

Welcome to this week's presentation and conversation hosted by the
Canadian Association for the Club of Rome,
a Club dedicated to intelligent debate and action on global issues.

***Sustainable Agriculture: Lessons from the 1930s onward
to inform a 2023 Federal Strategy and Partnership.***

Our speaker today is Dr. Meg Sears, an expert in environmental health who works to “make least-toxic the norm.” Her degrees are in Chemical Engineering & Applied Chemistry (U Toronto) & biochemical engineering (McGill). She has diverse laboratory & research experience. Her work includes: the *Medical Perspective on Environmental Sensitivities* for CHRC; a review of environmental, public health, & medical approaches to toxics for CIHR & SSHRC; guidance documents on toxicants, indoor environments, & COVID-19 with the Canadian Committee on Indoor Air Quality; & large medical systematic reviews.

DESCRIPTION: Orange skies & choking smoke expose Canada's vulnerabilities. Climate chaos threatens food security, floods, droughts, & desertification. This spring, the GoC announced a Sustainable Agriculture Partnership, but regenerative organic agricultural practices are absent, & gene-edited seeds could undermine our organic sector. There are signs of subversion of “sustainable” in agricultural sector. Farm organizations want better policy & agricultural extension. We must increase carbon storage, preserve & restore biodiversity, foster seed diversity, reform pesticides regulation to feed Canada in a hotter world.

The presentation will be followed by a conversation, questions, and observations from the participants.

CACOR acknowledges that we all benefit from sharing the traditional territories of local Indigenous peoples (First Nations, Métis, and Inuit in Canada) and their descendants.



Website: canadiancor.com
Twitter: [@cacor1968](https://twitter.com/cacor1968)
YouTube: [Canadian Association for the Club of Rome](https://www.youtube.com/channel/UC...)
2023 Jun 21 Zoom #152

Sustainable Agriculture:

Lessons from the 1930s onward to inform a
Federal Strategy and Partnership
(and to achieve climate and biodiversity goals)

Canadian Association of the Club of Rome

June 21st, 2023

Meg Sears, PhD
Chair Prevent Cancer Now



Do you eat food – the kind from farms?

- Canada is a net exporter of commodities, and importer of fruits and vegetables
 - Internationally, regions for fruits and vegetables are becoming arid, major rivers are disappearing (e.g., Rio Grande)
 - Climate is affecting Canadian farming (e.g. Lethbridge area crop failures, 2023)
 - Rainfall is more extreme, with floods and droughts
- www.agricorp.com/en-ca/Programs/ProductionInsurance/ForageRainfall/Pages/RainfallData.aspx
- Canadian population growing quickly (now 40 million).
 - Increasing demands for food
 - Less secure imports – need to diversify national supplies.

Image CBC (Lethbridge): Drought limiting cattle forage

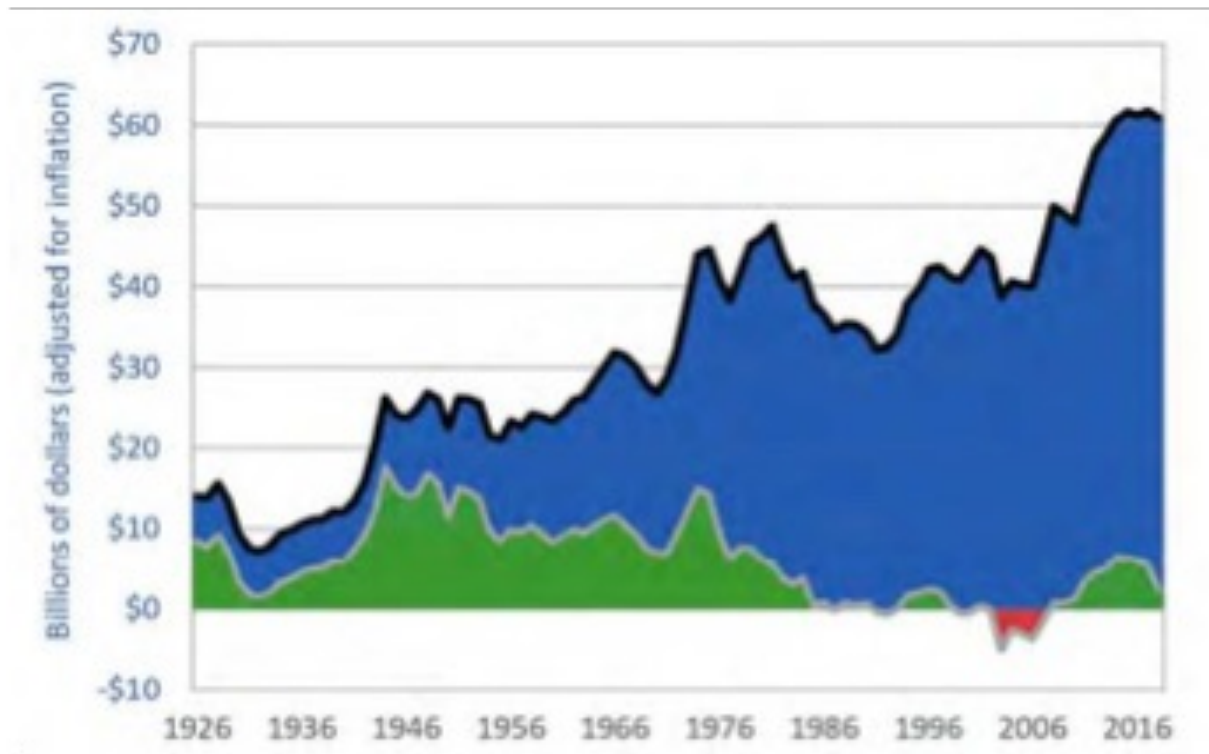
Lessons from the Dust Bowl

- 1920s – prairie grasslands started to be tilled for grain
- 1930s – droughts led to dust storms and agricultural failures in the prairies.
- Federal support to restore vegetation, riparian strips, wetlands
- By 1940s – trees and soil cover led to recovery
- Today – larger farms
- Droughts recurring in Canada and U.S.
- [Prairie Farm Rehabilitation Administration \(PFRA\)](#) was dismantled in 2010

Tackling the Farm Crisis and the Climate Crisis: A Transformative Strategy for Canadian Farms and Food Systems

National Farmers Union

Gross farm revenue and realized net income, net of government subsidies, Canada, 1926–2018. Input costs are crippling farmers' bottom line



A discussion paper by Darrin Qualman In collaboration with the National Farmers Union

<https://www.nfu.ca/wp-content/uploads/2020/01/Tackling-the-Farm-Crisis-and-the-Climate-Crisis-NFU-2019.pdf>

Agriculture practices for sustainability

Farming is high-stakes, hard work, and long term.

