

Questions & Answers

FLAX GENE EDITING

Q1: WHAT IS THE NEW PRODUCT?

A1: A new herbicide tolerant flax variety is being developed for Canada and the USA. The new variety will be tolerant to glyphosate and is based on CDC Bethune, which is still the most popular variety in Western Canada.

Q2: WHEN WILL THIS NEW HERBICIDE TOLERANT VARIETY BE AVAILABLE TO GROWERS?

A2: In 2016, there will be test plots grown in North Dakota to do preliminary research on the variety. The data compiled will be analyzed and providing the results are suitable in terms of the success of the gene-editing trait development and from other agronomic benchmarks we will be able to continue moving toward commercial application. The target period for commercial availability is 2020.

Q3: WHY WAS HERBICIDE TOLERANCE CHOSEN FOR THE FIRST TRAIT?

A3: One of the conclusions from the Canadian Flax Breeding Strategy document of Flax Canada 2015 was that flax will need an herbicide tolerant trait to give it a production advantage to make it more competitive with alternate crops. Flax is a relatively weak competitor and weeds significantly reduce yield by an estimated 10-25%. Herbicide tolerant flax would offset this yield loss and should result in a major expansion of flax acres.

Q4: ARE THERE ANY OTHER AGRONOMIC DIFFERENCES IN THE NEW VARIETY?

A4: None expected although there will need to be further assessment of the variety when field trials are concluded this year. Field trials and careful evaluation of the new variety is also planned from 2017 to 2019. The variety was developed by using CDC Bethune and therefore it is expected that other inherent agronomic traits will be present in the new variety.

Q5: WHO IS CIBUS?

A5: CIBUS is a precision gene-editing company located in San Diego with offices in Minnesota and the Netherlands. The company has developed and patented proprietary non-transgenic gene-editing technology called “The Rapid Trait Development System” (RTDS).
<http://www.cibus.com/>

Q6: WHAT IS THE RELATIONSHIP BETWEEN CIBUS AND THE FLAX INDUSTRY?

A6: In 2010 the Flax Council of Canada and CIBUS entered in to an agreement to collaborate in developing a herbicide tolerant variety of flax. Both parties still maintain a formal arrangement to continue the process in providing growers with this additional option in the near future.

Q7: ARE ANY OTHER FLAXSEED TRAITS BEING CONTEMPLATED THROUGH GENE EDITING?

A7: There are no other traits currently being developed. However, the RTDS gene editing process employed by CIBUS certainly has the potential for almost unlimited non-transgenic trait development.

Q8: HOW DOES GENE-EDITING EFFECT OUR OTHER PLANT BREEDING PROGRAM?

A8: Our current flax breeding program at the University of Saskatchewan will continue to exist as a cornerstone to varietal development. Research in this area will encompass all essential agronomic, quality and disease resistance needs with respect to both brown and golden flaxseed varieties in a prairie-wide and sustainable manner. Gene editing will be selective and trait specific in order to complement and empower our traditional flax breeding program.

Q9: ARE THERE ANY OTHER CROPS INVOLVED?

A9: CIBUS launched the first non-transgenic crop, SU (sulfonylurea) canola in 2015. Currently the company is working with rice and potato traits but the target is to develop non-transgenic traits in all major crops within the next 10 years.

Q10: WHAT ABOUT REGULATORY ISSUES IN OUR MARKETS?

A10: Gene-editing technology will be the wave of the future and CIBUS technology is not the only research in this area that is taking place. Currently this technology is recognized as NON-GMO in many markets since it is in fact non-transgenic which means there is no foreign DNA. However, the challenge is to have ALL countries clearly endorse the technology as NON-GMO. Regulatory approval relating to market access in all countries will need to be in place and this pertains not only to flax but all gene-editing technology effecting other crops as well. The Flax

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Council of Canada and CIBUS have been in constant collaboration throughout the development of the flax trait and will continue regular meetings as we move toward commercialization to ensure that all the necessary steps have been taken.

Q11: WILL GT FLAX INCREASE THE RISK OF HERBICIDE RESISTANT WEEDS?

A11: Up to date, flax has had very limited in-crop weed control options. Currently, only herbicide groups 1, 4 and 6 are available for in-crop use. The heavy reliance on group 1 herbicides for grassy weed control in flax may increasingly become an issue as group 1 resistant wild oat and green foxtail are present in all three Prairie Provinces. Beckie et al. (2014) showed that 50% of wild oat populations surveyed in the prairies were group 1 resistant. As well, group 4 resistant cleavers, hemp-nettle, kochia and wild mustard have been found in select Prairie Provinces. The concept of 'herbicide layering', where different herbicide groups are used in sequence, is being promoted for controlling tough weeds and slowing herbicide resistance. Considering herbicide rotation has and will continue to be important for flax producers in the prairies. When used in sequence with pre-emergent herbicides groups 14 and 8(&3), the addition of glyphosate for use in-crop can provide producers with another tool for controlling certain resistant weeds and prevention or management of herbicide resistant weeds. It also allows growers to 'save' herbicide groups 1, 4 and 6 for other crops.

Q12: HOW WILL GT FLAX FIT INTO MY ROTATION?

A12: Glyphosate tolerant flax can fit into crop rotations much in the same way it currently does. If following a crop rotation such as: GT FLAX – CEREAL – PULSE/OILSEED – CEREAL

Herbicide Rotation:

Options for pre-seed herbicides in GT flax

- Registered glyphosate tank mixes are still an option, but producers should consider moving towards fall-applied (Group 8&3) or pre-emergent herbicides (Group 14 & 8) for early weed control in flax.

Options to desiccate GT flax

- Reglone, Heat (registration pending; MRLs to be established)

Options to control volunteer GT flax in-crop

- **Barley:** Barricade II, Attain (Fluoxypyr+2, 4-D), Momentum, Prestige XC, Trophy
- **Oat:** Prestige XC
- **Wheat:** Altitude FX, Altitude FX2, Barricade II, Attain, Momentum, Prestige XC, Trophy

*Currently there are no registered products for control of volunteer flax in pulse crops.