not permitted. Repeat applications may be needed. Use 10-30 gal water per acre. For each gal, mix 1.3 Tbsp (0.65 oz; 19 ml) + 0.65 Tbsp (0.33 oz; 10 ml) NIS for a mid-range rate. Do not apply between hook and full fruit set.
Callisto	Efficacy may be variable.		See use pattern recommendations above. If chemigating, see Notes on Callisto at end.

HARDHACK *Spiraea tomentosa* *(Steeplebush)*

PRIORITY 4

Hardhack is a solitary plant that does not spread except through seed. Wiping or pulling this weed is very effective, but the roots of hardhack can be woody and larger plants may cause damage to the bog when pulled.

CHEMICAL RECOMMENDATIONS

Roundup WeatherMAX/ Glyphosate products	Apply anytime weeds are present except 30 days before harvest. See Notes on Roundup.

FEATHER, ROYAL, CINNAMON, AND SENSITIVE FERNS PRIORITY 4

Dryopteris thelypteris, Osmunda regalis, Osmunda cinnamomea, Onoclea sensibilis

(S) or (Smr) following the weed name indicates if "Spring" or "Summer" applications are preferred. When using iron sulfate treatments, apply a small amount to each plant. See Notes on Casoron and Iron Sulfate.

FERNS - CHEMICAL RECOMMENDATIONS

HERBICIDE	RATE	WEEDS CONTROLLED	NOTES
Preemergence Options			
Casoron 4G	up to 100 lb/A	Bracken fern (S) Royal fern (S)	Appears on bogs showing signs of stress. Spot-treat and use moderate rates.
Postemergence Options			
Iron sulfate	2 oz/sq. ft [20% a.i.] See Iron Sulfate notes	Feather fern (Smr) Sensitive Fern (Smr)	Sensitive fern is difficult to hand weed due to perennial rhizomes breaking. Use caution on bogs that have been sanded within 18 months.
Iron Sulfate & Salt	9:1 ratio (iron:salt)	Cinnamon fern, Feather fern, Sensitive fern	Treat during the summer months. Place a small amount at the base of each plant.

MINOR WEEDS PRIORITY 4

[Blue joint (*Calamagrostis canadensis*), Hawkweed (*Hieracium* spp.), Horsetail (*Equisetum* spp.), *Hypericum* spp., Marsh St. John's Wort (*Triadenum* spp.), Sweet pepperbush (*Clethra alnifolia*), Plantain (*Plantago* or *Littorella* spp.), Smartweed (*Polygonum* spp.), Sorrel (*Rumex* spp.), and Wild Strawberry (*Fragaria* spp.]

If weeds are scattered or of minor importance, consider potential vine stress or injury when choosing herbicide and rate. Consider hand pulling instead. For localized weed patches, consider spot treatment. Postemergence treatment with glyphosate products may also offer some control. Combine herbicide treatments with steps to improve vine growth. Growers have reported good control of horsetail with an herbicide available in 2010 on a Section 18 permit. Check with the Weed Specialist to confirm the use status for 2011.

CHEMICAL RECOMMENDATIONS

Preemergence Options	
Casoron 4G	Use lowest rates possible. Apply in Spring or Fall. See Notes on Casoron.
Postemergence Options	
Weedar 64	Mix 1 part Weedar to two parts water for hockey stick application. Best results are obtained when used in late June and July. Do not drip or touch vines. Labeled for *Hypericum* species and sweet pepper bush only.

AQUATIC WEEDS on bog *(Hydrilla, Elodea, Water lettuce, etc.)* Make sure any aquatic weed control that is performed within the bog system (irrigation laterals, ditches) is done with a product labeled for CROP use. Nautique (by SePro) has crop uses on its label. It is labeled to control floating, emersed, and submersed vegetation in still or flowing aquatic sites such as reservoirs, ponds, slow-flowing water bodies, crop and non-crop irrigation systems. Application rate varies by vegetation density and depth of treated area. Please read the label. If you have any questions, please consult with Weed Extension specialist prior to treating.