High-input farming:

- Increases risks of floods, heat and droughts
- Impacts pollination, with biodiversity losses
- Reduces margins, with costs of pesticides and fertilizers
- Is counter-productive, with removal of natural processes for fertility, carbon storage and balances among diverse species

Lower-input organic regenerative agriculture WORKS, at scale.

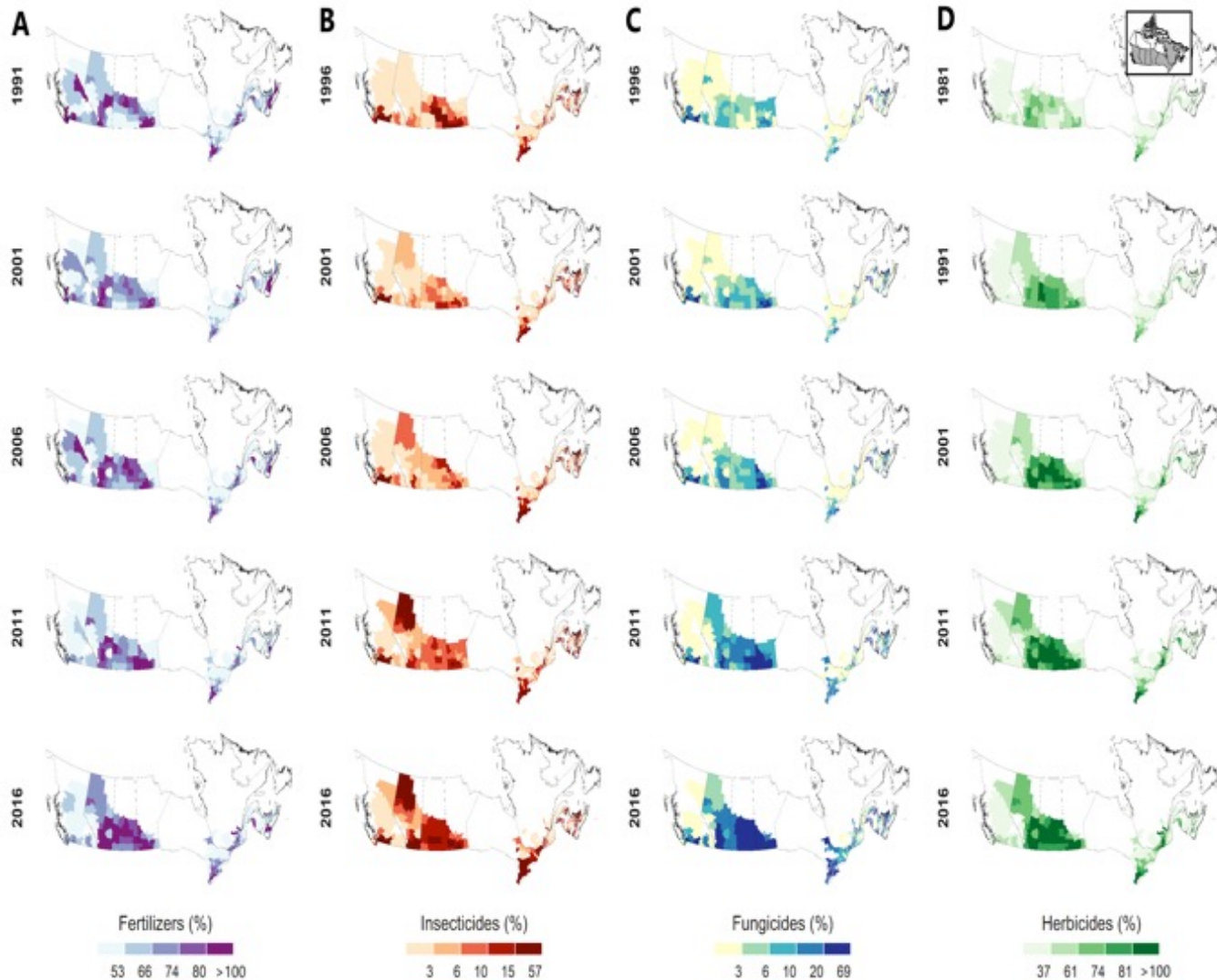
Better soil temperatures, yield

- no-till, with continuous ground cover
- successive crops, with different benefits and needs
- data driven re. soil health

Rick Green, 2022 Soy planted into winter wheat

<https://preventcancer.org/sustainable-agriculture-rickclark-guelph/>

Change in Agrochemical use in Canada 1981-2016



Canada's Food Guide

Well-studied healthy eating patterns centre on plant-based foods.

Have plenty of vegetables and fruits

Eat protein foods

Make water your drink of choice

Choose whole grain foods



<https://food-guide.canada.ca/en/>

If not organic,
higher consumption of grains and pulses
-> more **glyphosate, mycotoxins**
... and **cadmium**



keepingitclean.ca

Cadmium is high in:

- Prairie soils, Canadian potash
- Fertilizer (Canada has high limits)
- Common crops hyper-accumulate Cd; organic food has less Cd and glyphosate (examined by Environment Canada in 1990s; documented since / e.g., Benbrook)
- Glyphosate mobilizes cadmium from soil (Zhou et al., 2004, Chemosphere. <https://www.sciencedirect.com/science/article/pii/S0045653504007076>)
- Glyphosate, mycotoxin and cadmium levels are monitored in Canadian *exports* (by exporters; Canadian Grain Commission)
- Higher levels in dry legumes (e.g. chick peas).
- Cadmium accumulates in seeds (grains); is lower in organic crops. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5658984/>
- Less Cd in organic cereals. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5658984/>

Pest Management Regulatory Agency (PMRA) proposed permitting more glyphosate in some pulses and grains (2021)

