

Flax on the Farm

Preparing for Harvest

There are three issues to consider before harvesting flax: 1) plant maturity, 2) harvest methods, and 3) straw residue management.

I. Plant Maturity

Pre-Harvest Intervals

- A pre-harvest interval (PHI) is the minimum number of days between the last application of a chemical to a crop and harvest (swathing or straight-cutting).
- This time interval ensures that residue levels on the harvested crop will not exceed the maximum residue limits (MRL) of export markets.
- When a tank mix is used, the PHI is equivalent to the individual chemical with the longest PHI.
- See Table 1 for PHIs of mid to late season flax chemicals.

Maximum Residue Limits

- A Maximum Residue Limit is the legally tolerated maximum amount of pesticide residue on a food product that will not cause a human health concern. MRLs are set at levels which are well below amounts that could affect human health.
- MRLs for the same chemical often differ between countries because processes used to establish MRLs vary.
- Talk to your flaxseed buyer to find out if any chemicals are an issue for their market.
- See Table 3 for MRL comments regarding flax pre-harvest chemicals or see the [MRL information](#) on the SaskFlax website.

Pre-harvest intervals and maximum residue limits are determined through toxicological tests on agricultural products that are produced according to standard practices while following chemical labelling guidelines, and therefore it is very important to adhere to label requirements when applying late-season chemicals (Tables 1 and 3).

Determining Maturity

Variable plant staging within the same crop in 2019 made pre-harvest chemical application at the proper stage extremely challenging and reinforced the importance of rating the maturity flax crops accurately.

- The seed of brown-seeded varieties changes from pale green to yellow with brown tips and then to brown as it matures (Figure 1). Yellow-seeded varieties turn from pale green to pale yellow with darker yellow tips to a darker yellow colour.
- As the seed inside the boll matures, the colour of the boll changes. Bolls will change from green to yellow and finally to brown during the maturation process (Figures 1 and 2).
- Flax is considered physiologically mature when 75% of the bolls (in the field or on a plant) are brown and the boll segments have begun to separate (Figure 3). This is a visual rating that corresponds to a grain moisture content of around 30% and is known as the 75% boll turn or 75% brown boll stage.
- The shade of 'brown' can greatly differ between flax varieties so it is important to also look for boll segment separation.
- Flax is ready to be swathed or desiccated when physiologically mature because seed quality and yield will not be compromised at this stage of the crop's lifecycle.
- When a crop consists of plants of multiple growth stages, a pre-harvest chemical should not be applied until the

latest maturing plants reach physiological maturity, or the late maturing patches within the field should be avoided and then sprayed later when at the appropriate stage.

- Flax is ready to be combined when 90 to 100% of the bolls are brown. Seed will rattle loudly in the bolls and the moisture content will be 10% or less. Bolls will easily crush with fingers and seed should easily rub out of bolls.

Table 1. Pre-harvest intervals (PHIs) of mid to late season chemicals supported for use on flax