ALGAE *(Green scum)* Algaecides are usually prescribed on an acre-foot basis. An acre-foot is the amount of water needed to cover one acre of bog with one foot of water (~300,000 gallons of water, assuming the bog is level). Barley straw can also be used to help control algae. When water temperatures are cool (<50°F), it may take 6-8 weeks for the straw to decompose; 1-2 weeks if water temperature is >68°F. The bales should be contained in nets and maintained at the surface (floats can be inserted) to be most effective. Manufacturers recommend 4 bags (5-7 lb each) per 0.25 acre.

The products listed below are legal for use in cranberry farms. Many other available algaecide products are not for use in food crop systems; check with the Weed Specialist if you have questions about other products.

ALGAE - CHEMICAL RECOMMENDATIONS

Copper sulfate	4 lb/A-ft	Apply evenly on ice or in bog waters. When bogs are treated during winter months, water should be impounded for 5-7 days to allow for degradation in cool-temperature water. May also be used in late water.
Algae-Pro	0.75-1.5 gal/A-ft	Amount will vary depending on product, water volume, and algal density. Carefully read the label before application. See Notes on Copper Sulfate and Copper Complexes.
Cutrine-Plus	0.6-1.2 gal/A-ft	

NON-CROP USE !! OUTSIDE OF BOG AREA – WEED MANAGEMENT

AQUATIC WEEDS. Reports of grower problems with aquatic weeds have been increasing. Aquatic weeds can be submersed, floating plants, floating leaf plants or emergent plants. Common aquatic species for our area may include fanwort, variable watermilfoil, bladderwort, hydrilla (new one to look out for), duckweed, and water lilies. Be sure to get a correct identification of the weed problem before treating. Treatment of some water areas may require a permit. Non-chemical methods (e.g., harvesting, suction, hand pulling, dredging) are available but are very expensive. The use of grass carp for aquatic weed control is NOT permitted per MA Fish and Wildlife. Call 508-389-6300 for more information.

CHEMICAL RECOMMENDATIONS

Diquat Reward	1-2 gal per surface acre (37% ai diquat bromide)	Use during Summer months. Water use is restricted for various time periods depending on product and pattern of use. CHECK THE LABEL! Use only on still water areas outside of bog (e.g., farm ponds, reservoirs). Water temperature should be >50°F for best activity. **Do not use in or on bog ditches.**
Rodeo	(54% ai) 1.25% solution	Apply during the Summer months. Rodeo is registered for use on noncrop land only. Use in interior ditches is not permissible. Recommended spray solution: 5 oz/3 gallons. Add a nonionic surfactant at the rate of 0.25-0.50% volume basis (1-2 oz or 2-4 Tbsp in 3 gal.). More effective against cattails and water lilies. Not effective against submersed weeds.

WOODY AND BROADLEAF PERENNIALS **(not in ditches or canal banks)**

Hand pulling is most beneficial in the Spring and early Summer when the soil is moist and the plants are fairly small. Both of these herbicides are restricted use compounds. Be sure you have the proper license or use licensed personnel to do the application. **Both of these herbicides are restricted use compounds.**

CHEMICAL RECOMMENDATIONS – WOODY PERENNIALS – NON-BOG USE ONLY!!

Weedone CB	Do not dilute.	Apply in February and March. Spray to wet. Avoid drift onto bog. Controls woody plants on roadsides and non-crop areas. It is no longer produced, but available product may be used off the bog.
Crossbow	up to 2 gal/A	Mix with enough water to deliver 10-30 gal/A. Application rates vary depending on target species and application method. Drift to desirable plants may cause injury (esp. grapes and tomatoes). Do not apply to water. Read the label! See Notes on 2,4-D.

DITCH MANAGEMENT

WOODY AND BROADLEAF PERENNIALS ON DIKES (BOG-SIDE).
Cultural controls include mowing the ditch and dike areas during the summer months. Some areas may need to be done more than once. Hand pulling is most beneficial in the spring and early summer when the soil is moist and the plants are fairly small. Controlling weeds on the dikes may be useful in reducing spread of these weeds onto bogs.

