

Asparagus - Horticulture

Major update by Ben Phillips, Liz Maynard – Oct 2020
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Crop Description

Hybrid varieties of asparagus (*Asparagus officinalis*) have improved vigor, disease tolerance, and higher yields, and are grown from seeds or crowns. All-male hybrids have higher yields and do not produce seed. Absence of seed production is desirable because seeds develop into volunteer asparagus seedlings that are a weed problem. Order hybrids well in advance.

Some varieties are available for purchase as one-year old crowns. Others are only available as seed. Crown growers turn the seed into crowns as custom work for retailers and wholesalers who store and sell crowns to gardeners and small-scale growers, and others grow crowns for direct sale to growers involved in large-scale commercial spear production.

All-male hybrids: Jersey Knight (crowns available), Guelph Millennium (crowns available, industry standard), Guelph Eclipse, Guelph Equinox, Sequoia, Spartacus, Walker Deluxe (crowns available),

Hybrids (not all-male): Pacific Challenger 2

Non-hybrids: Mary Washington (crowns available).

Specialty: Purple Passion (crowns available).

Planting and Spacing

Crowns: Use only 1-year old crowns. Transplant April 15 to May 15. Use 4- to 5-foot rows and an in-row spacing that achieves 14,000-15,000 crowns per acre. Set the crowns in 8-inch furrows in light soils and 5- to 6-inch furrows in heavy soils. Cover with 2 to 3 inches of soil. Select deep, well-drained sandy loam soils. Start cultivating when spears begin to emerge and continue periodically until furrows are level at end of first season. Fields can be leveled with a disk the year after planting.

Seedling transplant: 10- to 14-week old seedling transplants can be mechanically transplanted. Transplant in either the spring or fall.

Fertilizing

pH: Maintain a soil pH of 6.7 to 7.0. If possible, apply lime the year before planting.

New plantings: Before planting new crowns, apply 50 pounds N per acre, 0 to 160 pounds P₂O₅ per acre, and 0 to 150 pounds K₂O per acre based on soil test results and recommendations from your state. Broadcast the fertilizer and plow it under when preparing the land for the planting furrows. In addition, apply 30 pounds P₂O₅ per acre in the bottom of the trench and cover with 1 inch of soil before setting crowns. For transplanted seedlings, apply 4 ounces of transplant solution (e.g. 2-3 lbs. of 10-52-17 or 9-45-15 in 50 gallons of water) to each transplant.

Established plantings: Each year before emergence, apply 20 to 40 pounds N per acre by broadcasting and incorporate by lightly tilling. After harvests conclude, apply 40 to 60 pounds N per acre. The total amount of N from fertilizer should be 80 pounds N per acre. No P₂O₅ is necessary if adequate fertilization was achieved prior to planting. Apply K₂O based on a soil test.

Harvesting

Roots are the “gas tank” of asparagus, storing photosynthates to power coming years’ harvests. Shoots that are picked during harvest represent a withdrawal of carbohydrates, that does not pay back via photosynthesis. Harvest ends to allow the crowns to grow fern, produce sugar via photosynthesis, and move it to the crowns in fall. As you establish a new planting, gradually increase harvest intensity to help plants invest photosynthates in building their root system early in a stand’s life. One example could be:

- Planting year (yr 1): No harvest
- Year after planting (yr 2): Harvest 2-3 times to avoid freeze injury to emerging shoots, or not at all
- Year 3: Harvest two weeks
- Year 4: Harvest four weeks
- Year 5 and beyond: Harvest full season, about 6 weeks

Harvest asparagus early in the morning for best quality. Allow the ferns to grow vigorously after this period to accumulate food reserves for the next season. As much care should be put into maintaining a healthy fern as into harvest.

Asparagus - Diseases

Crown and Root Rot of Asparagus - Fusarium Fungus

The Fusarium pathogen can be seed borne. Try to source material for new plantings from fields fumigated with chloropicrin.