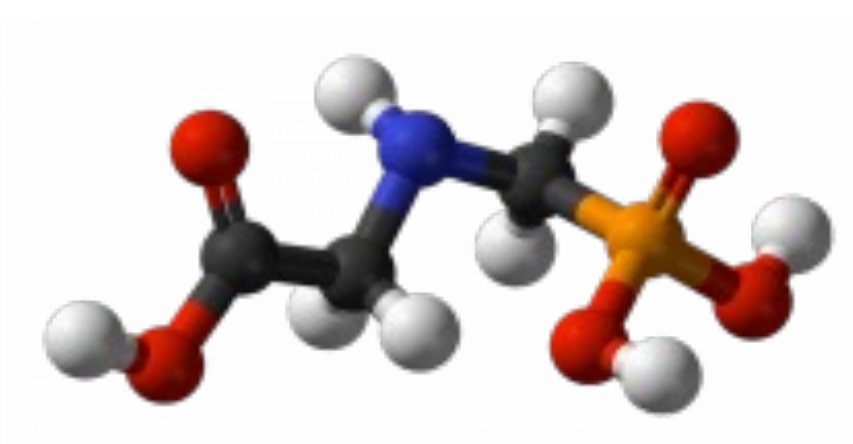
- Higher MRLs would prevent trade irritants for imported food
- Following label directions supposed to keep Canadian contamination lower
- Dessication / pre-harvest weed control causes higher glyphosate residues



<https://www.foodsystemeconomics.org/>

<https://www.hsph.harvard.edu/nutritionsource/legumes-pulses/>

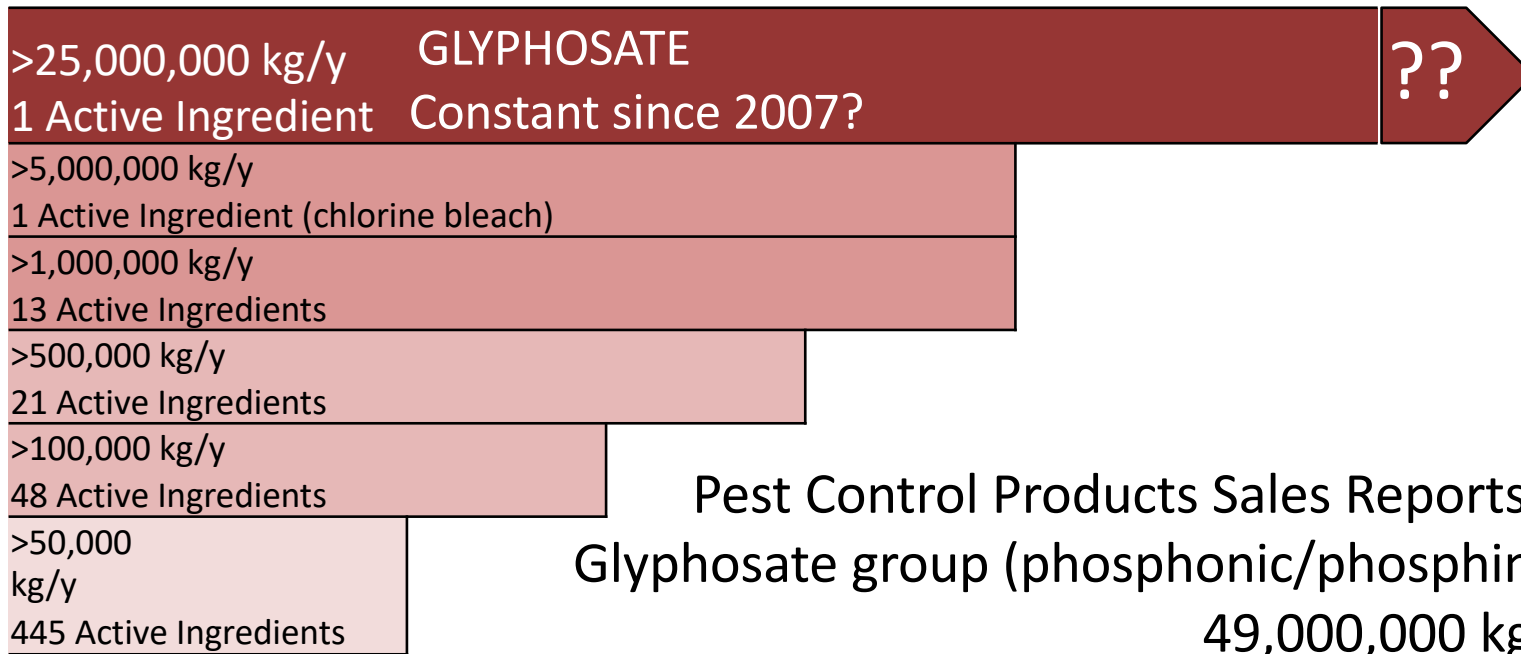
Glyphosate



ROUNDUP =
Glyphosate + *Adjuvants (for spreading, sticking, penetration)*

PREVENT
CANCER
NOW

Canadian Annual Pesticide Sales (2007–on)



Pest Control Products Sales Reports (PMRA)
 Glyphosate group (phosphonic/phosphinic acids)
 49,000,000 kg in 2016

Glyphosate use in USA increased approx. 100-fold since mid-70s (Vandenberg *et al.* 2017. *J Epidemiol Community Health*)

Glyphosate – multiple effects

- **Broad spectrum herbicide** (except for engineered crops and other resistant plants)
- **Antimicrobial**, affecting:
 - Gut microbiome → deficiency in essential nutrients manufactured by microbes; inflammatory bowel disease; colorectal cancer; neurocognitive and developmental problems.
 - Agricultural soils → soil microbiome, potential pathogens (*e.g.*, Fernandez, M.R. et al. 2009. Glyphosate associations with cereal diseases caused by *Fusarium* spp. in the Canadian Prairies. *Eur. J. Agron.* 31: 133–143.
<http://www.sciencedirect.com/science/article/pii/S1161030109000689>)
- **Chelator**, mobilizing metals such as cadmium, which is high in Canadian potash and some prairie soils.

Microbiome is central to health –
Glyphosate is an antibiotic
“Safe” levels damage intestinal microbiome

Sex-dependent impact of Roundup on the rat gut microbiome

- **“at environmental concentration of Roundup (0.1 ppb) ... sex-dependent impact on rat gut microbiome”**

2018 – Gut dysbiosis induced by pesticides could have a role in the development of metabolic disorders.

<http://www.sciencedirect.com/science/article/pii/S2214750017301129>

The Ramazzini Institute 13-week pilot study on glyphosate and Roundup administered at human-equivalent dose to Sprague Dawley rats: effects on the microbiome.

