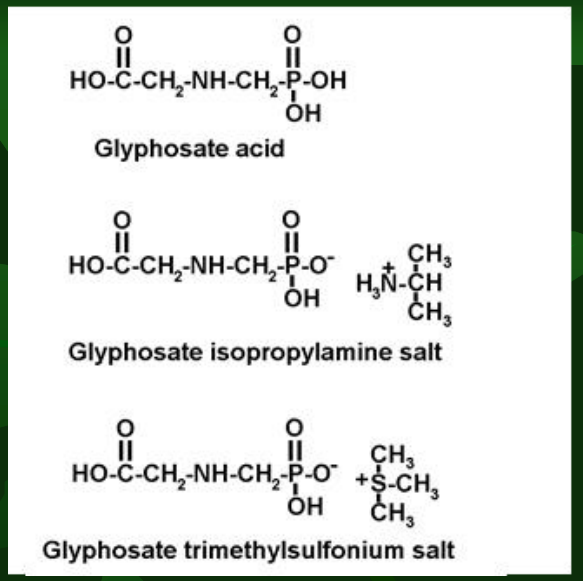
How Safe is Glyphosate?



Dr. Hannah Mathers

Mathers Environmental Science Services, LLC

Gahanna, OH

Website: www.mathersenvironmental.com

3 JURIES #1

- 11/2018 - Dewayne Johnson, 46 father of 2 - groundskeeper San Francisco Bay Area, 2012-2015 applied **Roundup** to school properties 2-3 hrs/ day, 20- 30 times/ year
- 80% of his body covered in lesions.
- $39.2 million in compensatory $250 million in punitive damages.
- Monsanto appealing

3 times
#1

- ✓ 2014 - severe skin irritation
- ✓ Reported - doctors, employer, and Monsanto
- ✓ Monsanto internal discussions
- ✓ Never responded
- ✓ Continued to use **Roundup**
- ✓ 08/2014 - Epidermotropic T-cell lymphoma

3 times
#1

- ✓ Still required to apply **Roundup**
- ✓ Chemotherapy throughout 2015
- ✓ Cancer advances
- ✓ September 2017, mycosis fungoides (non-Hodgkin lymphoma with large cell transformation).
- ✓ Poorer survival - with advanced age and black race.

3 times
#2

- 03/ 2019 -1st Federal case $80 million in damages to Edwin Hardeman (70)
- Stage 3 NHL
- Used **Roundup** as brush control
- On his Sonoma County property for 26 years.
- Bayer appealing.

3 times #3

- 05/19 – 70's
- $1 billion to Alberta Pilliod – NHL brain in cancer in 2015
- $1 billion to Alva Pilliod - NHL spread to bones, pelvis and spine.
- Started using **Roundup** in the 1970s and continued until only a few years ago around their property (in the 70's no other glyphosates).