Non-Pesticide

The disease is promoted by acidic (low pH) and poorly drained soil. Establish production fields with blemish-free crowns produced in virgin soil. Avoid fields with a history of crown and root rot. Use tolerant, vigorous varieties if available, and avoid long harvest periods to maintain vigor in the plant over years.

Pesticide

Cannonball (fludioxonil) | 0.5 oz. per 100 gals. of water. *Michigan 24c label only.* Submerge and soak crowns for 10 minutes and allow to drain before planting. REI: 12-hour. PHI: 365-day. FRAC 12.

Crown and Spear Rot of Asparagus - Phytophthora Oomycete

Non-Pesticide

Avoid excessive irrigation. Choose well-drained planting sites. Establish production fields from blemish-free crowns obtained from virgin soil. Avoid long harvest periods to maintain vigor in the plant over years.

Pesticide

mefenoxam/metalaxyl products (mefenoxam) | Several formulations (MetaStar, Ridomil Gold, Ultra Flourish, and Xyler) are labeled. Always check the label. Several formulations are labeled as soil-surface sprays at various rates between 1 pt. and 4 pt. per acre. Apply 30 to 60 days before the first cutting. Apply again just before the beginning of harvest. REI: 48-hour. PHI: 1-day. FRAC 04.

Orondis Gold (oxathiapiprolin, mefenoxam) | 28-55 fl. oz. per acre. REI: 4-hour. PHI: 1-day. FRAC 49, FRAC 04.

phosphite and phosphorous acid products (phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum) | Several phosphite or phosphorus acid products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed.

Apply the product to fully expanded ferns. Do not apply to ferns that are beginning to senesce. Thorough coverage is required. REI: 4 to 12-hour. PHI: see label. FRAC 33.

Leaf Spot of Asparagus - Cercospora Fungus

Cercospora leaf spot is favored by warm, humid conditions. The disease may be spread by splashing rain or irrigation water. Crop residue may harbor the fungal pathogen.

Pesticide

chlorothalonil products (chlorothalonil) | Several formulations are labeled at various rates (Bravo, Echo, Equus, Initiate). Always check the label. Use 38.5% (Zn) formulations at 2.75-5.75 pt. per acre. Use 54% (720) formulations at 2-4 pt. per acre. Use 82.5% (WDG) formulations at 1.8-3.6 lb. per acre. REI: 12-hour. PHI: 190-day. FRAC M05.

Dexter Max (mancozeb, azoxystrobin) | 2-2.2 lbs. per acre. REI: 24-hour. PHI: 180-day. FRAC M03, FRAC 11.

mancozeb products (mancozeb) | Several formulations are labeled at various rates (Dithane, Koverall, Manzate, Penncozeb, Roper DF). Always check the label. Use 37% formulations at 1.6 qt. per acre. Use 75% and 80% formulations at 2 lb. per acre. REI: 24-hour. PHI: 180-day. FRAC M03.

Phytophthora Blight of Multiple Crops - Phytophthora Oomycete

Pesticide

Orondis Gold 200 SC (oxathiapiprolin) | 4.8-9.6 fl oz per acre. For new planting: Used as plant soak prior to planting. Established plants: Make the first application to established asparagus beds at least 14 days prior to harvest (first cutting). Make a second application on the first cutting. Make no more than 2 sequential applications of Orondis Gold 200 before rotating to a fungicide with a different mode of action. REI: 4-hour. PHI: 1-day. FRAC 49.

Purple Spot of Asparagus - Stemphylium Fungus

Weather forecasting tools, such as TOM-CAST, can help asparagus farmers schedule their fungicide applications for control of purple spot. NOTE: Products labeled for rust may be helpful for purple spot control.

Non-Pesticide

Reduce crop residues by removing or mowing senescent and dried fern in the fall/winter.

