

Just how controversial is the glyphosate controversy?

Stephen F. Enloe and Jason Ferrell

University of Florida - IFAS



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What is glyphosate?

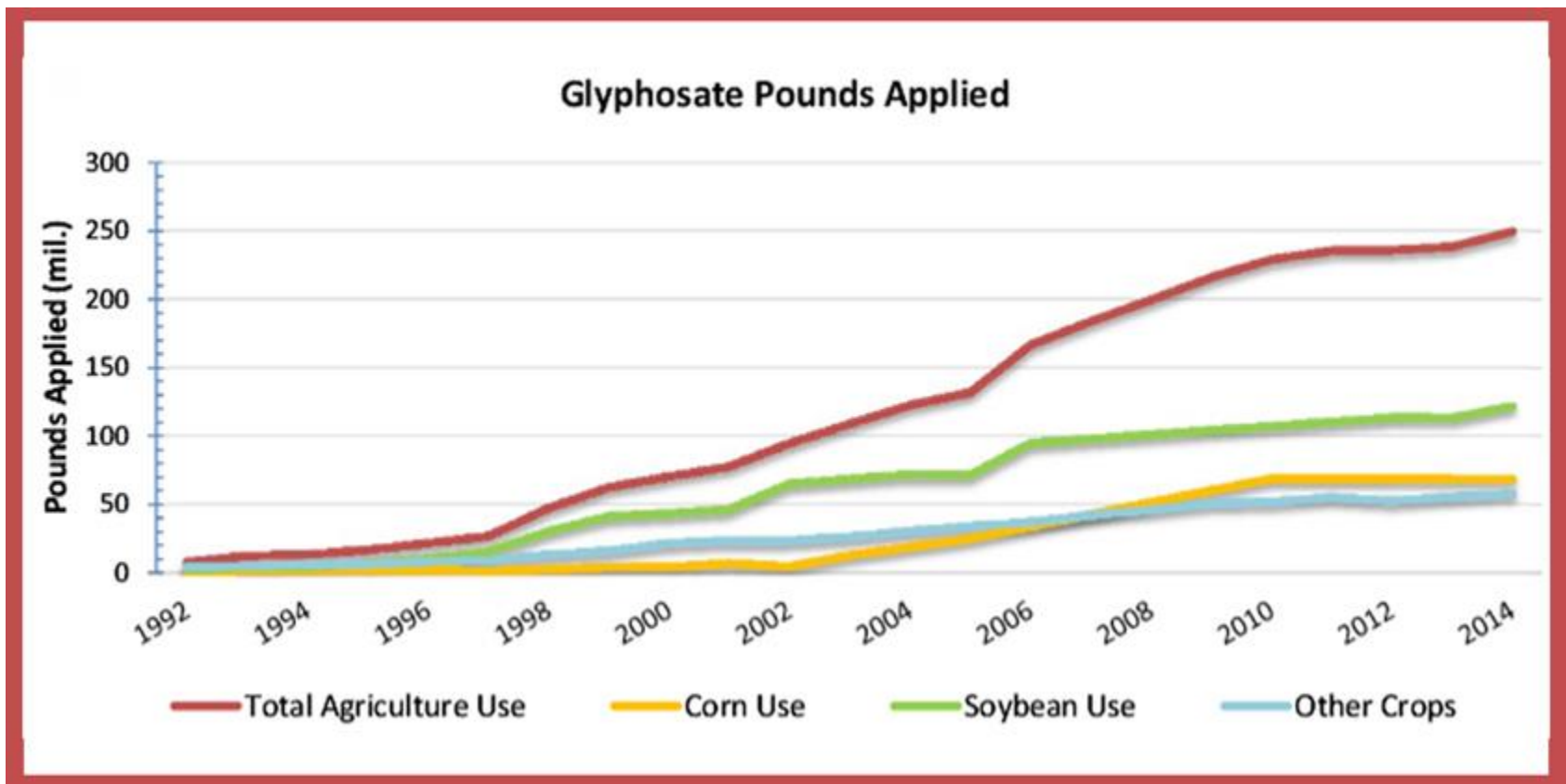
- Active ingredient in the world's most commonly used herbicide



Why is glyphosate so common?