Bayer applealing

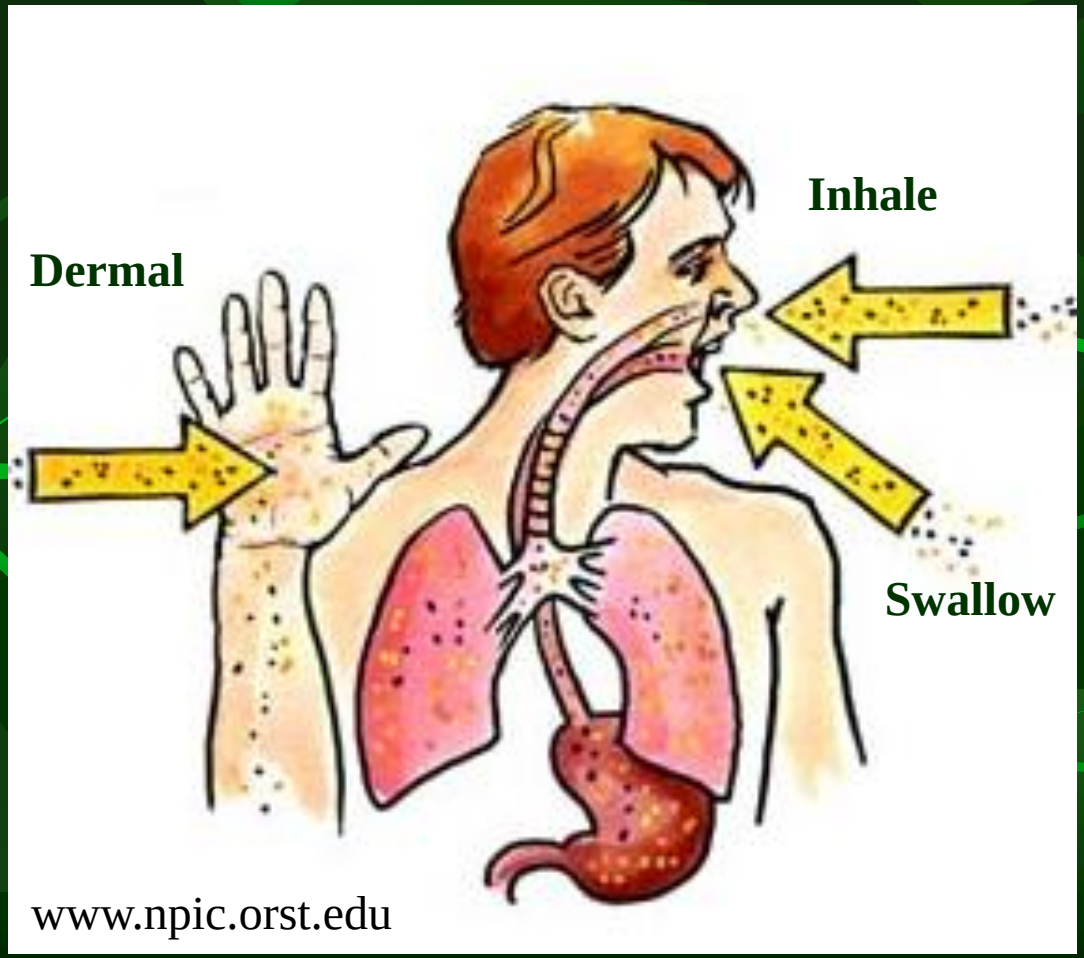
Glyphosate Exposure

Ag.PPE

Coveralls
Waterproof gloves
Shoes plus socks

PPE

Long-sleeved shirt and pants
Shoes plus socks

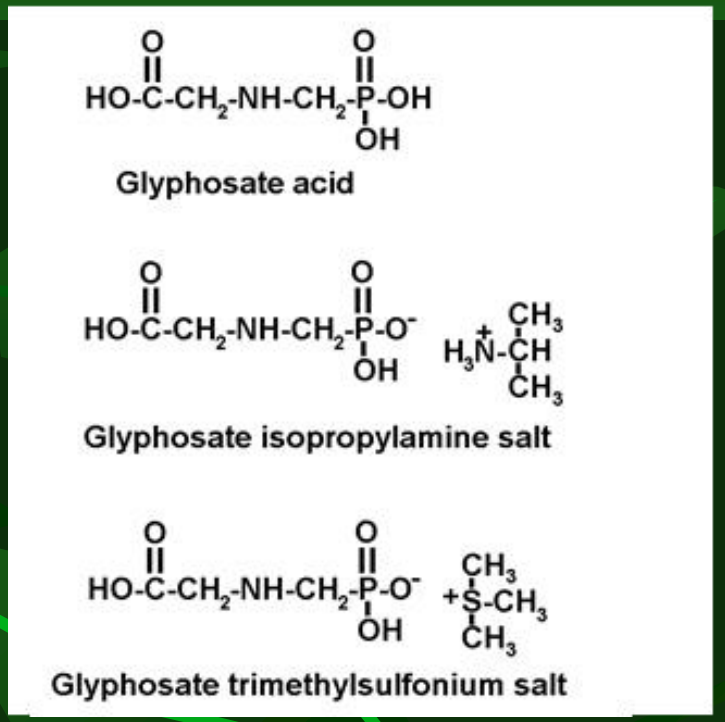


REI

Do not enter or allow worker entry into treated areas restricted-entry interval (REI) of 4-12 hours.