Pesticide

azoxystrobin products (azoxystrobin) | Several formulations are labeled at various rates (AZteroid FC 3.3, Quadris, Acadia LFC, Aframe, Quadris flowable). Always check the label.

Use 3.3 lb. a.i. per gallon formulations at 3.9-9.7 fl. oz. per acre. Use 2 lb. a.i. per gallon formulations at 6.0-15.5 fl. oz. per acre. Use 1.65 lb. a.i. per gallon formulations at 7.6-19.5 fl. oz. per acre. REI: 4-hour. PHI: 100-day. FRAC 11.

chlorothalonil products (chlorothalonil) | Several formulations are labeled at various rates (Bravo, Echo, Equus, Initiate). Always check the label. Use 38.5% (Zn) formulations at 2.75-5.75 pt. per acre. Use 54% (720) formulations at 2-4 pt. per acre. Use 82.5% (WDG) formulations at 1.8-3.6 lb. per acre. REI: 12-hour. PHI: 190-day. FRAC M05.

Dexter Max (mancozeb, azoxystrobin) | 2-2.2 lbs. per acre. REI: 24-hour. PHI: 180-day. FRAC M03, FRAC 11.

Flint Extra (trifloxystrobin) | 3-3.8 fl. oz. per acre. Apply on a 14-day interval as needed. Make uniform applications to the fern stage only using a minimum of 30 gal. per acre of water. Mow down the asparagus ferns (or allow the ferns to senesce) between the last fungicide application and harvest. REI: 12-hour. PHI: 180-day. FRAC 11.

Rust of Multiple Crops - Puccinia Fungus

Non-Pesticide

Reduce crop residues that may harbor the pathogen by removing or mowing senescent and dried ferns in the fall/winter. Scout for the early appearing bright orange aecial pustules in the spring, especially on new or young plantings that are not harvested the full season. Remove volunteer plants on field edges and ditchbanks. Plant crop rows with ample spacing and in the direction of the prevailing winds to increase air movement and minimize periods of prolonged leaf wetness. Reduce crop residues by removing or mowing senescent and dried fern in the fall/winter.

Pesticide

chlorothalonil products (chlorothalonil) | Several formulations are labeled at various rates (Bravo, Echo, Equus, Initiate). Always check the label. Use 38.5% (Zn) formulations at 2.75-5.75 pt. per acre. Use 54% (720) formulations at 2-4 pt. per acre. Use 82.5% (WDG) formulations at 1.8-3.6 lb. per acre. REI: 12-hour. PHI: 190-day. FRAC M05.

Dexter Max (mancozeb, azoxystrobin) | 2-2.2 lbs. per acre. REI: 24-hour. PHI: 180-day. FRAC M03, FRAC 11.

mancozeb products (mancozeb) | Several formulations are labeled at various rates (Dithane, Koverall, Manzate, Penncozeb, Roper DF). Always check the label. Use 37% formulations at 1.6 qt. per acre. Use 75% and 80% formulations at 2 lb. per acre. REI: 24-hour. PHI: 180-day. FRAC M03.

Rally 40WSP (myclobutanil) | 5 oz. per acre. REI: 24-hour. PHI: 180-day. FRAC 03.

Sonoma 40WSP (myclobutanil) | 5 oz. per acre. REI: 24-hour. PHI: 180-day. FRAC 03.

tebuconazole products (tebuconazole) | 4-6 fl. oz. per acre. There are many brand names (Monsoon, Onset, Vibe) with 3.6 lbs. a.i. per gallon that use the same rate. REI: 12-hour to 18-day. PHI: 180-day. FRAC 03.

Unicorn DF (tebuconazole, sulfur) | 2-3.75 lbs. per acre. REI: 12 to 24-hour. PHI: 180-day. FRAC 03, FRAC M02, IRAC UN.

Asparagus - Insects

Aphids

Treat when less than 5% of ferns have aphids present.