DITCH WEEDS (*e.g., Arrowhead, Pickerelweed, Pond lilies, Bur-reed, Duckweed*)
Clean ditches by hand or mechanically preferably twice a year. Draining ditches can sometimes be helpful in killing some aquatic weeds (e.g., duckweed). Preemergence herbicides registered for use on the bog may **NOT** be used in the ditches for weed control.

DITCH WEEDS - CHEMICAL RECOMMENDATIONS

Roundup WeatherMAX	Use as a *wipe* or *spray* during the Summer months in dry ditches. See Notes on Roundup. Spray: Use a 1-1.5% solution on a volume-to-volume dilution. Spray to just wet vegetation, not to run-off. Ditches must be kept dry at least 2 days after application.

CAUTIONS AND OTHER NOTES

1. Chemicals not registered for use on cranberries must not be used.

2. Herbicide use may weaken vines and crops may be reduced.

3. To be most effective, rain should follow the application of any dry herbicide formulation within 4 days or the bog should be irrigated.

4. Wash equipment with soap (or detergent) and water immediately after using. Rinse with ammonia after using hormone-type herbicides (such as 2,4-D).

5. Hand wiping with glyphosate products is often practical with some weeds if roots are weakened. This is particularly useful for dewberries after late water or a summer flood.

6. Mowing of tall weeds helps to prevent shading and reduces seed formation.
7. Late water causes general reduction of annual grasses and may reduce dewberry populations and re-growth.

8. Agricultural burning of brush or grass is allowed under regulations from the Director of Air Pollution Control, Southeastern Office of the Dept. of Environmental Protection and under permit from the local fire chief.

9. Review the Weed Management BMP in the UMass Best Management Practices Guide. http://www.umass.edu/cranberry/pubs/bmps.html.

NOTES ON THE USE OF COMMON HERBICIDES

CALLISTO (Mesotrione). Since Callisto interferes with photosynthesis, affected plants will turn white. Injury may take several days or weeks to show. Allow a minimum of 14 days between applications. Hardier weeds will likely need 2 applications over a period of successive years for control. Callisto should work well against crabgrass but is weak against foxtails. Callisto is rain-fast in less than 4 hours and has no known bee issues. Callisto can be applied in low volumes of water (if so desired) with no loss of efficacy; just be sure to get good coverage. If you want to add a dye to the herbicide mix, the manufacturer recommends using Spray Tracer; they recommend AGAINST using Blazon Blue (this product is NOT labeled for food crops). NIS and COC should work equally well with Callisto; however, some COC may cause injury on cranberry, so stay away from these products.

Use on New Plantings. Data from MA and WI indicate that Callisto is an excellent choice for use on newly planted vines. Growers have first applied Devrinol (within 3 weeks of planting) and then follow up with one or two Callisto applications; this combination seems to have worked well. No injury has been reported. Lower rates are often a good choice as many of the early weeds are grasses or annuals.

Resistance Management Concerns. Resistance to Callisto has been reported in other crops after only 7 years of use. It is important that we do not lose this tool for dodder and general weed management. Occasionally rotate Callisto out of your herbicide sequence and substitute other herbicides. Use non-chemical forms of weed control every when possible. Do not use Callisto repeatedly year after year.

CASORON (Dichlobenil). Applications of Casoron are most effective when applied as close to the time of weed germination or emergence as possible. Since Casoron volatilizes quickly, it must be washed in by irrigation or rainfall ASAP after application. Avoid applying during warm temperatures (air T >60°F). Apply pre-budbreak or post-harvest. Application just prior to sanding or on weak or new vines may cause injury. Applications on top of sand or late applications can be made, but must be watered in *immediately*. Low rates (<40 lb/A) may be applied after removal of a late water flood to control dodder with minimal risk of phytotoxicity. In general, applications of preemergence herbicides are not recommended *after* the late water flood is withdrawn.

Casoron may be applied by air or by ground equipment. Multiple applications may be made as needed. Allow an interval of 3-6 weeks between applications. Do not exceed 100 lb/A in any 12-month period. Single doses of high rates of Casoron may be needed to control some perennial weeds. However, some weeds are not controlled by Casoron at any rate due to their deep root systems. Cranberry vines with weakened root systems are more susceptible to stresses such as drought and may become more stressed with herbicide application. Some vine injury may occur from herbicide applications made in areas where puddling is a problem.