Category	Active ingredient	Products	PHI (d)
Herbicides	bentazon	Basagran, Basagran Forte, Benta Super, Broadloom, MPower Boa	none listed
	bromoxynil	Bromotril II 240 EC, Bromoxynil 240 EC, Brotex 240, Brotex 480, Brotex 4AT, Koril 235, MPower Buck, Pardner	60
	bromoxynil/MCPA ester	Badge II, Bromoxynil-MCPA 225-225, Buc tril M, Logic M, Mextrol 450, MPower Buck M	60
	clethodim	Antler 240 EC, Arrow 240 EC, Arrow All-In, Centurian, Clethodim 240, MPower Independence, Patron 240 EC, Select, Shadow RTM, Statue	60
	clopyralid	Lontrel 360, Lontrel XC, MPower Clobber, Pyralid	none listed
	clopyralid/MCPA ester	Curtail M, MPower Clobber M	60
	MCPA (amine, ester or Na salt)	600, Checkmate, Co-op MCPA Ester 600, IPCO MCPA Amine 600, IPCO MCPA Ester 600, IPCO MCPA Sodium Salt 300, MCPA Amine 600, MCPA Ester 600, MCPA Sodium 300, MPower MCPA Amine 500, MPower MCPA Ester 500, MPower MCPA Ester 600, Nufarm MCPA Amine 600, Nufarm MCPA Ester 600, Nufarm MCPA Sodium 300	none listed
	quizalofop	Assure II, MPower Quiz, Yuma GL, Contender	82
	sethoxydim	Poast Ultra	60
Insecticides	chlorantraniliprole	Coragen	1
	chlorpyrifos	Lorsban 4E, Lorsban NT, Pynrex 480EC, Nufos 4E, Citadel 480EC, Warhawk 480 EC, Sharphos, MPower Krypton	21
	deltamethrin	Decis 5 EC, Poleci 2.5 EC	40
	dimethoate	Cygon 480-AG, Cygon 480 EC, Lagon 480 E	21
	lambda-cyhalothrin	Labamba, Matador 120EC, Silencer 120 EC	7
	lambda-cyhalothrin, chlorantraniliprole	Voliam Xpress	7
	malathion	Malathion 85E, Malathion 500	7
	permethrin	Ambush 500EC, Perm-UP, Pounce 384EC	none listed
Foliar fungicides	fluxapyroxad, pyraclostrobin	Priaxor	21
	picoxystrobin	Acapela	28
	prothioconazole	Proline	36
	pyraclostrobin	Headline	21
Pre-harvest treatments	diquat	Armory 240, Bolster, Co-op Bolster, Craven, Desica, Dessicash, Diquat 240, Drifast, Guardsman Diquat, MPower Clone 240, Reglone, Reglone Ion, Stage	none listed
	glyphosate	Agri Star Crush'R 540, ClearOut 41 Plus, Co-op Vector 540, Credit 45, Credit Xtreme, Crush'R Plus, Flame Glyphosate 360, Glyforce WDG, Glyphosate 360, Guardsman Glyphosate, IPCO Factor 540, Matrix, MPower Disruptor, MPower Disruptor Glyphosate 540, Roundup Transorb HC Liquid, Roundup WeatherMax with Transorb 2, R/T 540 Liquid, Smoke 41%, Sharda Glyphosate 360, StartUp, Stonewall, Vector, Vector 540, VP480	none listed
	saflufenacil*	Heat LQ, Heat WG	3

Compiled from the 2020 AB, SK and MB crop protection guides and product labels. Check product labels for application rates and restrictions (environmental conditions, PPE, water volume, tank mixes, crop staging, re-entry periods and buffer zones).

*Saflufenacil (Heat WG and Heat LQ) is lacking an MRL for China and the established MRL for the EU is too low for the use of Heat as a desiccant in flax. **The use of Heat WG and Heat LQ on a flax crop that is exported to the EU will result in the MRL being exceeded.**