Pesticide

Assail 30SG (acetamiprid) | Use 30SG formulations at 2.5-5.3 oz. per acre. Use 70WP formulations at 1.1-2.3 oz. per acre. For control on spears during harvest, to prevent egg laying and feeding injury. REI: 12-hour. PHI: 1-day. IRAC 04A.

Fulfill (pymetrozine) | 2.75 oz. per acre. Apply to fern only after harvest has been completed. REI: 12-hour. PHI: 170-day. IRAC 09B.

Asparagus Beetles

At Harvest: Treat when 5-10% of plants are infested, or 2% of spears have eggs.

At Fern: Treat when 10% of plants are defoliated, or 50% of plants have larvae.

Pesticide

Assail 30SG (acetamiprid) | Use 30SG formulations at 2.5-5.3 oz. per acre. Use 70WP formulations at 1.1-2.3 oz. per acre. For control on spears during harvest, to prevent egg laying and feeding injury. REI: 12-hour. PHI: 1-day. IRAC 04A.

Dimethoate 4EC (dimethoate) | 1 pt. per acre. Use 4EC, LV-4 and 400 EC formulations at 1 pt. per acre. REI: 48-hour. PHI: 180-day. IRAC 01B.

Entrust SC (spinosad) | Use 2SC formulations at 4-6 fl. oz. per acre. Use 80WP formulations at 1.25-2.0 oz. per acre. REI: 4-hour. PHI: 60-day. IRAC 05. *OMRI-listed.*

Lannate LV (methomyl) | 1.5 - 3.0 pts. per acre. REI: 48-hour. PHI: 1-day. IRAC 01A. *RUP.*

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 3.2-6.4 oz. per acre. Use 3.2EC formulations at 2-4 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

Radiant 1SC (spinetoram) | 4-8 fl. oz. per acre. Postharvest protection of ferns only. REI: 4-hour. PHI: 60-day. IRAC 05.

Sevin XLR Plus (carbaryl) | 1-2 qts. per acre. Use low rate for control on seedlings and or spears during harvest, to prevent egg laying and feeding injury. Use high rate for control on fern growth after harvest is over. REI: 12-hour. PHI: 1-day. IRAC 01A.

Caterpillars

For cutworm caterpillars: Treat when 5% of crowns are infested at harvest. Treat in the fall when there is 1 larvae per 20 plants.

Pesticide

Coragen (chlorantraniliprole) | 3.5-5.5 fl. oz. per acre. For armyworms. REI: 4-hour. PHI: 1-day. IRAC 28.

Lannate LV (methomyl) | 1.5 - 3.0 pts. per acre. For armyworms, and cutworms. REI: 48-hour. PHI: 1-day. IRAC 01A. *RUP.*

Perm-Up 25DF (permethrin) | For cutworms. Use 25W, 25WP or 25DF formulations at 3.2-6.4 oz. per acre. Use 3.2EC formulations at 2-4 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

Sevin 5B (carbaryl) | 20 lbs. per acre. For cutworm control on spears during harvest, to prevent egg laying and feeding injury. Do not exceed more than 3 applications to spears. REI: 12-hour. PHI: 1-day. IRAC 01A.

Sevin XLR Plus (carbaryl) | For cutworms. Use low rate for control on seedlings and or spears during harvest, to prevent egg laying and feeding injury. Use high rate for control on fern growth after harvest is over. REI: 12-hour. PHI: 1-day. IRAC 01A.

Japanese Beetle

Pesticide

Assail 30SG (acetamiprid) | Use 30SG formulations at 5.3 oz. per acre. Use 70WP formulations at 2.3 oz. per acre. Apply to fern only after harvest has been completed. REI: 12-hour. PHI: 1-day. IRAC 04A.

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 3.2-6.4 oz. per acre. Use 3.2EC formulations at 2-4 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

Tarnished Plant Bug

Pesticide

Assail 30SG (acetamiprid) | Use 30SG formulations at 5.3 oz. per acre. Use 70WP formulations at 2.3 oz. per acre. Apply to fern only after harvest has been completed. REI: 12-hour. PHI: 1-day. IRAC 04A.