- Its characteristics have made it VERY a useful tool
 - Non-selective
 - Non-volatile
 - No odor
 - Non-staining
 - No soil carryover
 - Highly effective
 - Inexpensive





Benbrook *Environ Sci Eur* (2016) 28:3

Question: Should we question and study the use of this much glyphosate?

Answer: ABSOLUTELY!

The Three Worlds of Science

Good Science

- Solid
- Non-biased
- Credible peer review
- Highly technical
- “Scientific jargon” heavy
- Often inaccessible to public

Bad Science (Fraud)

- Fraud, scientific misconduct
- Agenda driven
- Sensational

Semi-science

- May ask good questions
- May have some peer review
- Extrapolates well beyond the data
- More readily available online
- More sensational
- Fits data to preconceived ideas to drive a message

If you look across the blogosphere...

- Glyphosate is accused of...
 - Causing cancer
 - Being present at toxic levels in
 - Air
 - Rainwater
 - Urine
 - Breast milk
 - Wine
 - Honey
 - Vaccines
 - Tampons

These are the types
of things that grab
the public's attention!

Monsanto

Monsanto ordered to pay \$289m as jury rules weedkiller caused man's cancer

Court finds in favor of Dewayne Johnson, first person to take Roundup maker to trial

**Sam Levin in San Francisco
and Patrick Greenfield**

Sat 11 Aug 2018 07:34 EDT



335,108

This article is over **6 months old**





BUSINESS DAY

W.H.O. Report Links Ingredient in Roundup to Cancer

By REUTERS MARCH 20, 2015



The world's most widely-used weed killer can "probably" cause [cancer](#), the [World Health Organization](#) said on Friday.

The organization's cancer arm, the International Agency for Research on Cancer, said glyphosate, the active ingredient in the [Monsanto](#) herbicide Roundup, was "classified as probably carcinogenic to humans." It also said there was "limited evidence" that glyphosate was carcinogenic in humans for non-Hodgkin lymphoma.

Monsanto, the world's largest seed company, said scientific data did not support the conclusions and called on the group to hold a meeting to explain the findings.

"We don't know how IARC could reach a conclusion that is such a dramatic departure from the conclusion reached by all regulatory agencies around the globe," Philip Miller, Monsanto's vice-president for global regulatory affairs, said in a statement.

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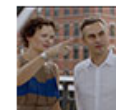
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World Health Organization

- March 2015, IARC reclassified glyphosate as “Probably Carcinogenic”
- First...what is IARC?

IARC: International Agency for Research on Cancer

- IARC is a branch within WHO.
- “Its role is to conduct and coordinate research into the causes of cancer. It also collects and publishes surveillance data regarding the occurrence of cancer worldwide.”

https://en.wikipedia.org/wiki/International_Agency_for_Research_on_Cancer



CLASSIFICATIONS

PUBLICATIONS

PREAMBLE

STAFF

of Classifications / **Volumes 1–123**

AGENTS CLASSIFIED BY THE IARC MONOGRAPHS, VOLUMES 1–123

Group 1	<i>Carcinogenic to humans</i>	120 agents
Group 2A	<i>Probably carcinogenic to humans</i>	82
Group 2B	<i>Possibly carcinogenic to humans</i>	311
Group 3	<i>Not classifiable as to its carcinogenicity to humans</i>	500

For definitions of these groups, please see the [Preamble](#).

<https://monographs.iarc.fr/agents-classified-by-the-iarc/>



What is a probable carcinogen?

- Probable doesn't mean likely

“There is *limited* evidence of carcinogenicity in humans and *sufficient* evidence in experimental animals.”

