

Flax on the Farm

Six Early Considerations for a Successful Flax Crop

1. Seed preparation

- Start with high quality seed. Vigour and performance decrease over time with farm-saved seed.
- If using farm saved seed, a sample should be sent to an accredited seed lab to verify that it is free from Triffid. When purchasing certified flaxseed ask if the seed has been tested for Triffid.
- Avoid using seed treated with pre-harvest glyphosate unless tested for germination and vigour.
- The germination and vigour of seed stored in a bin can decrease over time. Re-test seed in the spring if the fall results indicated that: germination was lower than desired, the variability between the germination and vigour tests was higher than desired or if storage moulds were detected.
- If seed quality is questionable, or if seeding into cool, wet soil, treating the seed with a fungicide may be beneficial to minimize the impact of seed rot, root rot, or seedling blights and to improve crop emergence.

Table 1. Seed treatments available for flax

Product	Active ingredient(s)	Fungicide group	Pathogens controlled	Comments
Insure Pulse	metalaxyl, fluxapyroxad, pyraclostrobin	4, 7, 11	Fusarium, Rhizoctonia	For use on-farm and for commercial treatment (facilities and mobile treaters), if using the high rate (600mL) seed should be treated into a bin or truck box and allowed to dry prior to placing in the seeder hopper to prevent bridging and clumping in the seeder.
INTEGO Solo	ethaboxam	22	Pythium	Only for use with closed transfer commercial seed treaters (facilities and mobile treaters) for flax, an appropriate colorant must be added.
Maxim 480FS	fludioxonil	12	Fusarium, Rhizoctonia	Only for use with commercial seed treaters (facilities and mobile treaters), an appropriate colorant must be added.
VitaFlo-280 Loveland VitaFlo SP IPCO VitaFlo SP	carbathiin, thiram	7, M3	Fusarium, Rhizoctonia	For use on-farm and for commercial treatment (facilities and mobile treaters), treated seed can be stored for up to 18 months with no reduction in germination.

Compiled from the 2020 Alberta, Saskatchewan and Manitoba crop protection guides and product labels. Consult product labels for rates and further restrictions.

2. Field selection and preparation

- Crop rotation choices impact flax yield. Flax on flax will reduce yield. Flax after canola or non-arbuscular mycorrhizal crops (e.g. canola, mustard, quinoa, buckwheat, sugar beets) and flax after oats typically reduces yield. Volunteer canola can be challenging to control in a flax crop. Three years between flax crops significantly increases yield due to decreased incidence of disease. Seeding flax after shallow-rooted crops (e.g., field peas, lentils) under low soil moisture conditions may decrease yield. Avoid growing flax after legumes and sugar beets if Rhizoctonia is present.
- Several herbicides have re-cropping restrictions for flax and certain environmental conditions (e.g. drought) may result in increased restrictions, so a review of the field history and a provincial crop protection guide or the March edition of Flax on the Farm (links below) prior to seeding is advised.
 - [Alberta](#)
 - [Saskatchewan](#)
 - [Manitoba](#)
 - [March 2020 Flax on the Farm](#)

- Good seed-to-soil contact and adequate moisture will improve germination and emergence. Loose and/or clumping seedbeds reduce seed-to-soil contact, and for this reason flax performs well in reduced and no-till conditions. If tillage is used, a firm seed bed with adequate moisture is recommended. Rolling flax before and/or after seeding may quicken emergence and produce a more uniform crop.
- Bunched straw from the previous year's crop may reduce plant populations by impeding emergence or may contribute to variable emergence due to its influence on soil temperature. Low plant stands may then contribute to lower yields and increased weed pressure. Large amounts of crop residue may also cause frost injury due to the lower insulative value and greater swings in day/night temperatures compared to bare soil.

3. Seeding date

- Minimum temperature for germination of flax seed is between 1 and 5°C (34 to 41°F). The optimum temperature for germination is between 7 and 10°C (45 to 50°F).
- Flax is frost tolerant. Newly emerged seedlings (cotyledon stage) can withstand temperatures down to -3.9°C (25°F). Plants at the two-leaf stage can tolerate down to -8°C (18°F) if hardened off.
- Flax grows well at 13°C (55°F) and grows at a faster rate than weeds at low temperatures.
- Flax is a longer season crop requiring 95 to 125 days to mature depending on variety, location and growing season conditions.
- Ideally, flax should be seeded by the end of the third week of May to maximize yield.
- Early seeding increases crop competitiveness with weeds, avoids high temperatures during flowering, shortens crop height and increases the chances of the straw being dry at harvest. It may also increase resistance to disease due to the plants being at a later growth stage during periods of high disease pressure and may also increase seed quality as mature seeds are more resistant to weathering.
- Flax resists the elements very well during tough harvest conditions, so even if it is seeded early it can stand until other crops are harvested or until the weather improves without much negative impact.
- Growing earlier maturing flax varieties can take the pressure off seeding earlier in a more northern location. Detailed information on registered and up and coming varieties is available in the provincial seed guides and through SaskFlax:
 - [Alberta](#)
 - [Saskatchewan](#)
 - [Manitoba](#)
 - [SaskFlax Variety Table](#)

