Herbicide Residue Considerations for Flax

Residual Herbicides

- Residual herbicides have become an integral part of crop production in Western Canada. These herbicides are dependent on either soil microorganisms or chemical reactions (e.g. hydrolysis, photolysis) for breakdown and consequently their persistence is further influenced by soil moisture, pH, type and organic matter content.
- Often, conditions of drought, extremes in soil pH and excessive cold will delay the breakdown of herbicide residues in the soil. Such conditions during the season of application, or even the season following, may result in higher levels of residue in the soil than expected causing injury to subsequent crops.
- Tillage and the number of subsequent applications of certain sub-groups of herbicides (i.e., imidazolinones, pyridines and sulfonylureas) can also influence the degree of herbicide carryover.

Re-cropping After Residual Herbicides

- Many residual herbicides have rotational crop restrictions associated with them and therefore herbicide labels should be consulted for details.
- Some residual herbicides have tank mix options, and in these cases the most restrictive replanting interval for the chemicals in the mix should be followed.
- Some residual herbicides require a plant or field bioassay to be conducted before planting the next crop in a treated field.
- Weakened seedlings are more susceptible to damage and therefore recommendations to decrease the chance of herbicide carryover injury to the subsequent crop may include: planting seed into moist, warm and shallow seedbeds, increasing the seeding rate by 10% and following best agronomic practices for the crop (e.g., high quality seed, optimal fertilizer rates, seed treatment, etc.) to get the crop off to the best start as possible.

Flax and Residual Herbicides

Flax is susceptible to damage from several herbicide residuals in the season following application, and in some cases, a few seasons after application. Before making the final decision on which field your flax will be seeded into this season, a review of what residual herbicides were applied last year is recommended. Table 1 summarizes the residual herbicides that may affect flax.

Bioassays

Field or plant bioassays are required before seeding flax into a field previously treated with certain residual herbicides. These tests provide an indication of whether the levels of herbicide residue remaining in the soil are sufficient to injure the intended crop. A plant bioassay (also known as a soil bioassay) involves collecting soil samples from the field in question, as well as from an untreated field, and growing the intended crop indoors to observe differences between plants grown in the treated and untreated soils. In contrast, a field bioassay involves planting strips of the intended crop in the field in question, as well as in an adjacent untreated field and observing any differences in plant growth throughout the season.

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Table 1. Residual herbicides with re-cropping restrictions for flax.

