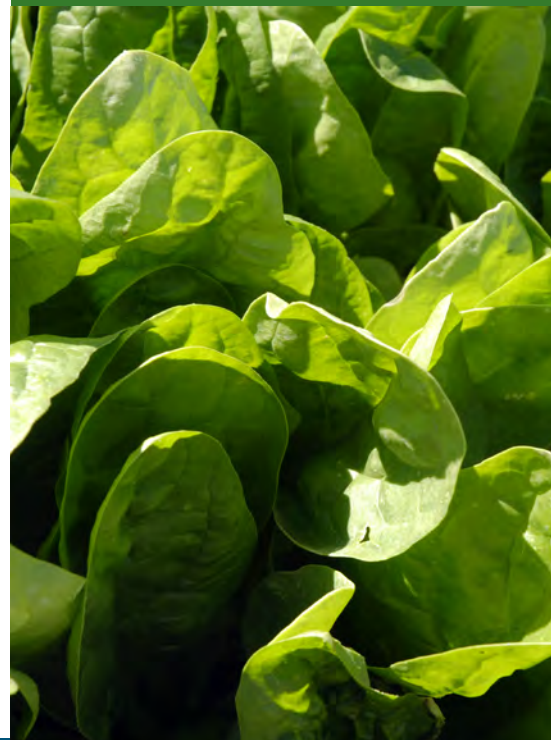


Spinach Management Schedule

*A guide to weed, insect and
disease management in spinach
in Nova Scotia*



2018



GUIDE TO PEST MANAGEMENT IN SPINACH



Nova Scotia Vegetable Crop Guide to Pest Management 2018 [SPIN1-18]

Updated March 15, 2018 by
Peter Burgess, Horticulturist, Perennia
Mélanie Leclerc, Research Associate, Perennia

IMPORTANT

This publication was compiled by representatives from Perennia using information from the Pest Management Regulatory Agency of Health Canada, specific pesticide labels, previous Atlantic Provinces Vegetable Pest Guides and manufacturer's information. **This information is continuously changing and therefore it can cease to be current and accurate. Pesticide labels are the best source of information and should always be consulted prior to using a product.** The label is the best source of information on: registered crop uses, rates, days to harvest, compatibility with other pesticides, toxicity and other special information on its effective and safe use

By printing this publication, Perennia does not offer any warranty or guarantee, nor do they assume any liability for any crop loss, animal loss, health, safety or environmental hazard caused by the use of a pesticide mentioned in this publication.

WARNINGS

This publication is meant to be used as a reference for possible pest control options. Where there are multiple brand names of a specific active ingredient registered in Canada, Perennia has only listed a couple for reference purposes and as such does not endorse one brand over another. If you have purchased a generic product not specifically in this guide but has your crop and pest on the label, always follow that product label.

If any information in this or any other publication conflicts with the information on the label, always use the label recommendation. If you have an old label, your pesticide supplier should be able to give you the newest label. You are legally responsible for the safe use of pesticides you purchase. This means the safe transport and storage of these materials, the label rates used on crops, and the safe disposal of containers.

| Pest | Group | Active Ingredient | Pesticide Product Name | Rate | Restricted Entry Interval (REI) | Pre-harvest Interval (days) | Remarks |
|--|-------|---------------------|-------------------------------|----------------------|---------------------------------|-----------------------------|--|
| WEEDS: | | | | | | | |
| Preplant <i>Perennial weeds including quackgrass</i> | 9 | glyphosate | Roundup WeatherMAX | 1.67-8.0 L/ha | 12 hours | 7 | Apply in the fall or spring prior to planting. Annual weed control programs will be necessary to control weeds germinating after planting. For quackgrass control, apply to actively growing quackgrass when at least 4 new leaves are present. The low rate (2.5 L/ha) will provide a minimum of one season control, while higher rates (4.75 to 7 L/ha) will provide longer term control. The low rate of Roundup should be applied in 50 to 100 L/ha water. If higher water volumes are used add a suitable surfactant. Wait 72 hours before plowing under. Best control of quackgrass is obtained when these herbicides are applied in the fall. |
| | | | Touchdown 480 | 2.5-7.0 L/ha | 12 hours | 7 | |
| | 14 | carfentrazone-ethyl | Aim EC | 36.5-117 mL/ha | 12 hours | 1 | |
| Preemergence <i>Stale Seedbed technique</i> | 22 | paraquat | Gramoxone 200 Sn | 2.75-5.5 L/ha | 24 hours | - | Apply in 300 – 1100 L of water/ha to foliage of emerged weeds but before the crop has emerged. |
| | 22 | diquat | Reglone 240, Dessicash | 2.3-4.6 L/ha | 24 hours | - | |
| Postemergence <i>Grasses</i> | 1 | sethoxydim | Poast Ultra plus Merge | 1.1 L/ha 1-2 L/ha | 12 hours | 15 | Apply to actively growing grasses. One application per year. |
| | 1 | clethodim | Select | 0.19 | 12 hours | 14 | Apply a maximum of two applications per |