Distribute Casoron uniformly. Avoid overlapping of herbicide. Temporary reddening of vines may occur especially with late spring application or when applied on sandy bogs. Do not apply after bud elongation as vine injury may occur and yields may be reduced. Do not apply to young beds (less than 3 years old unless root systems are well established) or on bogs prior to or immediately after mowing vines. Do not sand (spring or fall) on top of a Casoron application. Casoron is labeled for application in the fall prior to ice sanding that winter or in the spring after ice sanding. The efficacy of fall applications for many weeds has not been documented, but growers have reported good success in some cases.

Efficacy of Casoron may be reduced if irrigation to protect from frost (or other reasons or rainfall) follows application. Less than 0.5 inch of water will likely not affect efficacy but more than 1 inch probably will. The herbicide zone will widen to more than 6" and will miss many of the emerging weeds or seeds. Organic matter helps to retain the herbicides but MA are typically low in OM (<2%).

COPPER SULFATE and COPPER COMPLEXES (Algae-Pro, Cutrine-Plus). Copper sulfate may be used to control algal growth on winter or late water floods. Cutrine-Plus and Algae-Pro work best when water temperatures are warm (~ 60°F). These copper-complex products are formulated to last longer than copper sulfate in hard water (carbonates present). Copper-complex products work best when applied under calm and sunny conditions.

If you are holding a 4-week late water flood, plan to apply a copper product mid-way through the flooding cycle (for more details, see Prevention of Scum in the Late Water section). These products are typically applied directly through the irrigation systems (with heads on risers). For winter floods or late water floods of short duration, scout for algae and apply when growth is first visible on the water surface. Remember, these products only prevent further algal growth; they do not kill or remove what has already grown. Crystal copper sulfate will dissolve easily in water and can be applied as a spray solution. Though somewhat uncommon now, crystalline products can be placed in burlap bags and dragged across the water surface. When bogs are treated with copper sulfate during the winter months, water should be impounded for one week. Since late water floods tend to be warm, there is no need to impound these waters. Do not apply to water except as directed on the label. These products are toxic to fish. Do not use any other algaecide products; consult with the Weed Specialist if you have any questions.

Nautique is a copper carbonate (double-chelated copper formulation) product that can be used to control certain aquatic plants in irrigation systems (ditches, canals) in crop systems. It is highly corrosive and carries a DANGER label. It may be fatal if absorbed through the skin. Be very careful with this product!! Wear all recommended protective equipment. Fish toxicity is dependent on the hardness of the water; in

soft water, trout or other fish may be injured or killed. Do not use if carbonate hardness of the water is less than 50 ppm. If applying to public waters, check with the local authorities for permit process. Nautique can be mixed with other aquatic herbicides; check the label. When applying to irrigation ponds, hold water for a minimum of 3 hours before irrigating plants.

CROSSBOW, WEEDAR 64, WEEDONE CB (2,4-D). Crossbow and Weedone CB are labeled for **non-bog use only**. Be cautious! Crossbow contains trichlopyr for which there is **no food tolerance**. Do not use Crossbow or Weedone CB on dikes or canal banks. Use it only on weeds located far away from the bog. These products have considerable potential to evaporate and cause crop injury. Avoid applying 2,4-D on hot, sunny, and humid days when there is little air movement. Weedar 64 is the only 2,4-D product that can be used on the bog. 2,4-D products can be highly effective at controlling some weeds. However, the potential for significant vine injury may outweigh the advantages of using these materials. Weedar 64 has a 30-day PHI and may only be applied once per season. **Weedar 64 is a State-restricted use product!!**

DEVRINOL (Napropamide). Devrinol 50DF is available (24c label) for use on cranberries. Unlike Devrinol 10G, the new formulation can be injected though the irrigation system. Be sure to run the system after application to ensure that the herbicide is washed off the leaves and gets to the soil. 50DF seems to perform at least as well as Devrinol 10G, if not better in some circumstances. Be sure to get the supplemental label at the point of purchase. Since Devrinol will control grasses, give careful consideration to use of 50DF if you are establishing ditch banks and your irrigation system delivers coverage to the ditch bank area. Be aware that UPI has discontinued production of 10G.