Form acid/salt = does matter

- Pure glyphosate:
- Acid $C_3H_8N_2O_5P$
- IPA salt $C_6H_{17}N_2O_5P$*
- TMS salt $C_6H_{16}N_2O_5PS$



- Acid= most soluble of three -- all low solubility
- All more soluble in acidic conditions
- When stated in literature – acid form

*Most common

Form – makes a difference

- Can be applied **Pure** in 3 forms but not common.
- Absorption of acid through cuticle = moderate
- IPA salt less soluble than acid
- TMS salt least soluble

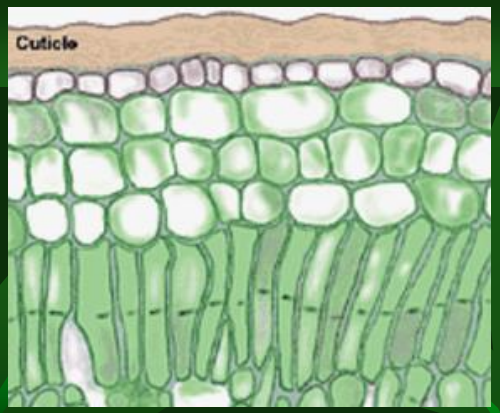
- High ⟶ Acid ⟶ IPA ⟶ TMS **Low**

Never high

Pure TMS salt absorbs water from air thus 70% aqueous solution = technical grade

Form makes a difference

- TMS salt greater toxicity to animals
- TMS salt greater injury to Roundup Ready now using
- Other forms applied = monoammonium salt, diammonium salt, potassium salt and sodium salt – because certain salts antagonize glyphosate activity
- Most literature indicates salt form of no consequence????

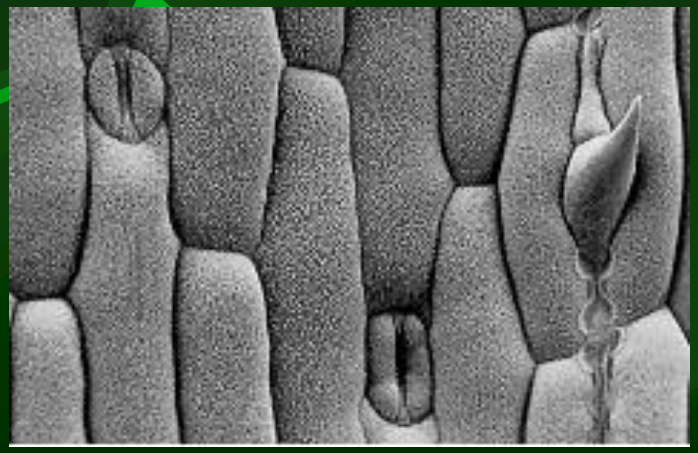


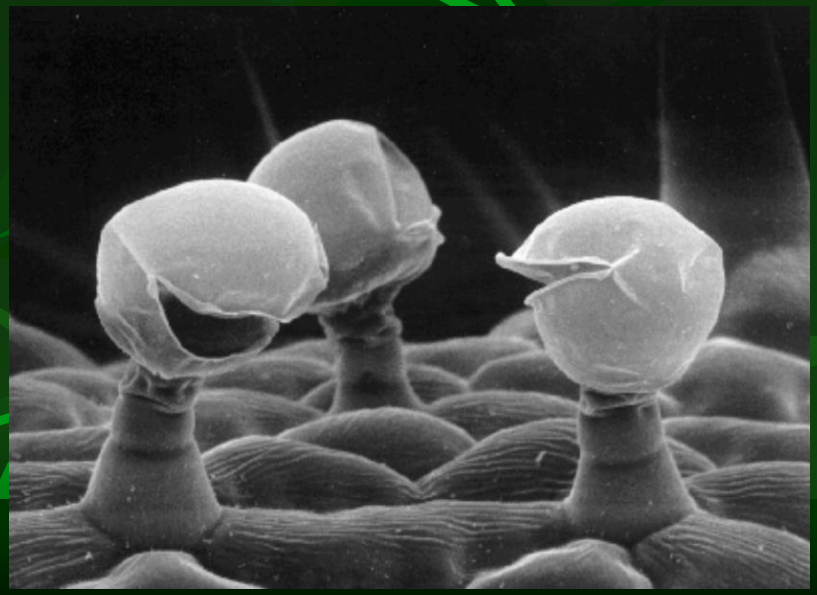
#8 Formulation doesn't make a difference

Glyphosate without adjuvants – poor ability to through cuticle, hairs, wax, etc.