| | | | | | | | |
|---------------------------|----|---------------------|-----------------------------------|-----------------------------|----------|---|---|
| | | | plus Amigo | L/ha plus 0.5 %v/v | | | year. |
| <i>Inter-row shielded</i> | 22 | paraquat | Gramoxone 200 Sn | 2.75-5.5 L/ha | 12 hours | - | Avoid spraying crop as damage may occur. |
| | 22 | diquat | Reglone 240, Dessicash | 2.3-4.6 L/ha | 24 hours | - | |
| | 14 | carfentrazone-ethyl | Aim EC | 36.5-117 mL/ha | 12 hours | 1 | Apply in minimum spray volume of 100 L/ha. Refer to label for target weeds, buffer zones and rates. Use high flow rate nozzles to apply the highest spray volume. |

| Pest | Group | Active Ingredient | Pesticide Product Name | Rate | Restricted Entry Interval (REI) | Pre-harvest Interval (days) | Remarks |
|-----------------|-------|-------------------|------------------------|-----------------|---------------------------------|-----------------------------|---|
| INSECTS: | | | | | | | |
| Leaf Miners | 4 | acetamiprid | Assail 70 WP | 86 g/ha | 12 hours | 7 | Max 5 applications/yr. |
| Aphids | 4 | acetamiprid | Assail 70 WP | 56-86 g/ha | 12 hours | 7 | Max 5 applications/yr. |
| | 1B | dimethoate | Lagon 480 EC | 700 ml/ha | 12 hours | 7 | Swiss Chard only Max 2 applications per year. |
| | 1B | malathion | Malathion 85E | 1345 ml/ha | 12 hours | 7 | Use sufficient spray volume to achieve adequate plant coverage |
| | 9B | Pymetrozine | FulFill 50WG | 193 g/ha | 12 hours | 14 | Apply when aphids first appear. Do not exceed 2 applications/season. Allow 7 days between applications. Causes feeding cessation shortly after application but aphids may remain on the plant for 2-4 days before they die. The use of a non-ionic surfactant at a rate of 0.25% v/v is recommended to improve performance under drought stress conditions. |
| | 29 | Fonicamid | Beleaf 50SG | 0.12-0.16 kg/ha | 12 hours | 0 | Thorough spray coverage of plant foliage is essential. Minimum of 94 L of water/ha. Max 3 applications/season; allow 7 days between applications. Avoid overnight storage of spray mixtures, do not use liquid fertilizer as a carrier and do not use adjuvants. |
| | 4 | thiamethoxam | Actara 25 WP | 105 g/ha | 12 hours | 7 | Apply before aphids reach damaging levels. Max 2 applications/year, with at least 7 days between them. This product |

| | | | | | | | |
|------------------------------|----|-------------------|-----------------------|---------------|----------|---|---|
| | | | | | | | is highly toxic to bees, do not apply to blooming crops and wait at least 5 days before placing beehives in a treated field. |
| | 4C | Sulfoxaflor | Closer SC | 100-150 ml/ha | 12 hours | 3 | Max 2 applications/growing season with at least 7 days between them. Do not apply during crop flowering period or when flowering weeds are present in treatment area. |
| Aphids and Whiteflies | 23 | spirotetramat | Movento 240 SC | 220-365 ml/ha | 12 hours | 3 | Minimum 7 day interval between applications. Maximum of 730 ml/ha of product applied per season. Product is TOXIC to bees through direct contamination of pollen and nectar. DO NOT apply this product during crop flowering period or when flowering weeds are present. |
| | | | Movento 150 OD | 347-585 ml/ha | 12 hours | 3 | Minimum 7 day interval between applications. Maximum 1.17 L/ha of product applied/season. This product is TOXIC to bees through direct contamination of pollen and nectar. DO NOT apply this product during crop flowering period or when flowering weeds are present. |
| Cabbage looper | 5 | spinosad | Success 480 SC | 0.182 L/ha | 12 hours | 1 | Max 3 applications/yr. |
| | | | Entrust 80 W | 109 g/ha | 12 hours | 1 | Max 3 applications/yr. Allow 7-10 days between applications. |
| | | Entrust SC | 364 ml/ha | | | | |
| | 5 | spinetoram | Delegate WG | 140-200 g/ha | 12 hours | 1 | Time application with peak egg hatch or small larvae. Repeat applications based on population monitoring. Use higher |