Perm-Up 25DF (permethrin) | Use 25W, 25WP or 25DF formulations at 3.2-6.4 oz. per acre. Use 3.2EC formulations at 2-4 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP*.

Asparagus - Weeds

All Weeds

Before establishing an asparagus planting, reduce perennial weeds in the area to be planted with systemic broad-spectrum herbicides. Herbicide options are limited in the planting year.

After the first year of establishment, a typical weed control program in asparagus includes a preemergence herbicide with a long residual applied before asparagus emerges. If needed, a preemergence herbicide may be applied again after harvest is finished and a clean mowing.

Postemergence herbicides may be applied before asparagus emergence or during or after the harvest season. Some require directed or shielded spray applications to avoid spraying asparagus.

It is important use herbicides with different modes of action from year to year with this perennial crop to avoid buildup of weed species not controlled by a particular mode of action.


For specific weeds controlled by each herbicide, check the Relative Effectiveness of Herbicides for Vegetable Crops table.



Rates provided in the recommendations below are given for overall coverage. For a banded treatment, reduce amounts according to the portion of acre treated.


Non-Pesticide



Good weed control in the planting year is especially important. Multivators, tines, rolling cultivators, and flame weeders work well before emergence of asparagus, but it is important to avoid damaging crowns when cultivating. Cultivate row-middles and hand-hoe after emergence. Flame weeders can also be used after clean harvest or mowing. Once established, straw mulch can be applied any time, but is easier for picking when applied after final harvest.


Pesticide


2,4-D (2,4-D) POST  | Available as both amine and choline formulations. Use 3-4 pts. per acre of liquid formulations with 3.8 lbs. per gal. acid equivalent. Apply before, during, or after the harvest season. During harvest season apply immediately after cutting. Discard deformed spears. Use drop nozzles for treatments after harvest to avoid spraying fern. Wait at least 30 days between applications. REI: 48-hour. PHI: 3-day. HRAC 04.


Aim EC (carfentrazone) POST   | 0.5-1.92 fl. oz. per acre. Include 0.5 pt. NIS or 0.25-0.5 gals. COC per 25 gals. of spray solution. Broadcast after spear harvest. Emerged asparagus will be injured. Do not exceed 3.8 fl. oz. per acre per season. Wait at least 20 days between applications. REI: 12-hour. PHI: 5-day. HRAC 14.



Callisto (mesotrione) POST PRE  | 3-7.7 fl. oz. per acre. Apply in spring before spears emerge after mowing, disking, or tilling; after final harvest; or both. For postharvest applications use drop nozzles or other equipment that will minimize contact with crop. Adding COC or NIS (alone or with UAN or AMS) will improve emerged weed control and increase crop injury risk in postharvest applications. Do not exceed 2 applications per year, or 7.7 fl. oz. per acre per year. REI: 12-hour. HRAC 27.

Chateau SW (flumioxazin) PRE   | 6 oz. per acre of Chateau SW or 6 fl. oz. per acre of Chateau EZ. *Established plantings only.* Apply to dormant asparagus at least 2 weeks before spears emerge. Crop injury may result if asparagus is not dormant. May be tank-mixed with paraquat to control emerged weeds. Or, apply after final harvest for the season before fern emerges. Do not exceed 6 oz. per acre per growing season. REI: 12-hour. HRAC 14.