- **“exposures to commonly used GBHs, at doses considered safe, are capable of modifying the gut microbiota in early development, particularly before the onset of puberty”**

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5972442/>

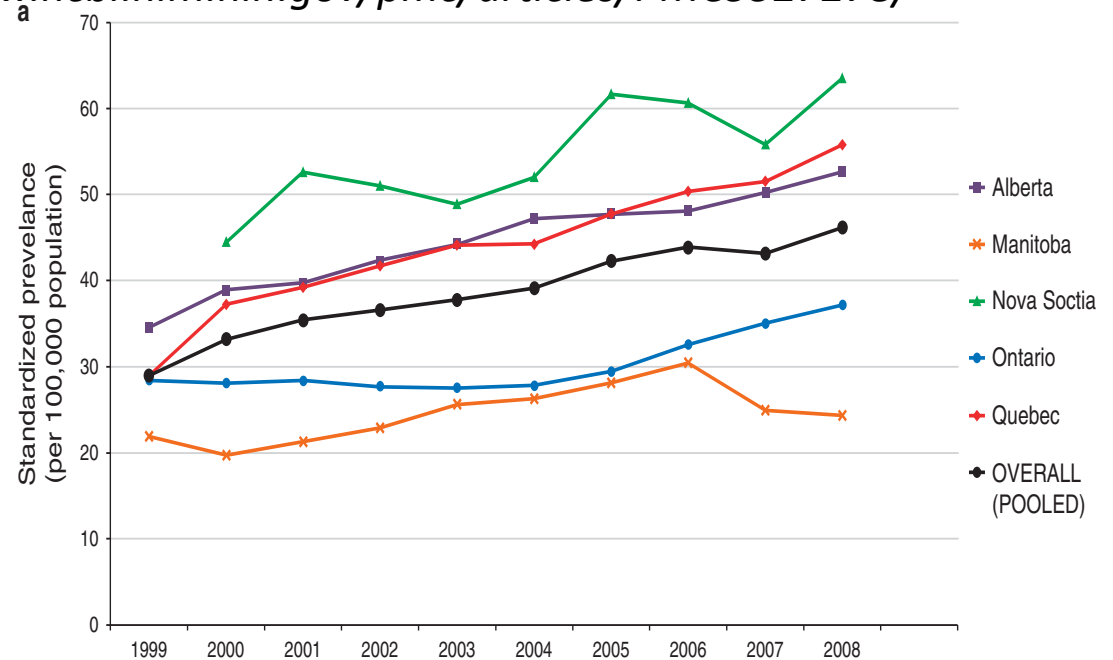
Direct consequence of altered microbiome in Canadians

- Childhood onset inflammatory bowel disease (IBD) increasing 7% per year, children under six (1999-2010)

Benchimol et al. (2017) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5527278/>

ALSO

- Colorectal cancer
- Increasing 6.7% per year (15-29 y olds)
- DESPITE improved diet, habits & exercise



<http://www.nature.com/ajg/journal/v112/n7/full/ajg201797a.html>

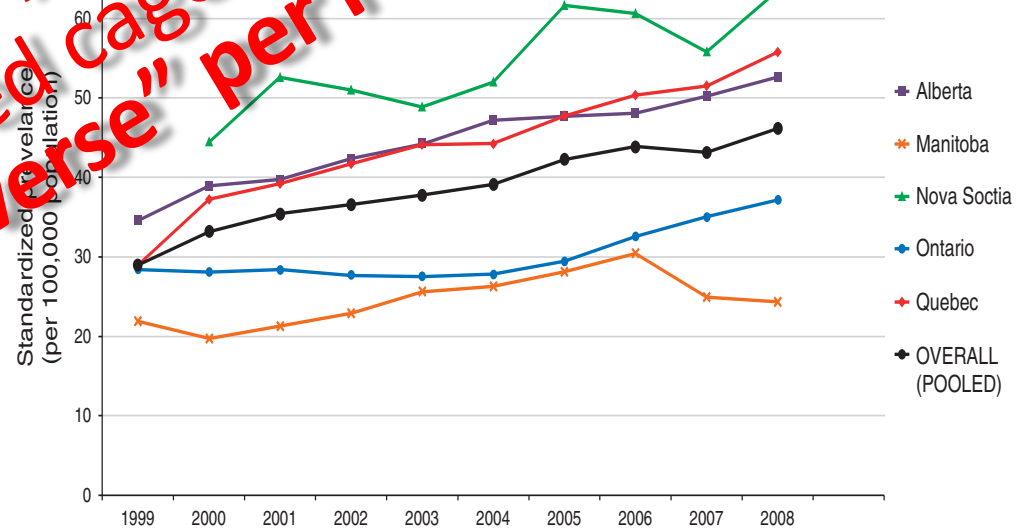


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Industry-Submitted Animal Studies Noted "Anal Straining" and soiled cage matting" Not "Adverse" per PMRA

<http://www.nature.com/ajg/journal/v112/n7/full/ajg201797a.html>



Glyphosate linked to Spontaneous Abortion, Early Birth, Infertility

Late abortion associated with pre-conception glyphosate exposure

“... Effect of Pesticide Exposure on the Risk of Spontaneous Abortion in an Ontario Farm Population”

Arbuckle *et al.* (2001) *EHP* 109(8): 851–57. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240415/>

More than 90% of pregnant women had detectable glyphosate.

Levels correlated significantly with shorter pregnancy

“Glyphosate exposure in pregnancy and shortened gestational length: a prospective Indiana birth cohort study”

Parvez *et al.* (2018) *Environ Health*. <https://doi.org/10.1186/s12940-018-0367-0>

Glyphosate interferes with implantation in rats, via estrogen receptor

“Epigenetic disruption of estrogen receptor alpha is induced by a glyphosate-based herbicide in the preimplantation uterus of rats”

Lorenz *et al.* (2019) *Molecular Cellular Immunity*. 480:133-141

<https://www.sciencedirect.com/science/article/pii/S0278691520304506>

Can glyphosate based herbicides cause cancer?

International Agency for Research on Cancer (IARC)

- 2015 – Probable Human Carcinogen (2A)



Health Canada (and other regulators)

- Probably *not* a human carcinogen, based on (highly uncertain) exposure levels
- IARC is said to be irrelevant because exposure is not considered

... BUT



BUT IARC considered
Canadian *real life* - epidemiology

Cancer Epidemiology, Biomarkers & Prevention

**Non-Hodgkin's Lymphoma and Specific Pesticide Exposures in Men:
Cross-Canada Study of Pesticides and Health**

Vol. 10, 1155-1163, November 2001

“a dose-response relationship”
for glyphosate and non-Hodgkin's lymphoma

Several other international studies linked glyphosate and cancer



... and the Science Keeps Coming in 2023

Genotoxicity Assays Published since 2016 Shed New Light on the Oncogenic Potential of Glyphosate-Based Herbicides

- *GBH mixture ingredients - not only active ingredient - must be declared, tested and on pesticide labels*
- *Independent science essential*
- ***The conclusion that GBHs pose no risk of cancer via a genotoxic mechanism is untenable.***