| | | | | | | | |
|-------------------------|----|---|----------------------|----------------|----------------------------|---|---|
| | | | | | | | rate for higher infestations or advanced growth stages. Max 3 applications/year with a minimum re-treatment interval of 5 days. |
| | 11 | <i>Bacillus thuringiensis</i> | Dipel 2X DF | 275-550 g/ha | - | 0 | Spinach Only. Looper only |
| | | | Thuricide HPC | 2.0-4.25 L/ha | - | 0 | |
| | 28 | chlorantraniliprole | Coragen | 250 ml/ha | 12 hours | 1 | Begin applications when treatment thresholds are reached. Do not apply more than once every 3 days. Max 4 applications/season. Do not exceed 1L per ha per season. Apply in a finished spray volume of 100L/ha. |
| | 18 | Methoxyfenozide | Intrepid 240F | 0.3 – 0.6 L/ha | 12 hours | 1 | Apply at the first sign of feeding damage or when infestations reach threshold levels as determined by monitoring. Repeat applications after 7-14 days if required based on population monitoring. Use higher rate for heavy infestations, advanced growth stages of the target pest or larger crop canopies. |
| | 11 | <i>Bacillus thuringiensis</i> , subsp. <i>aizawai</i> , (Strain ABTS-1857 fermentation solids, spores, and insecticidal toxins) | XenTari WG | 500-1000 g/ha | - | 0 | Also for the control of Beet Armyworm. Apply sufficient spray volume to ensure uniform deposition on all plant surfaces; recommend 500 L per ha. |
| Aster leafhopper | - | kaolin | Surround WP | 12.5-25 kg/ha | 4 hours *unable to find | 0 | An OMRI listed control product suitable for organic production. Apply in 500 L of water at 7-14 day intervals once initial infestation is detected. Use high rate for early applications. Do not exceed 25 kg/ha per application. |

| | | | | | | | |
|----------------------------|----|------------------|-----------------------|----------------------|----------|--------|--|
| Tarnished Plant Bug | 4 | thiamethoxam | Actara 25 WP | 210 g/ha | 12 hours | 7 | Apply before aphids reach damaging levels. Max one application/year. This product is highly toxic to bees, do not apply to blooming crops and wait at least 5 days before placing beehives in a treated field. |
| Onion thrips | 5 | Spinetoram | Delegate WG | 200-336 g product/ha | 12 hours | 1 | Max 3 applications/year. Apply when onion thrips first appear targeting egg hatch and small nymphs. Repeat in 7-10 days if needed. |
| | 23 | Spirotetramat | Movento 240 SC | 365 ml/ha | 12 hours | 3 days | Minimum interval between applications: 7 days. Maximum allowed per crop season: 730 mL/ha. Apply when thrips are first identified. Movento should be used during the first half of the season when adult populations are relatively low or building. Reductions in numbers of thrips larvae may take 3 to 4 days after Movento is applied. |
| Flea Beetles | 28 | Cyantraniliprole | Exirel | 500-1000 ml/ha | 12 hours | 1 | Begin applications when treatment thresholds have been reached. Thorough coverage is important to obtain optimum control. Re-application interval: 5 days. Max 4 applications/season. |