4. Fertilizer

- Flax is sensitive to seed-placed nitrogen and phosphorous, so side or mid-row banding 1 to 2" (2.5 to 5 cm) from the seed row is recommended.
- Seed-placed phosphorous recommendations vary by province. Alberta and Saskatchewan recommend a maximum of 15 lb P₂O₅/ac (17 kg/ha) while Manitoba recommends that no fertilizer be seed-placed with flax.
- Nitrogen rates (soil residual N + fertilizer N) from 45 to 110 kg/ha (40 to 98 lb/ac) are recommended.
- Recent research has shown that flax yields steadily increase with nitrogen levels up to approximately 100 kg/ha (89 lb/ac).
- No standard recommendation for phosphorous is in place. The yield response of flax to phosphorous is less pronounced than for other crops and can be highly variable. Flax is known to be a good scavenger of residual phosphorous, so planting the crop after a mycorrhizal crop (e.g. cereals, legumes) or into soil with good levels of residual phosphorous often increases the crop's ability to access and utilize phosphorous. Root access to phosphorous during the first four to six weeks of seedling growth is important to maximize yield potential.
- High rates of water soluble phosphorous may impede the colonization of flax roots by mycorrhizae.
- Recent research has shown some interaction between nitrogen and phosphorous such that the highest yields are often obtained when nitrogen and phosphorous are supplemented.
- Application of potassium and sulphur can be beneficial but tends to be field-specific, so a soil test is recommended to determine whether application of these nutrients is necessary.

- Flax can be very sensitive to deficiencies of iron (Fe), manganese (Mn) and zinc (Zn), especially if seeded into calcareous (high lime) soils when soil moisture is high. Zinc deficiency may also be seen in soils that test high for phosphorous and low for zinc. Under these conditions, irregular patches of chlorotic plants (pale green to yellow leaves) may appear in the field. Calcium (Ca) and Boron (B) deficiencies can also affect flax. Research has shown that even when soils are deficient, flax may not respond to the addition of micronutrients. Therefore, the application of these to a small area is recommended before applying to the entire field, so that the response of the plants can be observed. Both soil and plant tissue tests are recommended to confirm a micronutrient deficiency and determine residual levels in the soil. Yield may decrease if micronutrients are applied when not necessary.
- When considering managing flax fertility, previous crop, nutrient removal by flax (Table 2), arbuscular mycorrhizal fungi (AMF) and seed row placement should be considered. Fertilizing annually to maintain soil residual nutrient levels is a good stewardship practice.

Table 2. Macronutrient removal by flax (lb/ac) compared to spring wheat and canola

Crop (yield)	Removal (lb/ac) with seed and straw			
	N	P	K	S
Flax (24 bu/ac)	71	20	44	14
Wheat (40 bu/ac)	85	32	73	9
Canola (35 bu/ac)	112	52	81	19

Adapted from the Saskatchewan Ministry of Agriculture website (www.saskatchewan.ca)

5. Row spacing

- The current row spacing recommendation for flax is 6 to 8” (15 to 20 cm).
- Cumulative research indicates a 1 to 2% decrease in yield with every inch of row spacing increase above 8” (20cm).
- Narrower row spacing promotes earlier canopy closure and therefore increased competitiveness with weeds, and can also lead to earlier maturity, more uniform maturity and a shorter crop with thinner stems.