<http://monographs.iarc.fr/ENG/Preamble/CurrentPreamble.pdf>



The EPA disagrees with IARC



EPA Weighs In On Glyphosate, Says It Likely Doesn't Cause Cancer

September 17, 2016 · 9:49 AM ET



DAN CHARLES



EU disagrees with IARC

CONCLUSION ON PESTICIDE PEER REVIEW

Conclusion on the peer review of the pesticide risk assessment of the active substance glyphosate¹

European Food Safety Authority (EFSA)²

European Food Safety Authority (EFSA), Parma, Italy

ABSTRACT

The conclusions of the European Food Safety Authority (EFSA), following the peer review of the initial risk assessments carried out by the competent authority of the rapporteur Member State Germany, for the pesticide active substance glyphosate are reported. The context of the peer review was that required by Commission Regulation (EU) No 1141/2010 as amended by Commission Implementing Regulation (EU) No 380/2013. The conclusions were reached on the basis of the evaluation of the representative uses of glyphosate as a herbicide on emerged annual, perennial and biennial weeds in all crops [crops including but not restricted to root and tuber vegetables, bulb vegetables, stem vegetables, field vegetables (fruiting vegetables, brassica vegetables, leaf vegetables and fresh herbs, legume vegetables), pulses, oil seeds, potatoes, cereals, and sugar- and fodder beet; orchard crops and vine, before planting fruit crops, ornamentals, trees, nursery plants etc.] and foliar spraying for desiccation in cereals and oilseeds (pre-harvest). The reliable endpoints, concluded as being appropriate for use in regulatory risk assessment and derived from the available studies and literature in the dossier peer reviewed, are presented. Missing information identified as being required by the regulatory framework is listed. Concerns are identified. Following a second mandate from the European Commission to consider the findings from the International Agency for Research on Cancer (IARC) regarding the potential carcinogenicity of glyphosate or glyphosate-containing plant protection products in the on-going peer review of the active substance, EFSA concluded that glyphosate is unlikely to pose a carcinogenic hazard to humans and the evidence does not support classification with regard to its carcinogenic potential according to Regulation (EC) No 1272/2008.

<https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2015.4302>

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Canada disagrees with IARC



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Statement from Health Canada on Glyphosate

From: [Health Canada](#)

Statement

January 11, 2019 - Ottawa, ON - Health Canada

OTTAWA – Health Canada’s primary objective in regulating pesticides is to protect Canadians’ health and the environment. That is why the Department regularly reviews all pesticides to make sure that they continue to meet modern health and safety standards.

Following the release of the Department’s [final re-evaluation decision](#) on glyphosate in 2017, Health Canada received eight notices of objection. There have also been concerns raised publicly about the validity of some of the science around glyphosate in what is being referred to as the Monsanto Papers.

Health Canada scientists reviewed the information provided in these notices, and assessed the validity of any studies in question, to determine whether any of the issues raised would influence the results of the assessment and the associated regulatory decision.

After a thorough scientific review, we have concluded that the concerns raised by the objectors could not be scientifically supported when considering the entire body of relevant data. The objections raised did not create doubt or concern regarding the scientific basis for the 2017 re-evaluation decision for glyphosate. Therefore, the Department’s final decision will stand.

Health Canada follows a transparent and rigorous science-based regulatory process when making decisions about the safety of pesticides. As part of this process, Health Canada will publish its responses to each notice of objection in the Post



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<https://www.canada.ca/en/health-canada/news/2019/01/statement-from-health-canada-on-glyphosate.html>

Why is there such disagreement
with IARC?

Why are IARC and EPA at odds?

- IARC assesses “hazard”
 - Is harm possible?
- EPA assesses “risk”
 - Is harm likely?

Because they assess “hazard”, IARC has a high hit rate

- “Over four decades, a WHO research agency has assessed 989 substances and activities, ranging from arsenic to hairdressing, and found only one was “probably not” likely to cause cancer in humans. It was an ingredient in nylon used in stretchy yoga pants and toothbrush bristles.”

<https://www.reuters.com/investigates/special-report/health-who-iarc/>



Why is there such disagreement with IARC?

- It has to do with what data was included in the discussion.
 - IARC included two papers that EU, EPA, and Health Canada felt were insufficient.