Clarity (dicamba) POST  | 0.5-1.0 pt. per acre. Apply in 40-60 gals. of water per acre immediately after cutting. Discard crooked spears at harvest. Clarity can injure nearby broadleaf crops and garden plants. Maximum 1 pt. per acre per year. REI: 24-hour. PHI: 1-day. HRAC 04.


clethodim products (clethodim) POST  | Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. of COC per 25 gals. of spray solution (1% v/v). Use Select Max at 9-16 fl. oz. per acre with 8 fl. oz. of NIS per 25 gals. of spray solution (0.25% v/v). Spray on actively growing grass. Wait at least 14 days between applications. Do not exceed 32 fl. oz. of 2EC formulations or 64 fl. oz. of Select Max per acre per season. REI: 24-hour. PHI: 1-day. HRAC 01.



clopyralid products (clopyralid) POST  | 8-10.7 fl. oz. per acre. Apply Spur before or during harvest. May cause some crooking of spears. Controls Canada thistle, marestalk, mayweed, nightshade, plantain, smartweeds. Do not exceed 10.7 fl. oz. per acre per year. Avoid application 2 years in succession. REI: 12-hour. PHI: 2-day. HRAC 04.


diuron products (diuron) PRE   | *Established plantings only. Do not apply to young plants during the first year.* Use 80DF formulations at 1-4 lbs. per acre, and do not exceed 6 lbs. per acre per season. Use 4L formulations at 0.8-3.2 qts. per acre and do not exceed 4.8 qts. per acre per season. Use lower rates on light-colored soils with less than 2% organic matter. Apply after tillage or chopping fern in the spring and again after harvest, if necessary. See product label



for split application rates. 6-8 weeks of residual activity. *RUP in Michigan only*. REI: 12-hour. HRAC 05. *RUP*.



Dual Magnum (s-metolachlor) PRE   | 1.33-2.0 pts. per acre. *Illinois, Indiana, Michigan, and Minnesota 24c label only*. Apply before asparagus and weeds emerge in spring or after the harvest season. Needs moisture for activation. Do not exceed 1 application per crop. REI: 24-hour. PHI: 16-day. HRAC 15.



Fusilade DX (fluazifop-P) POST  | 8-12 fl. oz. per acre. Include 1-2 pts. of COC or 0.5-1 pt. of NIS per 25 gals. of spray solution. Spray on actively growing grass. Rates may be doubled if asparagus will not be harvested for 12 months. Wait at least 14 days between applications. Do not exceed 48 fl. oz. per acre per season on bearing asparagus. REI: 12-hour. PHI: 1-day. HRAC 01.


glyphosate products (glyphosate) POST   | 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal) at 0.66-3.3 qts. per acre. Apply to emerged weeds at least 7 days before spears emerge or immediately after last harvest. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. If spears are allowed to regrow, delay application until ferns have developed and apply as a directed or shielded spray. Contact of the spray with asparagus fern may result in crop injury. REI: 4-hour to 12-hour. PHI: 14-day. HRAC 9.



Lorox DF (linuron) POST PRE  | 2-4 lbs. per acre. *Established crowns*: Apply before spears emerge, before cutting season or immediately after cutting, or as directed spray in ferns. *New planted crowns*: To control small emerged weeds apply 1-2 lbs. per acre, up to 2 applications when ferns are 6-18 inches tall. *Newly seeded crops*: Apply a 1-inch band of activated charcoal over the row at planting, then apply Lorox. Use charcoal at 300 lbs. per acre of actual area sprayed, which is equivalent to 15 lbs. per acre of crop with a 20-inch row-spacing. Or, use the low rate of Lorox when ferns are 6-18 inches tall and weeds are less than 4 inches tall. Do not use on sand, loamy sand, or soils with less than 1% organic matter. Maximum 4 lbs. or 3 applications per acre per year. REI: 24-hour to 8-day. PHI: 1-day. HRAC 05.


metribuzin products (metribuzin) POST PRE   | *Established plantings only. Do not apply to young plants during first year*. Use 75DF formulations at 0.6-2.6 lbs. per acre. Use 4F formulations at 2-4 pts. per acre. See product label for split application rates. Use low rate if combined with diuron. 6-8 weeks residual activity. Two sprays necessary for seasonlong sandbur control. Do not exceed 2.6 lbs. or 4 pts. per acre per year. REI: 12-hour. PHI: 14-day. HRAC 05.