Active	Product(s)	Group	Rotational crop interval (no. seasons)**	Details for flax production
aminopyralid, 2,4-D	Restore II	4	3	
atrazine	Aatrex Liquid 480	5	1*	flax is typically not affected by rates up to 0.9 L/ac in the previous season, injury to succeeding crop may occur during extended periods of dry weather during the season of application, damage to the rotational crop may be further worsened by stressful conditions the following season (e.g. abnormally hot, dry weather), damage to rotational crops may be decreased by ploughing or deep tillage in the fall prior to seeding
atrazine, metolachlor	Primextra II Magnum	5,15	2*	extended periods of dry weather during the year of application followed by stressful conditions the following season (e.g. abnormally hot, dry weather) can injure the rotational crop
carfentrazone, pyroxasulfone	Focus	14,15	2*	field bioassay required before seeding flax, drought conditions following application will extend the rotational crop interval by one year
clomazone	Command 360 ME	13	2	residue carryover risk to rotational crops is greater in soils with pH ≤ 5.9 and during extremely dry conditions in the 4 months following application
clomazone, carfentrazone	Command Charge	13,14	2	residue carryover risk to rotational crops is greater in soils with pH ≤ 5.9 and during extremely dry conditions in the 4 months following application
dicamba	Banvel VM, Engenia, FeXapan, Oracle, XtendiMax	4	2*	dry weather and late applications (after September 1) may extend the rotational crop interval
ethalfluralin	Edge Granular	3	1*	breakdown slowed by drought or extended dry periods during the year of application and the following spring, do not direct seed (zero till) into standing stubble on land that was treated for the previous crop, low organic matter soils (< 2%) and soils with highly variable texture or organic matter may cause injury to rotational crops, weakened or stressed seedlings are more susceptible to damage from residue so seed flax into a shallow, warm and moist seedbed, possibly at a 10% higher seeding rate than normal
florasulam, dicamba	Korrex II	2,4	1*	flax may be grown if product applied before Aug. 1
florasulam, fluroxypyr, MCPA	Outshine	2,4	2¶	
florasulam, glyphosate	Blitz, FirstPass, MPower Battlefront 50 SC, PrePass Flex, Priority + glyphosate	2,9	2¶	
florasulam, glyphosate	PrePass XC	2,9	2¶	
florasulam, MCPA	Topline	2,4	2¶	
flucarbazone	Everest 3.0, Sierra 3.0	2	1*	dark brown and black soils: drought (less rainfall than the 10 year average for the area) and cold temperatures after application and in the following season, soils with low organic matter (< 2%) or high pH (> 7.5) may delay product breakdown, soil bioassay€ recommended under these conditions
flucarbazone	Everest 3.0, Sierra 3.0	2	2*¶	brown and grey wooded soils: drought (less rainfall than the 10 year average for the area) and cold temperatures after application and in the following season, soils with low organic matter (< 2%) or high pH (> 7.5) may delay product breakdown, soil bioassay€ recommended under these conditions
flucarbazone, florasulam, carfentrazone	Inferno Trio	2,14	1*	dark brown and black soils: conditions delaying breakdown include drought (less rainfall than the 10 year average for the area) and cold temperatures after application and in the following season, soils with low organic matter (< 2%) or high pH (> 7.5), soil bioassay€ recommended under these conditions
flucarbazone, florasulam, carfentrazone	Inferno Trio	2,14	2*	brown and grey wooded soils: conditions delaying breakdown include drought (less rainfall than the 10 year average for the area) and cold temperatures after application and in the following season, soils with low organic matter (< 2%) or high pH (> 7.5), soil bioassay€ recommended under these conditions

Table 1. Continued

Active	Product(s)	Group	Rotational crop interval (no. seasons)**	Details for flax production
flucarbazone, tribenuron	Inferno Duo	2	1*	dark brown and black soils: conditions delaying breakdown include drought (less rainfall than the 10 year average for the area) and cold temperatures after application and in the following season, soils with low organic matter (< 2%) or high pH (> 7.5), soil bioassay€ recommended under these conditions
flucarbazone, tribenuron	Inferno Duo	2	2*	brown and grey wooded soils: conditions delaying breakdown include drought (less rainfall than the 10 year average for the area) and cold temperatures after application and in the following season, soils with low organic matter (< 2%) or high pH (> 7.5), soil bioassay€ recommended under these conditions
flumioxazin	Chateau WDG, Valtera	14	1*	successful soil bioassay€ required before planting flax
flumioxazin, pyroxasulfone	Fierce	14,15	1*	a soil bioassay€ must be performed before seeding flax
fomesafen	Reflex¥	14	2*	a field bioassay is required before seeding flax
foramsulfuron	Option 2.25 OD¥	2	2¶	
glyphosate, fomesafen	Flexstar GT¥	9,14	2*	a field bioassay is required before seeding flax
halosulfuron	Permit WG	2	2*¶	drought or cool conditions after application may extend the rotational crop interval
hexazinone	Velpar DF CU	5	4*	perform a field bioassay no earlier than the 3rd season after application, persistence in the soil is influenced by temperature, rainfall, soil type and organic matter
imazamethabenz	Assert 300SC	2	2*	for brown and dark brown soils: conduct a field bioassay before planting flax, if sequential applications of other soil residual imidazolinone, sulfonylurea or pyridine herbicides have been made to the same field do not plant flax until a field bioassay is conducted, drought delays product breakdown
imazamox, imazapyr	Ares SN	2	2	drought, excessive cold and extremes in soil pH can delay product breakdown and extend the rotational crop interval
imazamox, imazapyr, clopyralid	Salute	2,4	2*	drought, excessive cold and extremes in soil pH can delay product breakdown and extend the rotational crop interval
imazamox, imazethapyr	Duet, MPower Ninja, Odyssey WDG¤, Odyssey NXT	2	2*	in the Peace River Region, a minimum three year rotational interval is required and a field bioassay the year prior to planting must be conducted, drought, excessive cold and extremes in soil pH can delay product breakdown and extend the rotational crop interval
imazethapyr	Pursuit 240, MPower Kamikaze, Phantom 240 SL, Guardsman Gladiator	2	2*	a field bioassay recommended before seeding flax, breakdown is slowed by drought, excessive cold and acid soils (pH < 6.5)
metsulfuron	Ally Toss-N-Go	2	2*	brown and dark brown soils, pH < 7: add one year to the re-cropping period if less than 5" (130 mm) of rainfall received during the season of application or any subsequent season, degradation influenced by pH, moisture and temperature of the soil
metsulfuron	Ally Toss-N-Go	2	1*	black and wooded grey soils, pH < 7: add one year to the re-cropping period if less than 10" (250 mm) of rainfall received during the season of application or any subsequent season, degradation influenced by pH, moisture and temperature of the soil
metsulfuron	Ally Toss-N-Go	2	3*	soil pH 7 to 7.9: add one year to the re-cropping period if less than 10" (250 mm) of rainfall received during the season of application or any subsequent season on black and grey wooded soils and if less than 5" (130 mm) on brown and dark brown soils, degradation influenced by pH, moisture and temperature of the soil
metsulfuron	Ally Toss-N-Go	2	2*	black and grey wooded soils, pH ≤ 7.5: add one year to the re-cropping period if less than 10" (250 mm) of rainfall received during the season of application or any subsequent season, degradation influenced by pH, moisture and temperature of the soil