Glyphosate toxicity and carcinogenicity: a review of the scientific basis of the European Union assessment and its differences with IARC

Jose V. Tarazona¹ · Daniele Court-Marques¹ · Manuela Tiramani¹ · Hermine Reich¹ · Rudolf Pfeil² · Frederique Istace¹ · Federica Crivellente¹

Received: 15 January 2017 / Accepted: 21 March 2017 / Published online: 3 April 2017
© The Author(s) 2017. This article is an open access publication

Abstract Glyphosate is the most widely used herbicide worldwide. It is a broad spectrum herbicide and its agricultural uses increased considerably after the development of glyphosate-resistant genetically modified (GM) varieties. Since glyphosate was introduced in 1974, all regulatory assessments have established that glyphosate has low hazard potential to mammals, however, the International Agency for Research on Cancer (IARC) concluded in March 2015 that it is probably carcinogenic. The IARC conclusion was not confirmed by the EU assessment or the recent joint WHO/FAO evaluation, both using additional evidence. Glyphosate is not the first topic of disagreement between IARC and regulatory evaluations, but has received greater attention. This review presents the scientific basis of the glyphosate health assessment conducted within the European Union (EU) renewal process, and explains the differences in the carcinogenicity assessment with IARC. Use of different data sets, particularly on long-term toxicity/carcinogenicity in rodents, could partially explain the divergent views; but methodological differences in the evaluation of the available evidence have been identified. The EU assessment did not identify a carcinogenicity hazard, revised the toxicological profile proposing new toxicological reference values, and conducted a risk assessment

for some representative uses. Two complementary exposure assessments, human-biomonitoring and food-residues-monitoring, suggests that actual exposure levels are below these reference values and do not represent a public concern.

Keywords Glyphosate · Toxicity · Carcinogenicity · IARC · EFSA · Public health · Consumer risk

Introduction

Glyphosate is the most widely used herbicide in the world. A broad spectrum herbicide, its uses include weed control in agriculture, vegetation control in non-agricultural areas, and harvesting aid as crop desiccant. Its use in agriculture has increased considerably due to the development of glyphosate-resistant GM crop varieties; the herbicide has also been used to control illegal crops through massive aerial applications (Solomon et al. 2007). The widespread use and public debate regarding these uses have aroused societal concern and a scientific controversy on the toxicity of glyphosate (Faria 2015) beyond the scientific debate (Blaylock 2015).

Glyphosate was considered an advantageous herbicide until its use led to the evolution of glyphosate-resistant weeds (Duke and Powles 2008) and studies suggesting effects of glyphosate-based formulations in humans and wildlife were published. Interest in glyphosate has increased exponentially among scientists, and the subject accounted for 5% of the articles on pesticides included in PubMed during 2015. About 25% of the articles cover the toxicity endpoints in humans and all types of organisms, and the majority is conducted with glyphosate-based formulations, containing other ingredients. Some

Electronic supplementary material The online version of this article (doi:10.1007/s00204-017-1962-5) contains supplementary material, which is available to authorized users.

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² Federal Institute for Risk Assessment (BfR), Berlin, Germany

Arch Toxicol (2017)
91:2723–2743



Even if everyone agreed, what are some other Probable Carcinogens?



Known vs. Probable Carcinogens

Known

- Alcoholic beverages
- Asbestos
- Tobacco
- Plutonium
- Solar Radiation
- UV Tanning Beds

<http://www.cancer.org/cancer/cancercauses/othercarcinogens/generalinformationaboutcarcinogens/known-and-probable-human-carcinogens>

Known vs. Probable Carcinogens

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<http://www.cancer.org/cancer/cancercauses/othercarcinogens/generalinformationaboutcarcinogens/known-and-probable-human-carcinogens>

Probable

- Glyphosate
- Hair products (work exposure)
- Red Meat (consumption)
- Beverages >150 F (consump.)
 - McDonald's coffee (180-190F)
- Shiftwork (circadian disruption)

What was not included: unpublished AHS study data

[J Natl Cancer Inst. 2018 May 1;110\(5\):509-516. doi: 10.1093/jnci/djx233.](#)

Glyphosate Use and Cancer Incidence in the Agricultural Health Study.

[Andreotti G¹](#), [Koutros S¹](#), [Hofmann JN¹](#), [Sandler DP²](#), [Lubin JH³](#), [Lynch CF^{4,5}](#), [Lerro CC¹](#), [De Roos AJ⁶](#), [Parks CG²](#), [Alavanja MC⁷](#), [Silverman DT¹](#), [Beane Freeman LE¹](#).