6. Seeding rate and depth

- A minimum plant population after emergence of 300 plants/m² (28 plants/ft²) is required to maximize yield potential. Below this population, yield potential is significantly reduced. A population greater than 400 plants/m² (37 plants/ft²) may not provide a yield benefit and may result in lodging.
- The emergence rate of flax is typically 50 to 60% but can be much higher depending on the quality of seed used and the environmental conditions following seeding.
- Percent germination and seed size (thousand seed weight (TSW)) should be considered when calculating seeding rate.
- How to calculate seeding rate for flax:

$$\text{Seeding rate (lb/ac)} = \text{desired plant population (\#plants/ft}^2\text{)} \times \text{area conversion (43,560 ft}^2\text{/ac)} \times \text{TSW (g/1000 seeds)} \times \text{weight conversion (1 lb/454 g)} \times \text{inverse of germination rate as a decimal (e.g. 1/0.95)} \times \text{inverse of emergence rate as a decimal (e.g. 1/0.5)}$$

$$\text{Seeding rate (kg/ha)} = \text{desired plant population (\#plants/m}^2\text{)} \times \text{area conversion (10,000 m}^2\text{/ha)} \times \text{TSW (g/1000 seeds)} \times \text{weight conversion (1 kg/1,000 g)} \times \text{inverse of germination rate as a decimal (e.g. 1/0.95)} \times \text{inverse of emergence rate as a decimal (e.g. 1/0.5)}$$
- At a germination rate of 95%, a seed size of 6 grams per 1,000 seeds, an emergence rate of 50% and a target plant population between 300 to 400 plants/m² (28 to 37 plants/ft²), the target seeding rate for flax is between 34 lb/ac (38 kg/ha) and 45 lb/ac (51 kg/ha).

- On-farm seeding rates vary greatly, and the following considerations should be made when determining the seeding rate for flax:
 - Some seed testing labs indicate that a vigour test result can be used as the emergence rate in the seeding rate calculation while others suggest that the difference between a germination test result and a vigour test result represents the expected mortality rate in the field. Others advise that % vigour can be used in place of % germination if seeding under cool, wet conditions and there is a large difference between vigour and germination test results.
 - Yellow-seeded flax should be seeded at a 10 to 15% higher seeding rate than brown-seeded flax.
 - Irrigated, pedigreed and organic flax should be seeded at higher rates.
 - Lower seeding rates under dry conditions are recommended to limit competition for moisture. Low seeding rates under wet conditions can translate to delayed maturity.
 - Higher seeding rates are recommended under wet conditions and may also improve competitiveness with weeds and crop uniformity.
 - Early seeding dates often result in decreased emergence rates compared to late seeding dates.
- Ideally, flax should be planted at 1” (2.5 cm) deep into moisture, but depths can range from 0.75 to 1.5” (2 to 3.8 cm) depending on moisture availability at seeding.

7. Early season weed control

- Flax is a poor competitor with weeds, so good early season weed control gives the crop a head start and improves its ability to compete with later emerging weeds.
- Several pre-seed and pre-emergent herbicides are registered for use in flax (Table 3).
- Cool early season temperatures and/or lack of moisture will delay weed seed germination and will make it even more challenging to control early season weeds in flax.
- Several of the pre-seed herbicides registered for flax require moisture for activation of residual activity.