Table 1 Continued

Active	Product(s)	Group	Rotational crop interval (no. seasons)**	Details for flax production
metsulfuron, aminopyralid, 2,4-D	Reclaim II	2,4	3	
metsulfuron, aminocyclopyrachlor	Navius Flex	2,4	2*	perform a field bioassay before seeding flax
picloram, 2,4-D	Grazon XC	4	5*	soil bioassay[€] recommended before planting flax
quinclorac	Clever, Facet L, Ingenious, MasterLine Quinclorac	4,26	2*	on lighter soils with low organic matter or on dry soils, do not grow flax until the 3rd year after application
rimsulfuron, nicosulfuron	Ultim[¥], Ultim 75 DF[¥]	2	2*	field bioassay recommended before seeding flax, re-cropping interval may be extended on sandy soils with low organic matter and pH > 7
sethoxydim, imazamox, imazethapyr	Odyssey Ultra, Odyssey Ultra NXT	1,2	2*	in the Peace River Region, a minimum three year rotation interval is required and a field bioassay the year prior to planting is recommended, breakdown is slowed by drought, excessive cold and extremes in soil pH
simazine	Princep Nine-T, Simazine 480	5	1*	do not seed flax if an excess of 2 kg/ha of Princep Nine-T or 3.65 L/ha of Simazine 480 was applied the previous season, breakdown slowed by high pH and/or low rainfall, extended periods of dry weather during the year of application followed by stressful conditions the following season (e.g. abnormally hot, dry weather) can injure the rotational crop
sulfentrazone, pyroxasulfone	Authority Supreme	14,15	3*	field bioassay with adequate moisture required before planting, rotational crop interval must be extended by a year under conditions of extremely low rainfall
thifensulfuron, tribenuron, quinclorac	Triton C	2,4	1*	on lighter soils with low organic matter or under dry conditions do not grow flax until the 2nd year after application
topramezone	Armezon	27	1*	conduct a field bioassay before planting flax the year after application
tribenuron, dicamba	Express FX	2,4	1*	do not seed flax the season following a post-harvest application
trifluralin	Bonanza 10G, Bonanza 480 EC, Rival 10G, Rival EC, Treflan Liquid EC, Treflan MicroActiv	3	1*	breakdown slowed by extended dry periods during the year of application and the following spring, more damage tends to occur with granular formulations, do not direct seed (zero till) into standing stubble on land that was treated for the previous crop, cultivation prior to seeding is strongly recommended, low organic matter soils (< 2%) and soils with highly variable texture or organic matter may cause injury to rotational crops, weakened or stressed seedlings are more susceptible to damage from residue so seed flax into a shallow, warm and moist seedbed