paraquat products (paraquat) POST   | 2.5-4 pts. per acre. Include 1 qt. of COC, or 4-8 fl. oz. of NIS per 25 gallons of spray solution. Apply before crop emergence or after last harvest before fern regrows. REI: 12 to 24-hour. PHI: 6-day. HRAC 22. *RUP*.



pendimethalin products (pendimethalin) PRE   | 2.4-8.2 pts. per acre. Use formulations with 3.8 lbs. active ingredient per gallon. Apply at least 14 days before first harvest and prior to spear emergence. If spears are present, remove before application. On sandy soil use no more than 2.4 pts. per acre. Do not apply to newly seeded asparagus during first year. REI: 24-hour. PHI: 14-day. HRAC 03.



Poast (sethoxydim) POST  | 1-1.5 pts. per acre. Include 1 qt. COC per acre. Spray on actively growing grass. Use high rate on quackgrass. Do not exceed 5 pts. per acre per season. REI: 12-hour. PHI: 1-day. HRAC 01.

QuinStar 4L (quinclorac) POST   | 12.6 fl. oz. per acre. Include 1 qt. of COC per 25 gallons of spray solution. Apply after final harvest for the year. Controls bindweed, Canada thistle, barnyardgrass, large crabgrass. Do not exceed 1 application per year. REI: 12-hour. HRAC 04.

Sandea (halosulfuron) POST PRE  | 0.5-1.5 oz. per acre. Apply before, during, or after harvest. Drop nozzles and using COC or NIS are recommended for applications after harvest. For first year transplants do not apply sooner than 6 weeks after fern emergence. Do not exceed 2 applications per crop cycle, or 2 oz. per acre per 12-month period. Has residual soil activity. Effective on nutsedge. REI: 12-hour. PHI: 1-day. HRAC 02.

Sinbar WDG (terbacil) POST PRE   | 0.62-1.5 lbs. per acre. Established crowns or direct-seeded crops only. Do not use on sandy soil or on soil with less than 1% organic matter. *Established crowns:* Apply in spring after cutting fern and prior to spear emergence. May also be applied after a clean cutting. *Seeded crops:* At planting spray activated charcoal at 300 lbs. per acre of actual area treated in a 1-inch band over the row (equivalent to 15 lbs. per acre of crop with 20-inch row spacing), then apply Sinbar. Do not plant other crops within 2 years of application. 8-12 weeks residual activity. REI: 12-hour. PHI: 5-day. HRAC 05.

Solicam DF (norflurazon) PRE   | 2.5-5 lbs. per acre. *Established plantings only.* Do not apply within 12 months of planting. Apply preemergence to soil free of weeds and debris. REI: 12-hour. PHI: 14-day. HRAC 12.

Spartan 4F (sulfentrazone) PRE   | 4.5-12 fl. oz. per acre. *Michigan only - applicators must have a supplemental label. Established plantings only.* Apply in spring before crop

emerges. Use low rate on light soil. Do not use on soils with less than 1% organic matter. Do not exceed 1 application and 12 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. HRAC 14.

trifluralin products (trifluralin) PRE   | *Established plantings only.* Use 4EC

formulations at 2-4 pts. per acre. Use 10G formulations at 10-20 lbs. per acre. Use lower rates on coarse soils. Apply and incorporate 1-2 inches early in the spring when spears are at least 4 inches below soil surface. See product label for split application instructions. 4-6 weeks of residual activity. REI: 12-hour. HRAC 03.

Tripzin ZC (pendimethalin, metribuzin) POST PRE   | 116-172 fl. oz. per acre.

Broadcast 14 days before emergence. Do not apply to seedlings or first-year transplants. REI: 24-hour. PHI: 14-day. HRAC 03, HRAC 05.