Up to three 6-lb/A applications or 2 9-lb/A applications of Devrinol 50DF may be used on new plantings but the maximum doses may not be necessary in many instances (depends on weed pressure and availability of labor). On established bogs, this herbicide provides some control of grassy weeds and annual broadleaf plants at higher rates (50DF: 12-18 lb/A; 10G: 60-90 lb/A for peat beds; 8-12 lb/A 50DF; 10G: 40-60 lb/A; for mineral soils), but works best on weed free areas. Rate differences for the soil types (higher rates with more OM) are primarily due to efficacy issues rather than toxicity or groundwater concerns. The top 2-4 inches of soil should be moist. If the soil is dry, irrigate soon after application. If the soil is already moist, the need is not as urgent. 50DF can be chemigated (10G may be applied by air or ground). Use the appropriate rate for the age of the bog. Devrinol can be used under or on top of sand.

DIQUAT. This herbicide should only be used on water weeds growing in areas OUTSIDE OF THE BOG. Do not use in any ditch associated with the production area. Diquat will control water weeds such as bladderwort, coontail, elodea, and pondweeds. A non-ionic surfactant (e.g., X-77) may improve performance. Check the label for rate information.

EVITAL (Norflurazon). Vine injury may occur in areas where water stands several days after flooding or heavy rains. Do not apply more than 160 lb/A per season on an established bog. Use lower rates on stressed vines or sensitive cultivars such as Stevens and McFarlin. Growers have reported good results with low rates (50-75 lb/A) for fall applications on these varieties; spring applications should not exceed 60 lb/A. Sanding can be done on top of an Evital application, but it is not recommended especially on bogs that have drainage problems. Sanding after applications of 50 lb/A or less has given good results. Growers have reported that applications of Evital (50-60 lb or less) on top of sanded vines work adequately on healthy well-drained beds.

Be conservative when applying Evital to new plantings! Usually, new vines are very sensitive to Evital. However, growers have reported using 35 lb in the fall on Stevens that were planted in the same year with good success. In other instances, vines have shown severe phytotoxicity to rates as low as 25 lb/A when applied 3-4 weeks after planting.

FUMIGANTS. Basamid (dazomet) and Vapam (metam-sodium) are soil fumigants that can be used on cranberry beds. **DO NOT USE FUMIGANTS AS A SPOT-TREATMENT IF ANY VINES WITHIN A DIKED SECTION WILL BE HARVESTED**. If you are renovating an entire section, a portion of that section can be spot-treated with a fumigant. More information on the use of fumigants may be found in the New Plantings Fact Sheet (available at the Station).

IRON SULFATE. May be spread as a broadcast application through conventional fertilizer rigs, such as hand cranks. Traditional use has been with a 20% ferrous sulfate (fine powder) product, but other formulations are available. Application rates listed in the Chart Book are for the 20% a.i. product. Adjust accordingly if using another percent active ingredient. Iron sulfate at rates exceeding 1.1 oz/sq. ft (20% a.i. product) may kill vines if they have been sanded within the past 18 months. Do not use on new bogs. To be most effective, rain should follow within 4 days of an iron sulfate application or the bog should be irrigated. When a 9:1 iron sulfate to salt combination is used, rain or sprinkling is not necessary.

POAST (Sethoxydim). This herbicide effectively controls emerged annual and some perennial ***true grasses***. Sedges are not controlled. It may be used on bearing and non-bearing beds. There is a 60-day PHI on bearing beds. Do not apply more than 5 pints (80 oz) of product per season. Allow a minimum of 14 days between repeat applications. Phytotoxicity may result if the herbicide is applied during the heat of the day or during bloom. Application during cool periods of the day, but after dew has dried, is preferable. If you have never used this material before, it may be wise to test a small area before applying the product to a larger area.