| Pest | Group | Active Ingredient | Pesticide Product Name | Rate | Restricted-Entry Interval (REI) | Pre-harvest Interval (days) | Remarks |
|---------------------|-------|----------------------------|--------------------------------------|-------------------------------|---------------------------------|-----------------------------|---|
| DISEASES: | | | | | | | |
| Anthracnose | 9, 12 | Cyprodinil and fludioxonil | Switch 62.5 WG | 775-975 g/ha | 3 days | 3 | Begin applications prior to or at the onset of disease and repeat applications at 7-10 day intervals if conditions remain favourable for disease development. Max 2 applications per year. Apply in sufficient water to ensure thorough coverage: Ground: 175-225 L of water /ha. |
| Pythium | 4 | metalaxyl-M and s-isomer | Apron XL LS | 20–40 ml / 100kg of seed | - | - | One application as a seed treatment. Do not apply to leafy greens that are destined to be grown in the greenhouse. |
| Downy Mildew | 11 | azoxystrobin | Quadris | 1.125 L/ha | 12 hours | 7 | Max 2 application/yr. Begin applications prior to disease establishment and repeat at 7 day intervals. |
| | 11 | Azoxystrobin | Azoshy 250SC | 1.125 L/ha | 12 hours | 7 | Max 2 application/yr. Begin applications prior to disease establishment and repeat at 7 day intervals. |
| | M | copper sulfate | Copper 53W | 2.5-3 kg/ha | 48 hours | 2 days | Apply at 7-10 day intervals. |
| | 40 | mandipropamid | Revus plus Non-ionic adjuvant | 400-600 ml/ha plus 0.125% v/v | 12 hours | 1 | For control of Downy Mildew and Blue Mold. Applications should begin prior to disease development and continue throughout the season on a 7-10 day schedule, following resistance management guidelines. Max four applications per year. |
| | 7 11 | boscalid, pyraclostrobin | Pristine WG | 1.6 Kg/ha | 24 hours 9 days for hand | 0 | For suppression of Downy mildew. Apply when disease first appears. Follow 5-7 days later with a fungicide with a |

| | | | | | | | |
|--|-----|------------------------------------|----------------------------|-----------------|-------------------------|---|---|
| | | | | | harvesting and thinning | | different mode of action. Do not make sequential applications of Pristine. Max 2 applications per year. |
| | 4 | metalaxyl-M and S-isomer | Ridomil Gold 480 EC | 1 L/ha | - | - | Apply at planting as a banded application over the row, pre-plant incorporated application. One application per season. |
| | 43 | fluopicolide | Presidio | 220-292 ml/ha | 12 hours | 2 | Apply in 200-1000 L/ha. For resistance management, Presidio must be tank-mixed with a labelled rate of another fungicide registered for the target pathogen, but with a different mode of action. Apply Presidio in a tank mix with Aliette. Follow the most restrictive use directions of either label. Make foliar applications on a 7-10 day schedule beginning with initial flowering, or when disease conditions are favourable, but prior to disease development. Use the lower rate and longer interval as preventive applications. Use higher rate and shorter interval if disease is present. |
| | 11 | Fenamidone | Reason 500 SC | 400 ml/ha | When dry | 2 | Begin applications prior to onset of disease which typically occurs in humid weather or when rains and heavy dews occur, approximately early to after mid-June. Continue applications on a 7-day interval. Do not make more than one application of Reason 500 SC before alternating with a fungicide from a different resistance management group. Apply with sufficient water to ensure thorough coverage of foliage. Max 4 applications/season. |
| | U15 | Oxathiapiprolin <i>NEW 2018</i> | Zorvec Enicade | 0.175-0.35 L/ha | 12 hours | 0 | Begin applications prior to disease development and continue on a 5 to 14 day interval. Use higher rate and shorter interval when disease pressure is high. |