Figure 1. Brown-seeded flax boll and seed colour change

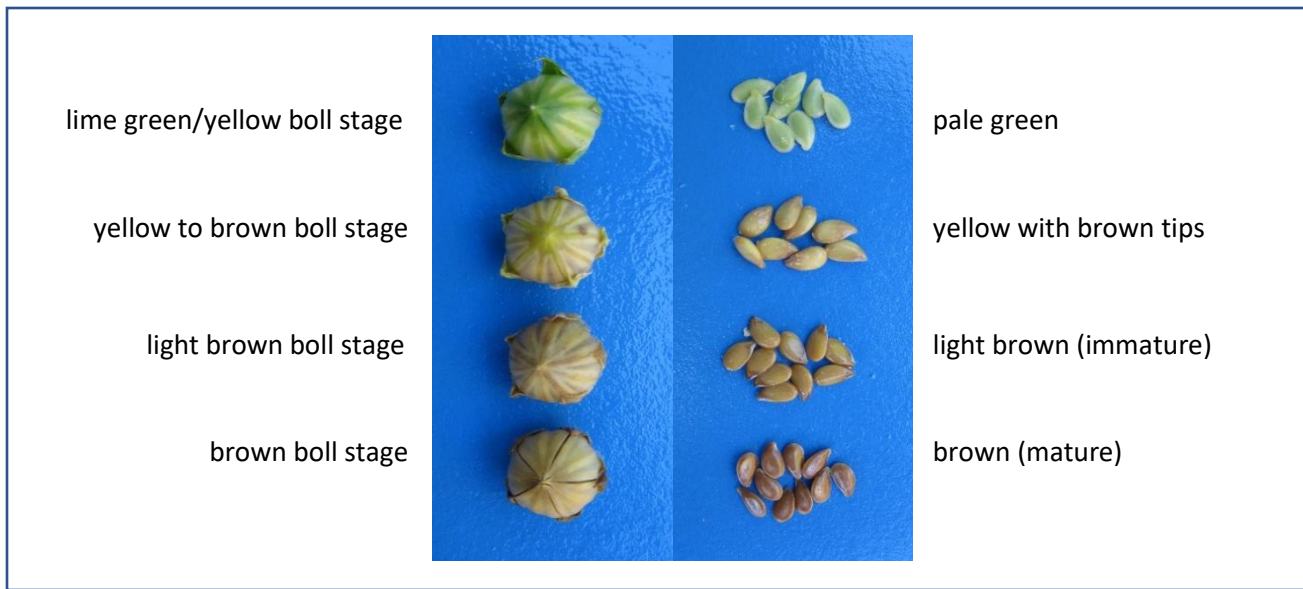


Figure 2. Flax maturity ratings

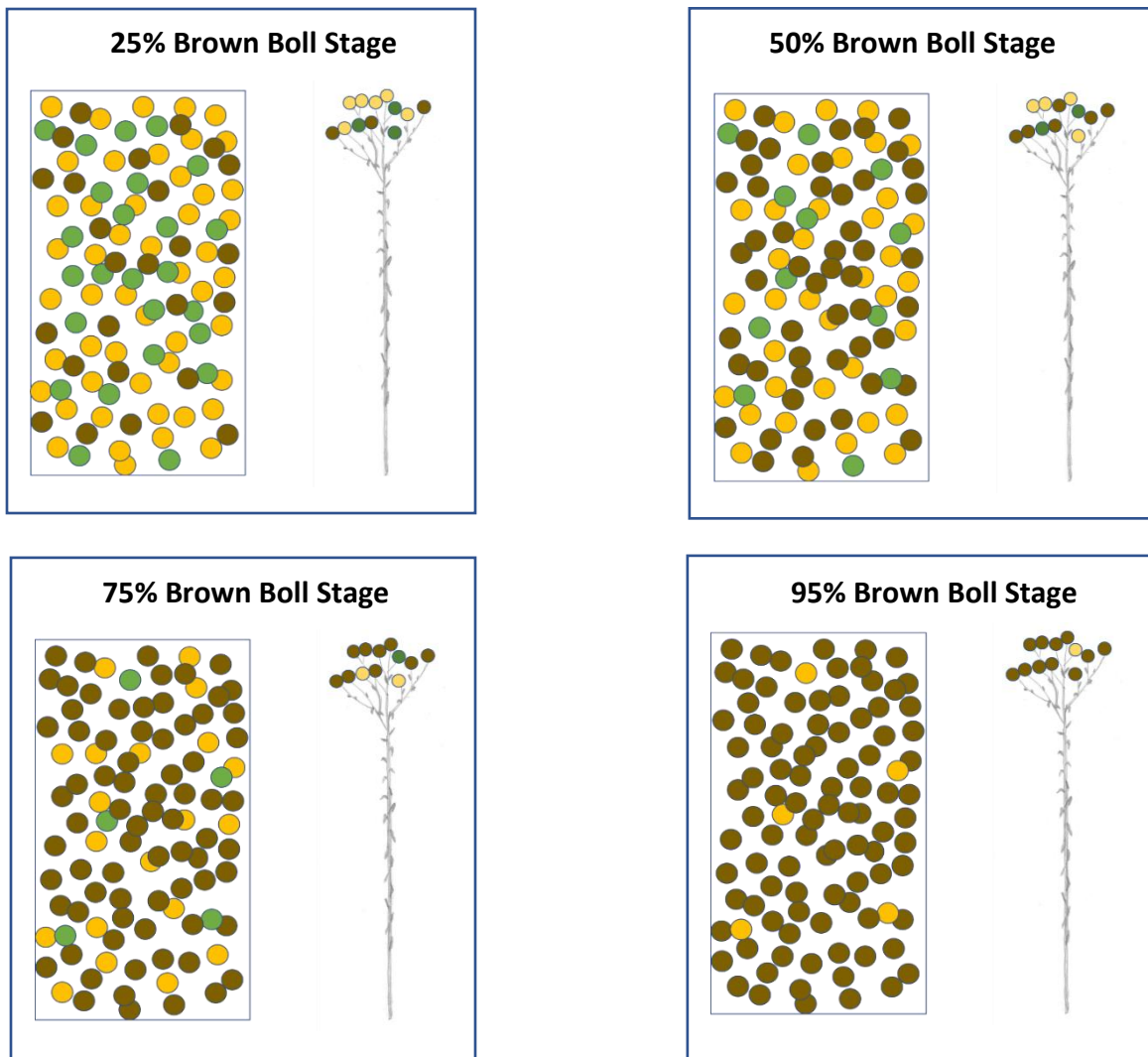
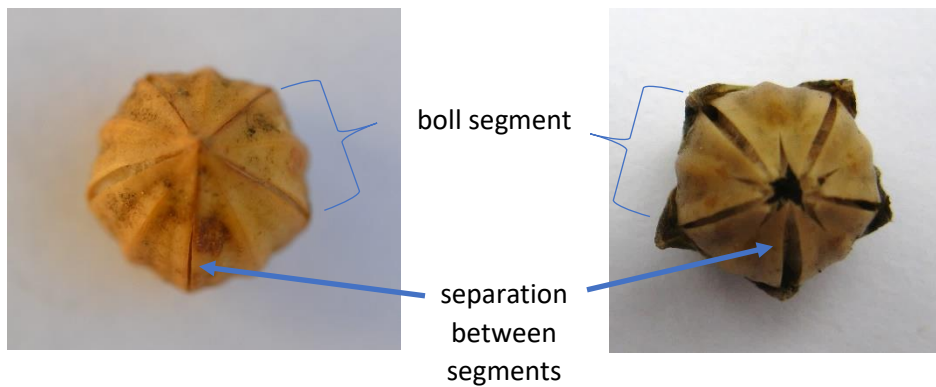