Compiled from the 2020 Alberta, Saskatchewan and Manitoba crop protection guides and individual product labels. Check product labels for more detailed information about rotation/re-cropping intervals and bioassays.
*special restrictions apply to the rotational crop interval. Refer to the 'Details for flax production' column.
** the minimum number of seasons required between product application and seeding. Refer to herbicide labels for detailed information on the number of months after application when flax seeding can occur. Rotation/recropping intervals may differ depending on rate, region, province, soil characteristics, environment, time of application, crop variety and whether the field is cropped or fallowed. If tank mixes were applied, the most restrictive guidelines should be followed.
[o]product no longer manufactured but some may still remain in the distribution system
[¥]product only registered for use in Manitoba or in the Red River Valley of Manitoba
[¶]an estimate only. Flax is either not listed as a rotational crop or for a particular soil type on the product label
[€]also known as a plant bioassay

How to Conduct a Plant (or Soil) Bioassay

- Sampling should occur to a depth of approximately 5 cm (2 in) for no-till soil and to the depth of tillage for cultivated sites (typically around 15 cm or 6 in) and can be collected using a trowel, spade or soil sampler.
- Clear surface of soil from combine residue before collecting samples.
- Although it is possible to conduct this test at home, it is recommended that soil samples be sent to a lab because optimal conditions for field crop growth at home are difficult to achieve.
- Collect samples randomly from various representative locations in the field. It is also advised to collect samples from locations in the field that may contain higher levels of residue (e.g., low spots, knolls or ridges, edges, headlands, slough margins, areas with noticeably different soil texture, etc.).
- The test should ideally be conducted one month prior to seeding but keep in mind that the lab turnaround times may be up to six weeks.

How to Conduct a Field Bioassay

- Plant test strips of the crop in question perpendicular to the direction the residual herbicide was applied.
- Strips should be placed to represent different field conditions (e.g., texture, pH, drainage, turn-around areas, edges, etc.) and should be long enough to cross the width of several spray swaths.
- Be sure to use the same planting time, conditions, techniques and cultural practices you normally use to plant and grow the crop.
- A check strip on an untreated piece of similar land is required for comparison.
- As the crop emerges and develops, observe the following: crop stand, root development, rate of growth, abnormality of growth (e.g., leaf cupping, meristem damage, excessive branching), plant colour (i.e., chlorosis, purpling), vigour and seed yield. If no visible signs of injury, stand reduction, or yield reduction occur, then the field can be seeded with the desired crop the next growing season. If the bioassay indicates that residues are still present, continue cropping only to those crops listed on the label, and do not plant the crop in question until a field bioassay indicates that it is okay to do so.

2020 Surveys

Spring-Harvested Flaxseed Survey

The Canadian Grain Commission is conducting a spring-harvested flaxseed survey to determine the end-use implications of delayed harvest. Receive quality data (oil, protein content and iodine values) and an unofficial grade for your sample. For more information and to sign up go to: https://grainscanada.gc.ca/en/grain-research/grl/crop-research/spring-harvested.html

Flax Disease Survey

A flax disease survey is planned for 2020, but this year permission to survey fields must be granted by landowners. If you are interested in supporting provincial pest survey efforts please sign up here: https://ca.surveygizmo.com/s3/50060966/Pest-Monitoring-Sign-up

For more information about herbicide residues and flax contact the following:

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Other Useful Links:

1. Pesticides
   - PMRA Pesticide Product Label Search:
     - Online
     - App
   - Provincial Crop Protection Guides:
     - Alberta
     - Saskatchewan
     - Manitoba
   - Saskatchewan Herbicide Carryover Risk Map
2. Lab offering plant bioassays:
   - A&L Canada Laboratories Inc.
3. Weather
   - AAFC Agroclimate Maps for the current season
4. Seed
   - Provincial Seed Guides:
     - Alberta
     - Saskatchewan
     - Manitoba
   - SaskFlax Registered Variety List
5. Pests
   - Prairie Pest Monitoring Network blog