<https://www.mdpi.com/2813-3145/2/1/5>

Glyphosate Exposure and Urinary Oxidative Stress Biomarkers in the Agricultural Health Study

- *... association between glyphosate exposure and oxidative stress in humans and may inform evaluations of the carcinogenic potential...*

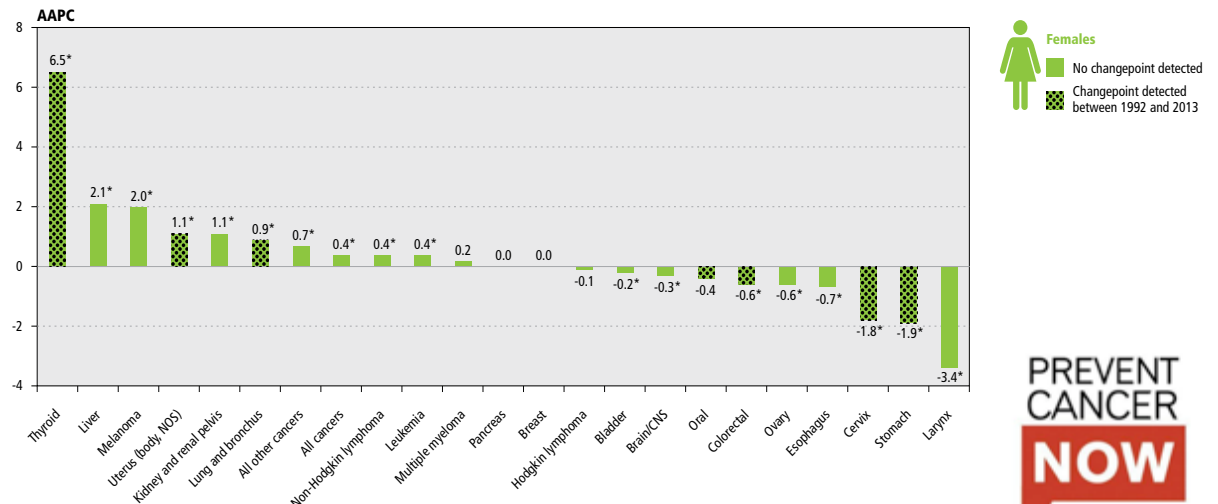
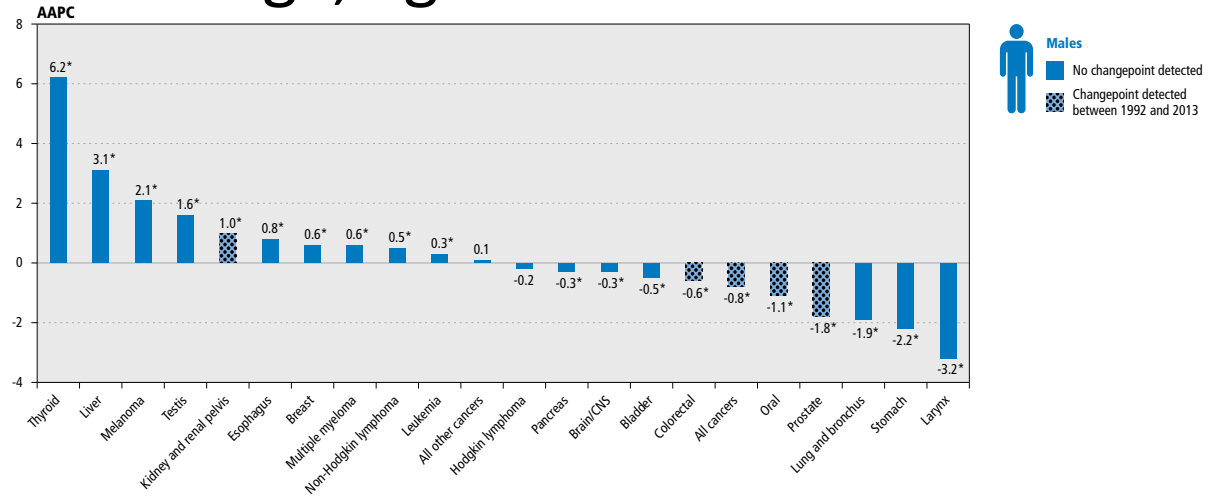
<https://doi.org/10.1093/jnci/djac242>

Canadian cancer incidence trends, 1992–2013 (CCS, StatsCan 2017)

Average annual percent change, age-standardized

Decreasing Incidence:
tobacco-associated cancers

Increasing Incidence:
thyroid, liver, melanoma, testis, uterus, kidney/renal, esophagus, breast, hematological (including nHL), “all cancers”



Analysis by: Surveillance and Epidemiology Division, CCDC, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada



Glyphosate Based Herbicides Cause Cancer

Following three large lawsuits, Bayer (that purchased Monsanto) is paying \$10.9 billion to settle more than 100,000 Roundup lawsuits
<https://www.baumhedlundlaw.com/toxic-tort-law/monsanto-roundup-lawsuit/>



<https://gem.cbc.ca/media/the-passionate-eye/s02e01>



US Agency for Toxic Substances and Disease Registry

Toxicological Profile for Glyphosate

SHOWS glyphosate causes non-Hodgkin lymphoma

ATSDR is NOT a regulatory agency

2019 ATSDR draft Glyphosate Profile:

<https://preventcancer.ca/wp-content/uploads/2022/09/atcdrNHLdraft.pdf>

2020 Final: <https://www.atsdr.cdc.gov/ToxProfiles/tp214.pdf>



Monsanto/Bayer lost because science was corrupted – one example

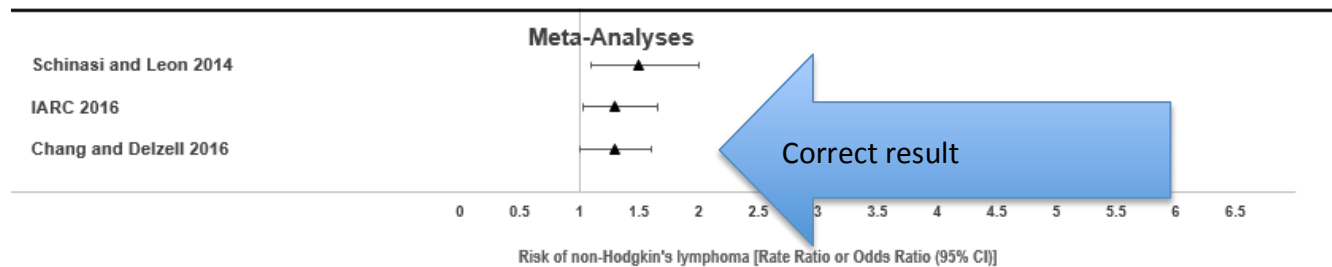
Pay Attention!