⊕ Author information

Abstract

BACKGROUND: Glyphosate is the most commonly used herbicide worldwide, with both residential and agricultural uses. In 2015, the International Agency for Research on Cancer classified glyphosate as "probably carcinogenic to humans," noting strong mechanistic evidence and positive associations for non-Hodgkin lymphoma (NHL) in some epidemiologic studies. A previous evaluation in the Agricultural Health Study (AHS) with follow-up through 2001 found no statistically significant associations with glyphosate use and cancer at any site.

METHODS: The AHS is a prospective cohort of licensed pesticide applicators from North Carolina and Iowa. Here, we updated the previous evaluation of glyphosate with cancer incidence from registry linkages through 2012 (North Carolina)/2013 (Iowa). Lifetime days and intensity-weighted lifetime days of glyphosate use were based on self-reported information from enrollment (1993-1997) and follow-up questionnaires (1999-2005). We estimated incidence rate ratios (RRs) and 95% confidence intervals (CIs) using Poisson regression, controlling for potential confounders, including use of other pesticides. All statistical tests were two-sided.

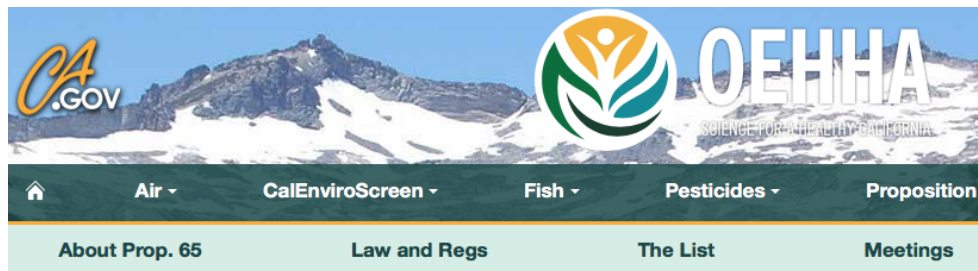
RESULTS: Among 54 251 applicators, 44 932 (82.8%) used glyphosate, including 5779 incident cancer cases (79.3% of all cases). In unlagged analyses, glyphosate was not statistically significantly associated with cancer at any site. However, among applicators in the highest exposure quartile, there was an increased risk of acute myeloid leukemia (AML) compared with never users (RR = 2.44, 95% CI = 0.94 to 6.32, Ptrend = .11), though this association was not statistically significant. Results for AML were similar with a five-year (RRQuartile 4 = 2.32, 95% CI = 0.98 to 5.51, Ptrend = .07) and 20-year exposure lag (RRTertile 3 = 2.04, 95% CI = 1.05 to 3.97, Ptrend = .04).

CONCLUSIONS: In this large, prospective cohort study, no association was apparent between glyphosate and any solid tumors or lymphoid malignancies overall, including NHL and its subtypes. There was some evidence of increased risk of AML among the highest exposed group that requires confirmation.



California Office of Environment Health Hazard Assessment

July 2017, proposes warning label under Prop 65



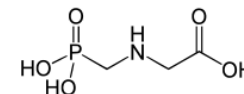
The screenshot shows the top of the OEHHA website. It features the CA.GOV logo on the left, the OEHHA logo (a stylized green and yellow leaf) in the center, and the text 'OEHHA SCIENCE FOR A HEALTHY CALIFORNIA' on the right. Below the logo is a dark green navigation bar with links for 'Air', 'CalEnviroScreen', 'Fish', 'Pesticides', and 'Proposition'. A light green secondary navigation bar contains links for 'About Prop. 65', 'Law and Regs', 'The List', and 'Meetings'.