Figure 3. Mature flax bolls with separated segments



Pre-Harvest Treatments

- Two types of chemicals are available to assist with flax harvest management: pre-harvest herbicides (sometimes called harvest-aids) and desiccants (Table 2).
 - Pre-harvest herbicides are non-selective systemic herbicides that provide late season perennial weed control and may improve the harvestability of the crop by reducing the amount of green material in the field.
 - Desiccants are non-selective contact herbicides that rapidly **dry down the crop and weeds** to allow for an earlier harvest.
 - Neither type of chemical will speed up the maturity of the crop.
- The main benefits of desiccants over pre-harvest herbicides is that the period between application and harvest is typically shorter and they can be used on crops when the harvested seed will be sown. Desiccants tend to be faster acting than pre-harvest herbicides because they do not require actively growing plant tissue (e.g. green leaves) for the chemical to be active.
- Three pre-harvest chemicals are currently available for use on flax (Table 3). Each of these chemicals lacks an MRL in one or more of the major flax export markets, so consult with your exporter/processor before you spray.
- When a pre-harvest treatment is used, the crop should be harvested as soon as possible after it reaches 10% or less grain moisture to minimize losses due to boll drop.
- The use of glyphosate as a harvest-aid outside of herbicide tolerant (HT) cropping systems, increases the risk of weeds developing resistance and of losing the effectiveness of the HT system.
- It is very important to follow label directions for late season chemicals because MRLs can be an issue and seed can be damaged if chemicals are applied too early. The use of pest control products that are not registered for use on flax can also cause the same issues.
- Some producers forego using pre-harvest chemicals and instead wait for the crop to dry down naturally or for a hard frost event to kill the crop. While effective, this could mean waiting a month before the crop is ready to harvest compared to 7 to 14 days after application of a pre-harvest herbicide or 4 to 10 days after using a desiccant.