Falsified cancer data in US government report

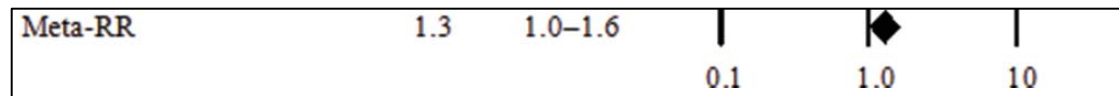
Agency for Toxic Substances and Diseases Registry

DRAFT
2019

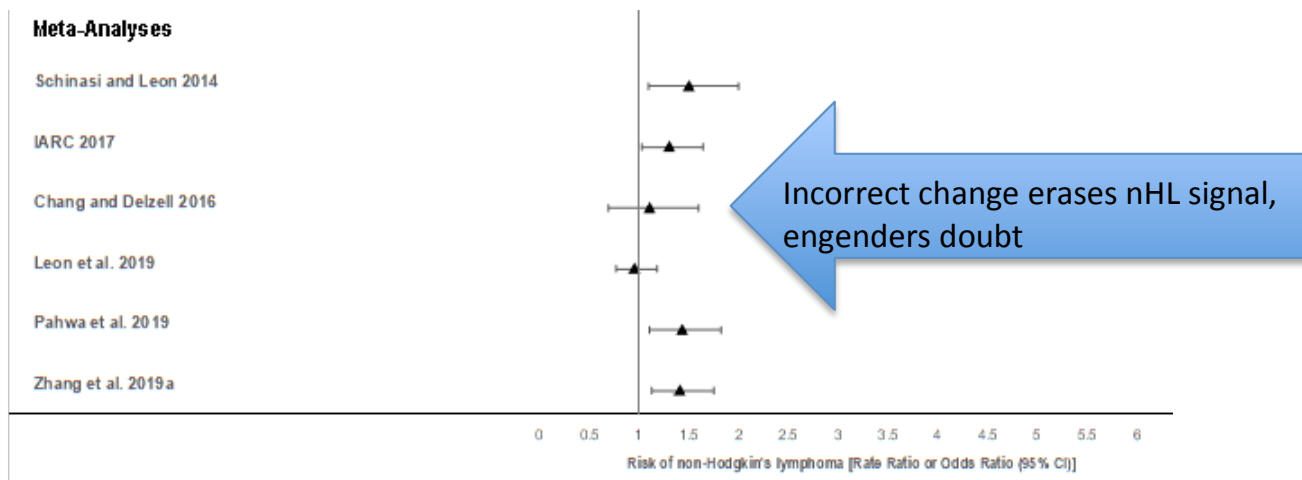


*Logistic Regression; **Hierarchical regression; ***Non-Asthmatic farmers; ****Asthmatic farmers
 a = adjusted; CED = cumulative exposure; IWED = intensity-weighted exposure days; IWLD = intensity-weighted lifetime days; OR = odds ratio; Q4 = 4th quartile; RR = rate ratio; T3 = 3rd tertile

Extract from Figure 1. Chang and Delzell⁴ Systematic review and meta-analysis of glyphosate exposure and risk of lymphohematopoietic cancers. The odds ratio point estimate is 1.3, with a 95% confidence interval of 1.0 to 1.6.



FINAL
2020



Increased glyphosate Maximum Residue Limits Safe Food Matters and Prevent Cancer Now objection

- MRLs are based on field trials / will accommodate trial data
- ***Data is very sparse, scattered, site-specific***
- **KEY FACTS:** Glyphosate accumulates in seeds as they ripen, so it should not be sprayed on immature pods
- Indeterminant crops continue to grow, and accumulate more herbicide than determinant crops.
- Groups of crops (e.g., “peas”) including determinant and indeterminant varieties, *are regulated based on one variety.*
- **INVALID ASSUMPTION:** glyphosate levels always decrease over time after spraying – they can increase!

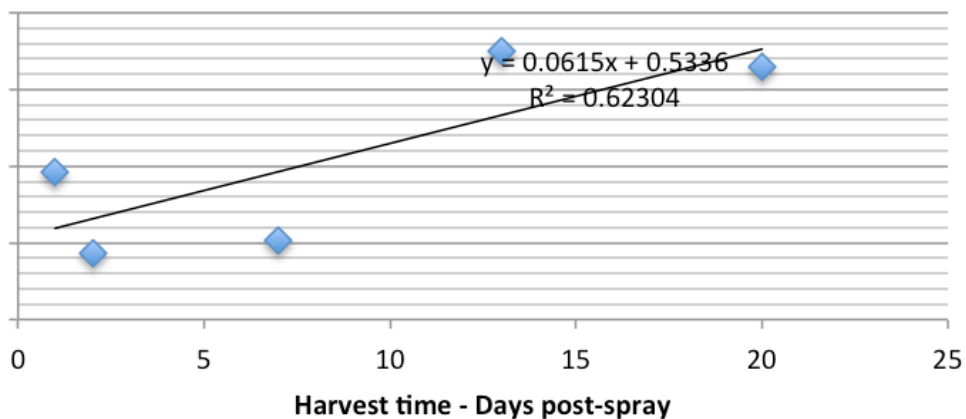
preventcancer.ca/submissions/https-preventcancer.ca-wp-content-uploads-2022-11-sfmpcn-glyphosatemrlsubmission-ap2022-pdf

After pre-harvest spraying, maturing/drying seeds accumulate glyphosate

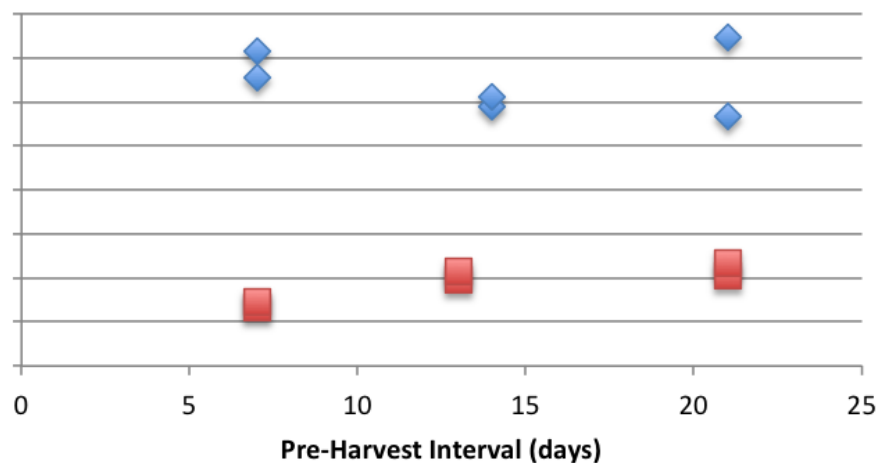
So-called "Decline Studies"