[Home](#) » [Proposition 65](#) » [Chemicals Considered or Listed Under Proposition 65](#) » [Glyphosate](#)



Glyphosate

More information about [Glyphosate](#)



Chemical Status

Cancer:	Currently listed
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Upcoming Actions

[Notice of Proposed Rulemaking: Amendment to Section 25705, Specific Regulatory Levels Posing No Significant Risk: Glyphosate](#)

Chemical Listing Details

Cancer

Listed as causing:	Cancer
Date of Listing:	07/07/2017
Basis for Listing:	LC-IARC

Public Notices Related to this Chemical

- [Glyphosate Listed Effective July 7, 2017, as Known to the State of California to Cause Cancer](#)
- [Glyphosate to be Listed under Proposition 65 as Known to the State to Cause Cancer](#)
- [Notice of Intent to List: Tetrachlorvinphos, Parathion, Malathion, Glyphosate](#)
- [Notice of Proposed Rulemaking: Amendment to Section 25705, Specific Regulatory Levels Posing No Significant Risk: Glyphosate](#)

California Court blocks warning label

Glyphosate cancer warning in California halted



By GEOFFREY MOHAN FEB 27, 2018 | 1:15 PM



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<http://www.latimes.com/business/la-fi-glyphosate-prop65-story.html>

Judge William Shubb - ruling

- Shubb said a cancer warning would be "misleading at best," given that "a reasonable consumer would not understand that a substance is 'known to cause cancer' where **only one health organization** had found that the substance in question causes cancer and **virtually all other government agencies and health organizations** that have reviewed studies on the chemical had **found there was no evidence that it caused cancer.**"

<http://www.latimes.com/business/la-fi-glyphosate-prop65-story.html>



Why was Monsanto sued for millions?

Monsanto

Monsanto ordered to pay \$289m as jury rules weedkiller caused man's cancer

Court finds in favor of Dewayne Johnson, first person to take Roundup maker to trial

Sam Levin in San Francisco and Patrick Greenfield

Sat 11 Aug 2018
07:34 EDT



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335k
This article is over 5 months old



▲ DeWayne Johnson listens during the Monsanto trial in San Francisco last month. Photograph: Reuters

Monsanto suffered a major blow with a jury ruling that the company was liable for a terminally ill man's cancer, awarding him \$289m in damages.

Dewayne Johnson, a 46-year-old former groundskeeper, won a huge victory in the landmark case on Friday, with the jury determining that Monsanto's

<https://www.theguardian.com/business/2018/aug/10/monsanto-trial-cancer-dewayne-johnson-ruling>

“Monsanto Papers”

- According to court documents:
 - There was evidence of Monsanto employees “ghost writing” articles to minimize the cancer concerns



EU and other agencies have thoroughly reviewed these documents



EFSA Statement regarding the EU assessment of glyphosate and the so-called “Monsanto papers”

Background

On 29 May 2017, EFSA received a request from the European Commission to produce a statement concerning the EU assessment of glyphosate following allegations made in the so-called “Monsanto papers”. The requestor asked EFSA to provide responses to the following points:

- What impact the allegations about Monsanto ghostwriting scientific review articles would have on the overall EU assessment of glyphosate, if they were confirmed;
- The role of the scientific review articles in question, including the type of publication, amount of available information, transparency of industry support for some articles;
- The legal provisions on the assessment of open scientific literature in the EU legislation on pesticides and their implementation in the EU peer review;
- The steps taken during the assessment to ascertain the reliability of guideline studies and those from the open literature.

In line with the request from the European Commission, this statement outlines the EU legislative framework concerning the submission of open scientific literature for the assessment of active substances and explains how such literature is considered during the peer-review process by Member State and EFSA experts. The statement continues with information about the steps that Member State and EFSA experts take to ascertain



Ghost Writing Concerns

“Following this investigation, EFSA can confirm that even if the allegations regarding ghostwriting proved to be true, there would be no impact on the overall assessment as presented in the EFSA Conclusion on glyphosate.

...[If] these two review papers might have been ghostwritten by Monsanto, their provenance was evident from the Declarations of Interest and Acknowledgements in the papers themselves.

The review papers in question represented only two of approximately 700 scientific references in the area of mammalian toxicology considered by EFSA in the glyphosate assessment.”

Some things to look out for...