Inert ingredients – EPA Exempt

Not required to be listed on the label





Formulation makes a difference

- Monsanto = Bayer
- Largest Manufacturer of Glyphosate based products
- Their most common = polyethoxylated tallow amine (POEA) = surfactant
- Helps with penetration into plants

Formulation makes a difference

- Pure glyphosate is low in toxicity to fish and wildlife, but some products containing glyphosate may be toxic because of the other ingredients in them.
- Roundup due to the presence of surfactants, including POEA, modify the toxicity of the formulation, independently from glyphosate (Webster and Santos. 2015. BMC Genomics. 16:32-46)

#9 Inert Ingredients – Not Inert

The EFSA
– “acknowledged that some of the **co-formulants** added to glyphosate (noting POEA in particular) appear to have toxic effects **higher than the glyphosate itself!!**

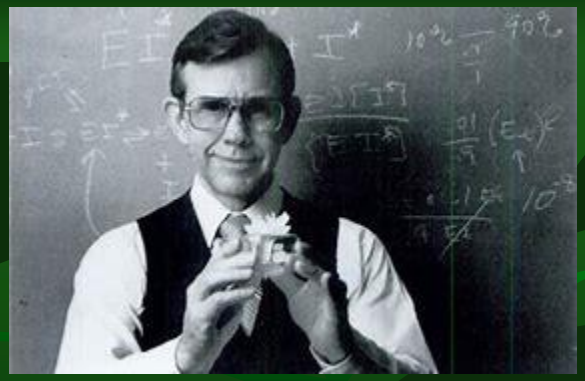
Aquatic vs Terrestrial

- Ex. Rodeo
- Can use aquatics on land – actually labeled forestry, campgrounds, parks
- Cannot use terrestrials around water
- "Safe to use around fresh or brackish water including ponds, lakes, seeps, irrigation and drainage ditches, canals, and reservoirs (do not apply within 1/2 mile of potable water intake)."

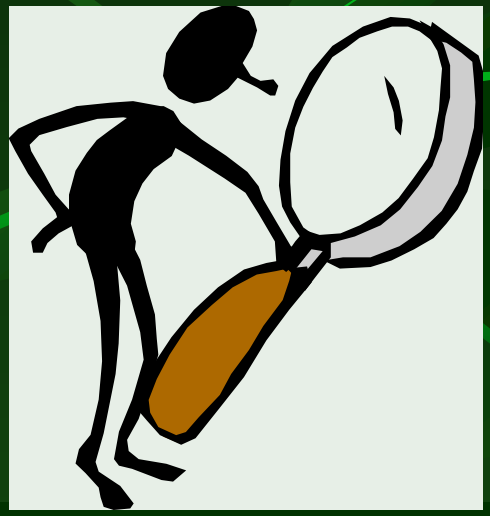
Recommend

- Most aquatic formulation do not include surfactant
- GlyphoMater41 and Shore-Klear do have surfactant
- GlyPro, Rodeo, AquaPRO, Acord Concentrate,
- =Shore-Klear = no surfactant, IPA salt
- Refuge = No surfactant and P salt

History



- Glyphosate discovered by Dr. Henri Martin, 1950 – he was a Swiss chemist in a pharmaceutical co.
- Molecule sold – analyzed & tested for possible uses
- John Franz of Monsanto Co. identified herbicidal properties in 1970
- Federal Environmental Pesticide Control Act in 10/1972 (FEPCA-1972)
- Formulated and sold by Monsanto in 1974



History

- 1985 to 1996, Monsanto reduced price of Roundup by 50%
- 1990 to 1996 sales increased by 20%/ yr.
- Now 2019: > 750 products sold in US. Containing glyphosate (National Pesticide Information Center) (http://npic.orst.edu/factsheets/glyphogen.html)
- 160 countries
- >40 companies

History

- US patent expired in 2000
- In 2014, EPA approved Enlist Duo, by Dow Agro Sciences = 2,4-D plus glyphosate
- In 2015, EPA sought to reverse approval
- In 2016, 9th Circuit Court rejected EPA's petition

Take Home

- Long residual product in soil - Yes
- Long carry over product in the plant - Yes
- All forms of glyphosate are not the same
- Not all formulations are the same
- Should the label better warn re protection – Yes
- Should limit use – Yes
- Should non-Inert products be Labelled - Yes
- Should glyphosate be a RUP – Yes