(Test data provided by the PMRA; scale is confidential)

**Glyphosate in Beans
"Decline" Study**



Peas Field Trial "Decline" Studies



Proposed MRLs are higher than field trial data, to avoid exceeding legal limits

Poisoning Regulation, Research, Health, and the Environment: The Glyphosate-Based Herbicides Case in Canada

- Canadian scientific assessment and regulation of pesticides are deficient and lagging behind other countries. The PMRA
 - embraces industry narratives and biased evidence,
 - is receptive to industry demands, and
 - is opaque about decision making—lack transparency re. data and reasoning
- **REGULATORY CAPTURE:** Health Canada's Pest Management Regulatory Agency (PMRA) promotes commercial interests over public health and environmental protection.

Bacon et al., Toxics **2023**, 11(2), 121; <https://doi.org/10.3390/toxics11020121>

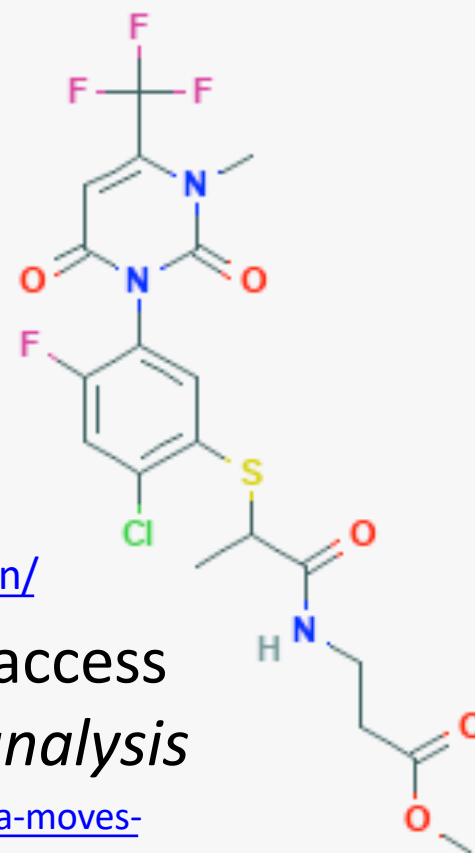
Responses to herbicide resistance

- More frequent, greater applications of glyphosate
- Genetically engineered crops resistant to additional old herbicides (e.g., dicamba)
- **NEW:** More potent, persistent, hazardous herbicides (e.g., **tiafenacil**)

<https://preventcancer.ca/submissions/tiafenacil-notice-of-objection/>

- **WIN:** PMRA regulatory reform proposal for access to “inspect” confidential test data, *with re-analysis*

<https://www.canada.ca/en/health-canada/news/2023/06/government-of-canada-moves-forward-on-commitments-to-strengthen-the-pesticide-review-process.html>



Rigorous pesticides oversight exceeds PMRA scientific capabilities and feasibility

How to link multiple pesticides to human and environmental health?

Too many variables, too little data

NEEDS **\$\$\$\$, expertise, and will**

- Baseline and monitoring (e.g., humans, food, environment)
- Regular, systematic literature searching, data extraction and updating of scientific syntheses
- Sales and use
- *Scientific infrastructure* to link exposures to health
- TRANSPARENCY – meaningful data access for independent researchers

PMRA's "Transformation"

- 2021 election commitments: glyphosate MRL pause
- Aspirations did not match actions.
 - Transparency promised; PCN waited months to receive consultation document PRD2022-01 (Tiafenacil)
 - Chlorpyrifos court case was dragged out

RECOMMENDATION: Do as the Agency's name says

– focus on ecology before chemicals

- TRANSPARENCY: access to data, *and PMRA analyses*
- SOLUTION: Out with the old, toxic chemicals!
- In with least-toxic products *and strategies*

Pest ^{icide} Management Regulatory Agency – RE-THINK

Broader Regulatory Capture? PMRA consultation re. “Proportional Effort”

- Deloitte was hired by the PMRA
 - Late 2022, they consulted stakeholders and proposed a framework to reduce PMRA backlog

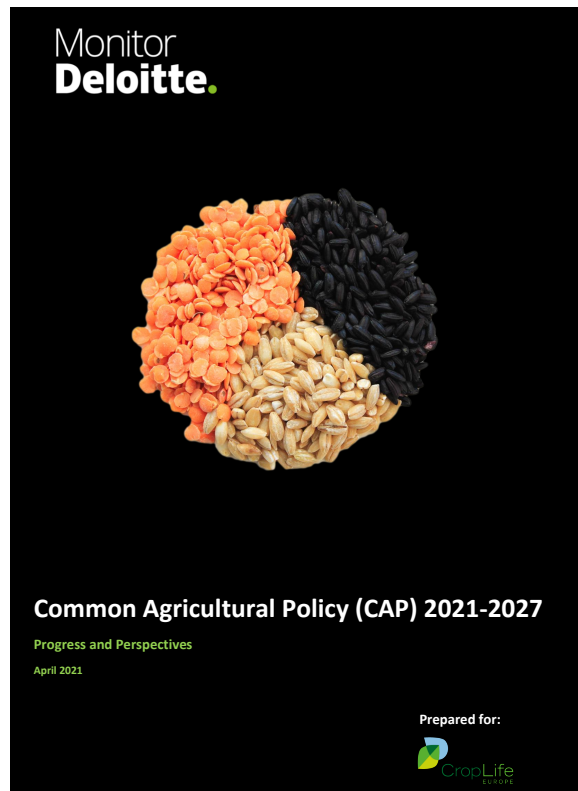
“What we heard” ≠ “What we said”

- 2018 – 2022 (5 years) Deloitte had
 - 1078 Federal contracts
 - Worth \$1,526,319,462

Deloitte works for the pesticide industry

For CropLife Europe

Achievements [that continue use of pesticides] - *Sustainable Use of Pesticides Directive and Integrated Pest Management.*



For CropLife Australia

[pesticides] use makes a significant contribution to agricultural production in Australia ...