Efficacy is enhanced by addition of crop oil concentrate (COC) or Dash HC; an adjuvant should always be used. Other adjuvants may reduce efficacy or increase crop injury. Since COC or Dash HC can be mildly phytotoxic, Poast should not be applied during periods of crop stress or during flowering. Poast should not be mixed with other chemicals, particularly chemicals whose label warns against inclusion of an adjuvant.

Poast must be absorbed into the grass to be effective. Therefore, do not apply Poast if rainfall or irrigation is expected within one hour of application. Poast should be applied when grasses have 6 to 8 leaves to provide enough leaf surface for absorption. Apply Poast to grasses that are actively growing and free of stresses such as drought, disease, or mechanical injury.

POAST CANNOT BE APPLIED THROUGH THE IRRIGATION SYSTEM! Spot treatments with small sprayers are effective. **For one gallon Poast solution, mix 2 oz of Poast with 0.6 oz of Dash HC (or 1.3 oz of crop oil concentrate) in 1 gallon water**. Thoroughly wet the grass foliage, but do not let the solution run off the leaves.

Broadcast Application. Use standard high-pressure hollow cone or flat fan nozzles only. Use 5-20 gal of spray solution per acre at 40-60 psi. Inadequate coverage of grasses due to heavy cranberry canopy may reduce control. Do not use re-circulating sprays, wiper applicators or shielded applicators. Use of Poast with control drop application is not recommended due to erratic coverage. *Aerial Application*. Do not apply if wind speed is greater than 10 mph.

Use on New Plantings. Poast can be safely used on newly planted vines. Wait for roots to develop before application. Growers report mid-July applications approximately 6 weeks after planting worked well. Grass control was enhanced when Poast applications were followed by Callisto applications.

REGLONE (Diquat dibromide). Reglone should only be used on bogs that will be renovated or will not be harvested for 1 year. The intended use is as a site-preparation product, not for use for spot weed control on an active farm. This product works as a plant desiccant and should be used as a directed spray. Reglone cannot be applied by chemigation.

RODEO. This glyphosate product can only be used to control weeds that occur in dry ditches and canals outside of the production area. Application is spray to wet leaf surfaces, not to runoff. Extremely cool or cloudy weather following application may slow the activity of this herbicide. Best control is obtained when plants are at late growth stages approaching maturity. Weeds under stress will not be controlled as well as healthy plants. Rainfall within 6 hours of application may reduce effectiveness and heavy rainfall within 2 hours of application may necessitate reapplication. Do not add ammonium sulfate to Rodeo mixtures.

ROUNDUP (Glyphosate). Many Roundup and glyphosate products are available on the market. Please read the label of any product you are using to ensure compliance. This product may be applied on bogs, by wiper or clipper, during the growing season. If you are using Roundup Ultra, you will need supplemental labels for dry ditch and postharvest sprays. If you are using WeatherMAX, these spray uses are incorporated into the label and additional labels are not needed. WeatherMAX is slightly more concentrated than Ultra, so keep that in mind when preparing solutions. Use 1%-1.5% solutions (2.5-3.8 Tbsp or 38-57 ml/gal) for dry ditch applications and 0.4%-0.7% solutions (~3.0-5.5 tsp or 15-27 ml/gal) for postharvest sprays. Recent research indicates that Howes may be slightly more sensitive to postharvest spray injury than Early Black.

It is not necessary to mix Roundup Ultra or WeatherMAX with any additional surfactants or additives (as with older glyphosate products). Add a dye to track leaf coverage. Technical information indicates that ammonium sulfate may improve uptake of these Roundup products when moderate to large amounts of carbonates ('hard water') are present in water (rarely a problem in MA). Roundup WeatherMAX is rainfast 1-2 hours after application. Available glyphosate products vary as to whether they carry a 'Caution' label or 'Warning' label. Look at the label!! When using Roundup, protective eyewear is not mandated; the REI for WeatherMAX is 4 hours. Thorough coverage is essential to maximize control of perennial weeds. Do not touch or allow material to drip onto vines. **Apply any time weeds are present except 30 days before harvest**. Make herbicide mixtures fresh each day for maximum effectiveness. Do not store in galvanized containers.