Table 2. Comparison between pre-harvest herbicide and desiccant characteristics

Characteristic	Pre-harvest herbicide	Desiccant
type of herbicide	systemic	contact
desiccant?	no	yes
growth stage when applied	75-80% brown bolls or < 30% grain moisture	75% brown bolls
cost	cheap	expensive
water volume required	less	more
weeds controlled	annual (inconsistent), perennial	annual, perennial (suppression)
effect on maturity	none	none
effect on dockage	reduction	reduction
effect on seed moisture	decrease	decrease
effectiveness under cool temperatures	poor	good
number of days after application until harvest	7-14	4-10
effect on seedling vigour and emergence	decreased germination and vigour	none

Table 3. Pre-harvest chemicals registered for use on flax

Active ingredient	Type	Products	Group	Desiccant?	Harvest-aid?	Annual grassy weed control?	Annual broadleaf weed control?	Perennial weed control?	Crop stage	Conditions that may enhance effectiveness	Conditions that may reduce effectiveness	Comments
diquat	contact	many*	22	✓		✓	✓	S	75% brown bolls	application on cloudy days or in the evening/at dusk	temperatures and high humidity following application, muddy water	harvest when seed dry (≤ 10% grain moisture); no MRLs for US, China or Codex
glyphosate	systemic	many**	9		✓	✓	✓	✓	< 30% grain moisture (75 to 80% brown bolls, typically 7 to 14 days before harvest)	environmental conditions that promote active growth of the crop and weeds	rainfall within one hour of application or heavy rain following application; cool, wet and/or cloudy conditions between application and harvest; heavy frost prior to application (do not apply after the first killing frost of the season); hard water; muddy water; foliage covered in dust	do not apply to crops if harvested seed will be sown; no MRL for China or Codex
saflufenacil [†]	contact and systemic	Heat WG, Heat LQ	14	✓	✓		✓	S	75% brown bolls	environmental conditions that promote active growth of the crop and weeds	rainfall, cool temperatures and high humidity following application	if tank mixed with glyphosate do not sow harvested seed; no MRL for China

Compiled from the 2020 AB, SK and MB crop protection guides and product labels. Check product labels for application rates and restrictions (environmental conditions, PPE, water volume, tank mixes, crop staging, re-entry periods, buffer zones and pre-harvest intervals).

[†]Saflufenacil (Heat WG and Heat LQ) is lacking an MRL for China and the established MRL for the EU is too low for the use of Heat as a desiccant in flax. **The use of Heat WG and Heat LQ on a flax crop that is exported to the EU will result in the MRL being exceeded.**

*Armory 240, Bolster, Co-op Bolster, Craven, Desica, Dessicash, Diquat 240, Drifast, Guardsman Diquat, MPower Clone 240, Reglone, Reglone Ion, Stage

**Agri Star Crush'R 540, ClearOut 41 Plus, Co-op Vector 540, Credit 45, Credit Xtreme, Crush'R Plus, Flame Glyphosate 360, Glyforce WDG, Guardsman Glyphosate, IPCO Factor 540, Matrix, MPower Disruptor Glyphosate 360, MPower Disruptor Glyphosate 540, Roundup Transorb HC Liquid, Roundup WeatherMax with Transorb 2, R/T 540 Liquid, Smoke 41%, Sharda Glyphosate 360, StartUp, Stonewall, Vector, Vector 540, VP480

S=suppression

II. Harvest Methods

- Swathing used to be the most common method of harvesting flax but straight-cutting has significantly increased in popularity.
- Flax straw can be tough, so ensure cutter/sickle bar and knives are sharp and in good working condition prior to harvest. Sharp straw chopper knives are also key. Knives should sit flat and tight on fingers to reduce vertical play on the knives and to promote good shearing (i.e. scissoring) action. Removal of the secondary knife set may ease the flow of flax straw through the combine. Sunny days with relative humidity <65% are best for combining flax.
- Swathing/windrowing
 - The crop is ready for swathing at the 75% brown boll stage.
 - Combining can occur as early as a couple of days after swathing if the weather is hot and dry, but more typically occurs a week afterwards. The crop is ready to combine when grain moisture is ≤ 10% which corresponds to the 90-100% brown boll stage when seeds are rattling loudly within the bolls.
 - Swathing is a good alternative for a crop that is not uniform in maturity (e.g. lots of fall re-growth), is lodged, has hail damage or may remain in the field for an extended period of time prior to harvest.

- Seed in swaths may be more resistant to frost.
- Straight-cutting
 - Flax can be straight-cut when grain moisture is $\leq 10\%$. This corresponds to the 90-100% brown boll stage when seeds are rattling loudly within the bolls and often occurs one to two weeks after applying a pre-harvest herbicide depending on the weather conditions and product used.
 - Flax can be susceptible to boll drop when left standing if pasmo is present, a fungicide was not applied and if strong winds or hail occur.
 - If you have access to a stripper header for straight-cutting flax there are advantages:
 - Taller stubble captures more snow and provides greater protection against erosion.
 - Can combine when stems are not fully dried down.
 - Less straw reduces wear on the combine.
 - Produces higher quality straw.