Table 3. Pre-seed and pre-emergent herbicide options for flax

Herbicide	Active ingredient(s)	Group	Pre-plant	Pre-emerg	Weeds Controlled (most common and those with confirmed herbicide resistance)																						
					Broadleaved Weeds														Grassy Weeds								
					buckwheat, wild chickweed	cleavers	cow cockle	dandelion	hemp-nettle	kochia	lamb's quarters	mallow, round-leaved	mustard, ball	mustard, wild	narrow-leaved hawk's beard	pigweed, redroot	shepherd's purse	smartweed, annual	sow-thistle, annual	stinkweed	thistle, Canada	thistle, Russian	volunteer canola	barnyard grass	foxtail, green	foxtail, yellow	oat, wild
Carfentrazone ⁸	carfentrazone	14	v			v			v	v	v			v	v	SS ^A		v	v	v							
Carfentrazone + Bromoxynil**	carfentrazone, bromoxynil	6,14	v		v	v	v			v	v	v		v	v	v		v	v	v							
Carfentrazone + Glyphosate (IPA or K salt)**	carfentrazone, glyphosate	9,14	v		v	v		v	v	v	v	v		v	v	v		v	v	v			v	v	v	v	
Carfentrazone + Bromoxynil+ Glyphosate**	carfentrazone, bromoxynil, glyphosate	6,9,14	v		v	v	v	v	v	v	v	v		v	v	v		v	v	v			v	v	v	v	
Carfentrazone + MCPA (amine or ester)**	carfentrazone, MCPA	4,14	v		v			v**	S**	v	v	v	v	v	v	SS ^A	v**	v	TG	v	v						
Aim EC + Authority 480* ^o	carfentrazone, sulfentrazone	14	v		v	v				v	v	v				v	SS ^A		v	v							
Authority 480*	sulfentrazone	14	v	v	v	S				v	v	v				v											
Authority 480 + Glyphosate*	sulfentrazone, glyphosate	9,14	v	v	v	v		v	v	v	v	v		v	v	v	v	v	v	v		v	v	v	v	v	
Authority 480 + Aim EC + Glyphosate*	sulfentrazone, carfentrazone, glyphosate	9,14	v		v	v		v	v	v	v	v		v	v	v	v	v	v	v		v	v	v	v	v	
Authority 480 + Aim EC + MCPA amine + Glyphosate*	sulfentrazone, carfentrazone, MCPA, glyphosate	4,9,14	v		v	v		v	v	v	v	v	v	v	v	v	v	v	v	v	TG	v	v	v	v	v	
Avadex (Liquid EC and MicroActiv)*	triallate	8	v																								
Axxe ^h	ammonium salt of fatty acid	-	v		SS	SS	SS	SS	TG	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	TG	SS	SS	SS	SS	SS	SS	SS
CleanStart (Credit + Aim EC)	glyphosate, carfentrazone	9,14	v		v		v	v	v	v	v	v		v	v	v	v	v	v	v		v	v	v	v	v	
Eptam Liquid EC*	EPTC	8	v			v					v				v								v	v	v	v	v
Eptam Liquid EC + Trifluralin ^h [§]	EPTC, trifluralin	3,8	v		v	v		v		v	v	v			v								v	v	v	v	v
Fortress MicroActiv*	trifluralin, triallate	3,8	v		S					S	S				S						S		v	v	v	v	
Glyphosate	glyphosate	9	v	v	v	v		v	v	v	v			v	v	v	v	v	v	v		v	v	v	v	v	
Glyphosate + Bromoxynil/MCPA**	glyphosate, bromoxynil, MCPA	4,6,9	v	v	v	v	v	v	v	v	v			v	v	v	v	v	v	v	TG	v	v	v	v	v	
Glyphosate + MCPA	glyphosate, MCPA	4,9	v	v	v	v		v	v	v	v			v	v	v	v	v	v	TG	v	v	v	v	v		
GoldWing	MCPA, pyraflufen-ethyl	4,14	v	v	v	v	v	S		v	v	v	v	v	S	v						v					
GoldWing + Glyphosate	MCPA, pyraflufen-ethyl, glyphosate	4,9,14	v	v	v	v	v	S		v	v	v	v	v	SS	v	v	v	S	v	v	v	v	v	v	v	

Adapted from the 2020 Alberta, Saskatchewan and Manitoba crop protection guides. Check product labels for application rates, tank mix products allowed, adjuvants/surfactants required, the complete list of weeds controlled and other requirements and restrictions.

*re-cropping restrictions (may be further influenced by drought conditions)

**only applies to certain products/formulations

⁸Aim EC, Revenge

^oformerly Authority Charge

^ha biopesticide

^hnot recommended in Saskatchewan due to risk of crop injury. Do not use on soils with less than 3% organic matter. Seed less than 3 cm (1.2") deep into a firm seed bed.

[§]Treflan EC and Rival EC only

[§]may result in reduced crop stand and/or crop damage, however yield should not be affected

^hPennsylvania smartweed only

Type of control: S=suppression, SS=spring seedlings, TG=top grow

Flax Disease Survey

A Saskatchewan 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 early considerations for flax contact the following:

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Other Useful Links:

1. Pesticides
 - PMRA Pesticide Product Label Search:
 - [Online](#)
 - [App](#)
 - [Saskatchewan Herbicide Carryover Risk Map](#)
 - Pesticide resistance:
 - [Manage Resistance Now](#)
 - [Sprayer tank cleanout tips](#)
2. Lab offering plant bioassays
 - [A&L Canada Laboratories Inc.](#)
3. Seeding rate calculators
 - [Alberta Agriculture and Forestry](#)
 - [FP Genetics](#)
4. Crop nutrient uptake and removal charts
 - [International Plant Nutrition Institute](#)
 - [Manitoba Soil Fertility Guide](#)
 - Government of Saskatchewan
 - [Nitrogen Uptake](#)
 - [Phosphorous Uptake](#)
 - [Potassium Uptake](#)
 - [Sulphur Uptake](#)
5. Crop rotation
 - [Principles and Practices of Crop Rotation-Saskatchewan Ministry of Agriculture](#)
 - [Crop Rotations and Yield Information-Manitoba Agricultural Services Corporation](#)
6. Pests
 - [Prairie Pest Monitoring Network blog](#)