Roundup Products	Mix 1 part glyphosate with 4-9 parts water (10-20% solutions). No additional additives, buffers, or surfactants are needed. However, the addition of ammonium sulfate may sometimes improve performance.
+ **A marker dye** (e.g., Spray Tracer)	Add according to manufacturer's recommendations.
Glyphosate products	Mix 1 part glyphosate with 4-9 parts water (10-20% solutions).
+ **Surfactant**	1 oz (2 tablespoons) per gallon of glyphosate mixture.
+ **Ammonium sulfate**	3 oz (6 tablespoons) per gallon of glyphosate mixture.
+ **A marker dye** (e.g., Spray Tracer)	Add according to manufacturer's recommendations.

OTHER GLYPHOSATE PRODUCTS. Glyphosate is sold under several product names. CHECK THE LABEL! To enhance control with glyphosate products other than Roundup WeatherMAX, add a nonionic surfactant (e.g., X-77) and ammonium sulfate (see rates above). Other label differences include: Do not apply if rainfall is expected within 6 hours of application. Do not irrigate within 6 hours of application. The REI is 12 hours for these products. Note also that glyphosate products other than Roundup WeatherMAX may carry a 'Warning' label, instead of a 'Caution' label. Always use a dye to track your coverage with any wipe product. Check the label for appropriate protective clothing.

Clipper Applicators (Roundup only). Concentrations of 50-100% Roundup have worked well. The herbicide should flow out consistently, but not so fast that herbicide drips from the blades. Be sure to use a dye. Clip weeds close to the ground, without contacting the vines. Roundup must contact the stem as you are cutting! 'Clip and dab' or 'mow and wipe' techniques may have reduced efficacy as the herbicide is not applied simultaneously with the cut. Late-season treatments give better results than early-season treatments. The effectiveness of post-harvest treatments with clippers is not known. Be sure to clean the blades after use to

prevent corrosion. Availability of commercial clippers has become more scarce over the past few years. Growers may need to manufacture their own clippers.

General Wiping Tips. Use a small sponge or applicator that permits excellent coverage with minimal dripping. Adequate coverage of each stalk must be obtained. Several leaves (at least 50%) on each stalk must be treated with the herbicide. Repeat applications to remaining plants the following year. Be patient. Most treatments will not give 100% control in the first year. Applications in subsequent years should be less time-consuming.

Hand wipe Technique for Controlling Dewberries or Other Weeds that Lay in the Vine Canopy. Application by hand with sponges or specially designed applicators may be necessary with low-growing weeds (e.g., bristly dewberry, poison ivy). Repeat applications within a season are legal and may be necessary, especially for well-established perennial weeds. Poor growing conditions such as drought stress, disease, or insect damage may reduce effectiveness. Avoid touching or dripping material onto cranberry plants during application. Some growers have had success staking the vines (tomato stakes or similar) for wiping and allowing them to dry prior to laying them back on the vines. This certainly reduces vine injury.

SUPPLEMENTAL LABEL USES. Supplemental labels may be needed with certain Roundup products when doing post-harvest sprays (0.5%-1%), applied as a spot-treatment, or sprays in dry ditches (1%-2%); these uses are included in the regular labeling for WeatherMAX, PowerMAX, and OriginalMAX. CHECK THE LABEL of the product you are using. Generic glyphosate products do NOT have supplemental use labels.

SALT. Salt (sodium chloride) may be used as a spot-treatment for control of certain weeds (e.g., wild bean, rushes). Judicious applications do not inhibit re-colonization of cranberry vines once the weed dies. Do not use during bloom. Use of calcium chloride or other types of salts is not recommended. Salt is corrosive to machinery. Be sure to wash equipment thoroughly after application.

SELECT (Clethodim). Similar to Poast with regards to target species, timings, and applicators. Note these differences. Apply when weeds are 2-6 inches high and actively growing (check label for specific heights for each target weed). Multiple applications are typically needed for perennial weeds. Results are best when weeds are not under stress. Irrigation should follow within 7 days if rainfall does not occur. Use of a non-ionic surfactant (NIS) is recommended with Select Max. For a 1-gal mixture, use 1.3 Tbsp Select MAX with 0.65 Tbsp NIS. Select Max has a 30-day PHI. Do not apply more than 16 oz Select MAX per application per acre. Do not exceed 64 oz/A/season. Allow 14 days between applications. You can use 3-10 gallons water with aerial applications, 10-30 gal/A otherwise.