- Catchy headlines
- Shock value
- Absolutes (*this study definitively proves...*)
- Sales pitches
- Fear-mongering
- Character assassination



Common weed killer glyphosate increases cancer risk by 41%, study says

By Emily Dixon, CNN

Updated 2:45 PM ET, Fri February 15, 2019



More from CNN



Man wrongfully incarcerated for 39 years



Bank of America is phasing out the 105-year-old Merrill Lynch...

Holiday Inn Express
AN IHG HOTEL

BOOK EARLY AND SAVE

Some things to look for...

- Addressing study results in relation to the body of scientific literature on the issue
- Cautious interpretation of results
- Admission of study limitations
- Follow-up peer review

University of Florida position

“UF/IFAS is committed to safety and supports integrated pest management as the first line of defense against weeds and other pests, including the use of glyphosate and other pesticides.”

- Integrated Pest Management means using all reasonable options in concert to control pests

https://pested.ifas.ufl.edu/wp-content/uploads/2018/09/ICS_GlyphosateFactSheet03-9-17-18.pdf



Options if you choose not to use glyphosate in FL

- Glyphosate - \$15-26/gal;
 - No odor, no soil activity, controls grasses and forbes, upland or aquatic sites, no irrigation restrictions.
- Imazapyr - \$18/gal
 - No odor, controls grasses and forbs, significant soil activity. Upland and aquatic sites.
 - Can't be used near desirable trees, 120d irrigation restriction
- Tigr – \$320/gal
 - Distinct odor, grasses only, no soil activity
 - Upland or aquatic, 30d irrigation restriction

Options if you choose not to use glyphosate

- Triclopyr – \$30-40/gal
 - 4 different formulations: some for aquatic, some upland
 - Forbs only no grass; some formulations smell, some are volatile. Irrigation restriction – 120d

A new twist...



Insurance may become
a bigger issue than
the current lawsuits

HARRELL'S EXPLAINS MOVE TO DISCONTINUE DISTRIBUTION OF GLYPHOSATE PRODUCTS

March 14, 2019

0 Comments

Jack Harrell Jr., CEO of Harrell's, wrote a letter regarding the company's recent decision to discontinue distribution of glyphosate products.

There has obviously been some discussion and concern about our decision to stop selling glyphosate products. I apologize for any confusion about this, and I would like to explain why we made this decision.

First, Harrell's is not making any judgment as to whether glyphosate is detrimental to anyone's health. In fact, the weight of scientific evidence strongly supports its safety when used properly.



Jack Harrell Jr.

That said, during our annual insurance renewal last month, we were surprised to learn that our insurance company was no longer willing to provide coverage for claims related to glyphosate due to the recent high-profile lawsuit and the many thousands of lawsuits since. We sought coverage from other companies but could not buy adequate coverage for the risk we would be incurring. So, we had no choice other than to notify our Harrell's team and customers that we would no longer offer products containing glyphosate as of March 1, 2019.

We are still ready and able to help you with a variety of alternative products that will meet your nonselective control needs or to help you find glyphosate elsewhere. As always, we will make sure your needs are met no matter whether we sell a particular product or not.

Finally, be assured that Harrell's will continue to partner with our suppliers, customers and all national, state and local associations to advocate for responsible regulation and legislation of our products and practices. Together we can educate lawmakers and the public and ensure we can continue Growing A Better World.

In addition to being a distributor of branded fungicides, herbicides and insecticides, Harrell's produces custom blended fertilizers, specialty liquids and wetting agents.



[photo by Karen via FlickrCC](#)

Miami Bans Controversial Herbicides That Are Killing Biscayne Bay

JESSICA LIPSCOMB | MARCH 1, 2019 | 7:11AM



48k

Glyphosate is a popular ingredient in weed-killing herbicides because it's extremely effective. But it's also a well-known pollutant – researchers have found the chemical in samples of **the air we breathe, the food we eat, and even the beer and wine we buy from the liquor store.**



201



3



Now, the ingredient has been banned in Miami. On Thursday, city commissioners approved a resolution prohibiting the city and its contractors from using herbicides containing glyphosate, including Roundup. The ban went into effect immediately.

Questions?

Contact us:

sfenloe@ufl.edu

jferrell@ufl.edu



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