III. Straw Residue Management

- Options for handling straw:
 - Use of a stripper header
 - The less straw processed by a combine means that combining is more efficient and there is less wear and tear on the equipment.
 - Harvest can typically occur earlier than if harvesting whole plants because the stems can still be somewhat green.
 - Ensures that the maximum length of straw is left standing.
 - Subsequent crop can be seeded into very little chaff between the standing rows improving seed to soil contact.
 - The fibre content of flax stems is lowest at the base of the plant and highest towards the top of the main stem, so flax plants may be more difficult to cut higher up on the stem than at the base.
 - Potential for flax straw to cause problems during seeding if disc openers are not used.
 - Chop and spread
 - Method of reducing the bulk of straw deposited by the combine.
 - Requires a combine equipped with a straw chopper or installation of an after-market straw chopper.
 - May require desiccation to ensure uniformity and maximum dryness of the crop for ease of combining.
 - Planting an early maturing variety and/or seeding early may help to ensure the crop is as dry as possible at harvest.
 - Typically slows the process of combining.
 - Potential for flax straw to cause problems during seeding if hoe openers are not used.
 - Some producers have had success with combining their flax crop at a 45-degree angle (to the direction of seeding) in order to reduce straw bunching and plugging issues when seeding into flax stubble the following spring.
 - Not Chopped
 - Straw is typically baled or bunched.
 - Can provide additional crop income if a flax straw buyer can be found (see links below or [the straw buyer list on the SaskFlax website](#)).
 - Buyers often have specific harvest recommendations depending on the intended use of the straw (e.g. straw must lay in the field for a couple of weeks before baling).
 - Flax straw contains valuable nutrients. If removed from the field, consider replacing the equivalent the following season ([flax seed and straw nutrient and uptake removal-IPNI](#)).
 - Burn
 - Straw is typically bunched into large piles but can also be burnt in windrows.
 - Burning may require a permit from the local municipality.
 - Burning may negatively affect populations of arbuscular mycorrhizal fungi and other beneficial soil microbes.

For more information about flax harvest preparation contact the following:

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Useful links:

1. Maximum Residue Limit Information:
 - [Canadian MRL database](#)
 - [U.S. MRL database](#)
 - [Links to MRL databases around the world](#)
2. Provincial Crop Protection Guides:
 - [Alberta](#)
 - [Saskatchewan](#)
 - [Manitoba](#)
3. PMRA Pesticide Product Label Search:
 - [Online](#)
 - [App](#)
4. Straw Buyers:
 - [Schweitzer Mauduit \(SWM\)-Winkler, MB](#)
5. Combine Adjustment and Harvest Tips:
 - [Don't Set it and Forget it! \(PAMI\)](#)
 - [Maximizing Harvest Productivity \(PAMI\)](#)
 - [Harvesting Oilseed Crops in Late Fall \(Manitoba Agriculture\)](#)
 - [Harvesting Fields with Multiple Crop Stages \(Saskatchewan Ministry of Agriculture\)](#)
6. Grain Drying and Storage Information:
 - [Manage Stored Grain \(Canadian Grain Commission\)](#)
 - [Grain Storage \(Alberta Agriculture & Forestry\)](#)
 - [Crop Storage \(PAMI\)](#)
 - [Grain Drying and Storage \(NDSU\)](#)
 - [Drying and Storage of Damp Grain \(Manitoba Agriculture\)](#)
 - [The Process of Grain Aeration \(Ron Palmer\)](#)
 - [Moisture Content of Canadian Grains \(Canadian Grain Commission\)](#)
 - [Flax Moisture Meter Conversion Table \(Canadian Grain Commission\)](#)
7. Storage Pests
 - [Seed Storage Insect Identification Keys \(Canadian Grain Commission\)](#)
 - [Insects and Mites in Farm-Stored Grain \(Manitoba Agriculture\)](#)
 - [Insects in Stored Grain app \(University of Manitoba\)](#)