| | | | | | | | |
|---|------|-----------------------------|--|------------------------------------|---|---|--|
| White rust (<i>Albugo occidentalis</i>) | - | <i>Bacillus subtilis</i> | Serenade Opti | 0.6-1.1 Kg/ha | - | 0 | Biopesticide that will only suppress the indicated diseases. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat as necessary on a 7-10 day interval. |
| | 21 | Cyazofamid | Torrent 400SC Plus Sylgard 309 | 0.15-0.2 L/ha Plus 0.15 L/ha | 12 hours | 1 | Suppression only. Max 5 applications per year. Make applications at 7-day intervals beginning when disease is first seen or when conditions favour disease development. Use the low rate for preventative applications or very low disease pressure; use high rate as disease pressure increases. Spray volume to use varies with the amount of plant growth and will range from 300-500 L/ha. A plant back interval of 30 days is required. |
| Sclerotinia rot (<i>Sclerotinia sclerotiorum</i> , <i>Sclerotinia minor</i>) | 7 11 | boscalid, pyraclostrobin | Pristine WG | 1.0 – 1.3 Kg/ha | 24 hours 9 days for hand harvesting and thinning | 0 | For suppression of white mold. Apply once per season before disease develops. |
| | 7 | penthiopyrad | Fontelis | 1.25-1.75 L/ha | 12 hours | 3 | Begin applications prior to disease development, continue on a 7-10 day interval. Use higher rate and shorter interval when disease pressure is high. Max seasonal rate is 5.25 L/ha. Do not make more than 2 sequential applications before switching to another mode of action. |
| Grey mould (<i>Botrytis cinerea</i>) | 7 | penthiopyrad | Fontelis | 1.25-1.75 L/ha | 12 hours | 3 | Begin applications prior to disease development, continue on a 7-10 day interval. Use higher rate and shorter interval when disease pressure is high. Max seasonal rate is 5.25 L/ha. Do not make more than 2 sequential applications before switching to another mode of action. |

| | | | | | | | |
|--|-------|----------------------------|-----------------------|--------------|--------|---|--|
| | 9, 12 | Cyprodinil and fludioxonil | Switch 62.5 WG | 775-975 g/ha | 3 days | 3 | Begin applications prior to or at the onset of disease and repeat applications at 7 to 10 day intervals if conditions remain favourable for disease development. Make no more than 2 applications per year. Apply in sufficient water to ensure thorough coverage: Ground: 175-225 L of water /ha. |
|--|-------|----------------------------|-----------------------|--------------|--------|---|--|

Use the following web link to search for any pesticide label mentioned in this guide, or any other pesticide registered in Canada:

<http://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php>

PESTICIDE EMERGENCY CONTACT INFORMATION

| Poison Control Centres | | |
|-------------------------------|-------------------------------------|--|
| Nova Scotia | 800.565.8161 or 902.428.8161 | IWK, Halifax, NS |
| New Brunswick | 911 | Ask for Poison Information |
| Prince Edward Island | 800.565.8161 or 902.428.8161 | IWK, Halifax, NS |
| Newfoundland | 709.722.1110 | Dr. Charles A. Janeway Child Health Care Centre, St. John's, NF |

| Environmental Emergencies (Pesticide Spills) | |
|--|--------------|
| Transport Canada Regional Operations Centre (24 hours) | |
| Nova Scotia | 800.565.1633 |
| New Brunswick | 800.565.1633 |
| Prince Edward Island | 800.565.1633 |
| Newfoundland | 800.563.9089 |

ABBREVIATIONS & CONVERSIONS

| Formulation and Measurement Abbreviations | | | |
|--|------------------------------------|--------------|---------------------------------|
| FORMULATIONS | | MEASUREMENTS | |
| DF | Dry flowable | mL | millilitre |
| EC, E | Oil-based emulsifiable concentrate | kPa | kilopascal |
| EW | Water-based concentrate | kg | kilogram |
| SC | Suspension concentrate | g | gram |
| Sn | Solution | L | litre |
| WP, W | Wettable powder | BIU | Billions of International Units |
| | | ppm | parts per million (1000 ppb) |
| | | ppb | parts per billion (1/1000 ppm) |

| Helpful Conversions¹ | |
|---|--|
| kPa X 0.14 = pounds per square inch (psi) | millilitres X 0.035 = fluid ounces |
| hectares X 2.47 = acres | litres X 35 = fluid ounces |
| kilograms X 2.2 = pounds | litres X 0.22 = imperial gallons |
| kilograms per hectare X 0.89 = pounds per acre | litres per hectare X 14.17 = fluid ounces per acre |
| kilograms per hectare X 0.40 = kilograms per acre | litres per hectare X 0.40 = litres per acre |
| | degree-days C X 1.8 = degree-days F |

¹ **Pesticide Units of Measurement**

It is not recommended to convert label rates to imperial units because there is a high probability of mathematical and rounding errors. Present day pesticides are formulated to be more effective in smaller amounts. Therefore, even small conversion errors can lead to the use of incorrect rates (either too high or too low). Use metric – you will be glad you did!