STINGER (Clopyralid). Stinger is a selective, postemergence herbicide used to control wild bean, narrow-leaved goldenrod (NLGR), asters, clover, ragweed, pitchfork (and other members of the Composite and Legume families), and certain other weeds within the treated area. Growers have reported effective control (and reduced vine injury) when using lower rates than recommended on the label. This is particularly true for wild bean control.

Apply when weeds are actively growing. It is best to apply Stinger when vines are dormant, if possible. For weeds that emerge late (NLGR, wild bean, etc.), wait until after fruit set to apply. It is not recommended to apply Stinger when vines are going through active growth spurts (e.g., budbreak-roughneck stage). Stinger has a 50-day PHI. Stinger may be applied as a wipe or as a spray. Spray to just wet the weeds, but not to run-off. BE VERY CAREFUL! Overspray can cause injury that may take 1-3 years for full vine recovery. Minimize drift when applying as a spray. Results may be slow to show; be patient. Two applications per season are permitted, not to exceed a total of 1 pint per acre. Stinger cannot be applied by air or through the irrigation system.

SULFUR. Determine soil pH in the weedy area prior to sulfur application. If pH is 5.0 or above, use two applications of 500 lb/A each (or 4 applications of 250 lb/A) to reach 1,000 lb. of elemental sulfur per season. Begin application in late spring when soil is drained and sprinkling for frost is over. Most growers allow 3-6 weeks between applications. Do not apply sulfur to puddled or waterlogged areas as resultant production of hydrogen sulfide can cause severe vine toxicity. Changes in pH can be very slow. Granular applications may take up to nine months to reduce pH enough to affect weed populations. The smaller the sulfur pellet size, the faster the pH is lowered. Use pelletized sulfurs only. Do not use flours of sulfur; they can be phytotoxic and are difficult to apply. Do not use potassium sulfate. Yearly sulfur applications may be needed as the pH can creep up in subsequent years. Test soil pH yearly to determine the effectiveness of sulfur applications. The effect of lowered pH on control of cinquefoil is moderate. Eye protection and dust masks are recommended when making sulfur applications.

ADJUVANTS. These products are added to a pesticide mixture to improve its physical qualities and its effectiveness and includes surfactants, stickers, penetrants, compatibility agents, etc. Pesticide labels may list specific types of adjuvants that will maximize effectiveness of the pesticide. Be sure to use the proper category of adjuvant if the manufacturer makes a specific recommendation.

Nonionic surfactants (NIS) spread the spray droplet evenly over the leaf surface and help it adhere to the leaf. It increases penetration of the herbicide through the leaf cuticle. Common commercial products include LI-700 or Activator 90 (replaced X-77). Crop oil concentrates (COC) are also nonionic. They may consist of petroleum, vegetable, or methylated vegetable or seed oils (along with a surfactant) designed especially for use in agricultural pesticide spray programs. Many COCs are available and may be sold as Crop Oil or under other trade names such as Herbimax. COCs tend to be less expensive per gallon but you typically have to use more product per acre.

Insecticides and fungicides may also require the addition of an adjuvant, so check the label!

Materials used for a dye test (e.g., Hi-Light) are not adjuvants and should not be mixed with pesticides.

NOTES ON CONSERVATION SEED MIXES FOR DIKES AND DITCHES

Several criteria were used to compose the seed mix recommended by Plymouth County Conservation District. The seed mix needed to contain perennial species, must contain at least one nitrogen-fixer, must be drought-resistant, must not introduce known weed seeds, contain at least 3 species and be economical to purchase. The current seed mix is creeping red fescue (39.7%) with a germination rate of 85%; perennial ryegrass (34.2%) with a germination rate of 90%, empire birdsfoot trefoil (24.5%) with a germination of 70%, and 5% hard seed and some inerts. For more information on planting rates and cost, please contact the West Wareham office at 508-295-5495.