Deloitte.
Access Economics



Economic activity attributable to crop protection products
CropLife Australia
February 2018

CropLife Collaboration with U.N. Food and Agriculture Organization

October 2, 2020. ... collaborate for the “sound management of pesticides...”

– NO FAO collaboration with the organic sector!



Food and Agriculture Organization
of the United Nations



LETTER OF INTENT

BETWEEN

THE FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

AND

CROPLIFE INTERNATIONAL

Government enacted CropLife “gene-edited”
seeds recommendation:

NO regulation, NO mandatory transparency

Key point:

Organic foods must not be genetically modified or edited. Contamination is a big problem for the sector.

- *Voluntary* listing of new gene-edited seeds

<https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/transparency-initiative.html>

- Allegedly equivalent to breeding sped up

Right to Save Seeds?

Can farmers save their own regionally-adapted seeds?

Sustainable Agriculture Strategy

What about organic agriculture?

- Canada's fastest-growing agricultural sector
- established regenerative, sustainable farming
- Practices are codified and regulated federally science-based expert consensus and ongoing improvement.

Federal strategy is missing the knowledge to achieve sustainable, regenerative farming

Strategies for Sustainable Agriculture Success

1. Focus on healthy ecosystems, including wetlands and natural areas, biodiversity, and organic, regenerative practices
2. Ambitiously reduce inputs

.....

- COP 15 on Biodiversity 2030 goal: ***reduce pesticides***
 - ***proposed by 2/3 ~ final agreement by 1/2***
 - EU 2030 goal: ***halve the toxic burden, numbers and quantities of pesticides***
- ***Focus on least-toxic options*** with comparative assessments
- The PMRA and Agriculture Canada *need* to listen to, and learn from the organic experts.

Sustainable Agriculture Strategy, Partnership

The [National Farmers' Union](#) couldn't be more explicit in the urgent need for ambitious transformation:

We need a multiplication of effort and speed — near-wartime levels of ambition and action as we struggle to blunt the massively damaging impacts of accelerating climate change.

We are moving far too slow,

We are losing,

We risk losing everything,

We must act faster.

We need a government-led mobilization for food-system transformation.

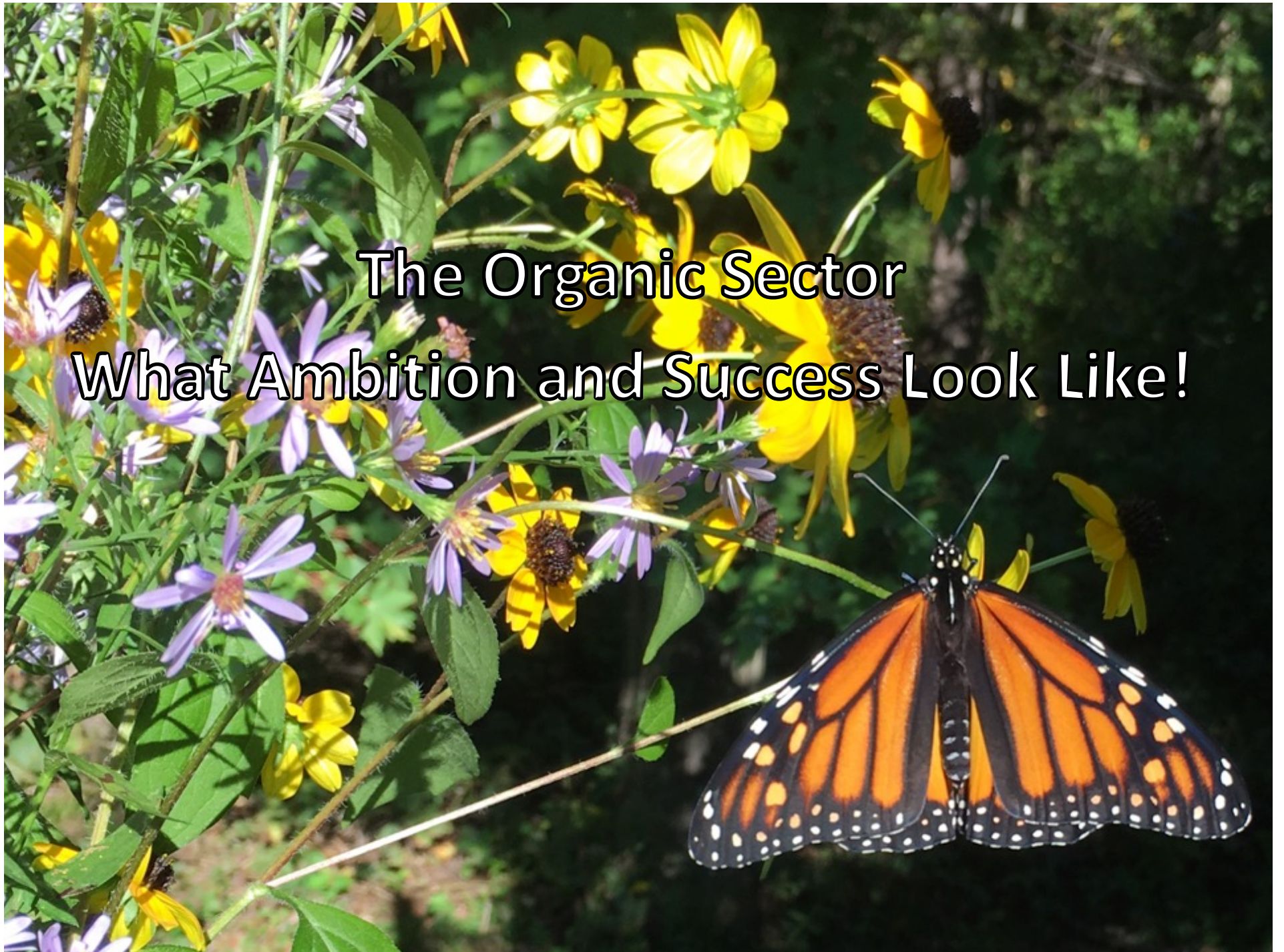
April 1, 2023 [Sustainable Canadian Agricultural Partnership](#) (SCAP), replicates the problems highlighted Strategy submissions.

The sources of problems will not solve them

Promising possibility ...

[Canadian Farm Resiliency Agency](#)

“to lead climate adaptation and emissions reduction, hire and train hundreds of independent agrologists, and create a network of demonstration farms where low-emission practices could be refined and showcased.”



The Organic Sector
What Ambition and Success Look Like!

Thank you! ... Questions, thoughts?

PREVENT
CANCER



Meg Sears PhD

meg@preventcancer.ca

<https://PreventCancerNow.ca>