Impact of Glyphosate and GMOs on Soil, Crop, and Animal Health: Failed Promises: Flawed Science

Parliamentary Library Discussion

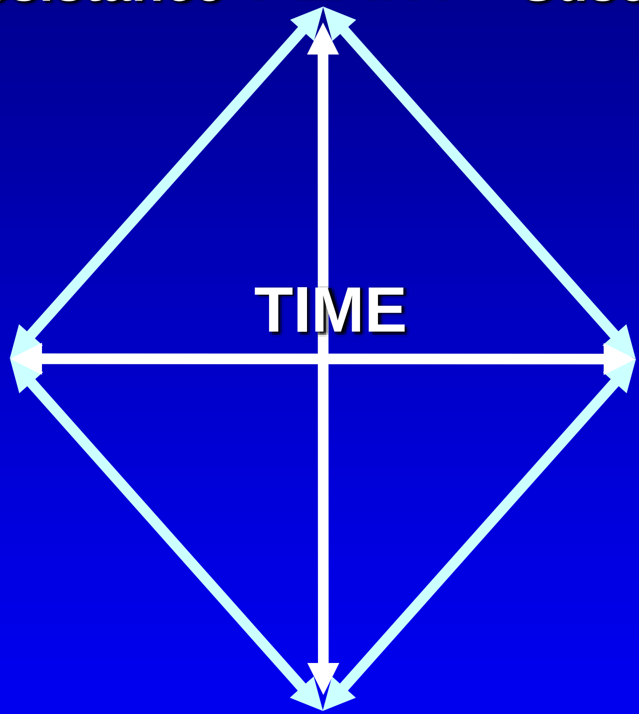
Wellington, New Zealand - February 12, 2015

Don M. Huber, Professor Emeritus, Purdue University

Interacting Factors Determining Nutrient Availability & Disease Severity

Vigor, Stage of Growth, Root Exudates

Resistance **PLANT** Susceptibility



PATHOGEN

Population
Virulence
Activity

ABIOTIC ENVIRONMENT

Nutrients
Moisture
Temperature
pH (redox potential)
Density, gases
Ag Chemicals

BIOTIC ENVIRONMENT

Antagonists, Synergists
Oxidizers, Reducers
Competitors, Mineralizers
[Co, Cu, Fe, K, Mn, N, Ni, S, Zn]

Nutrients are:

Components of plant parts as well as

Activators,

Inhibitors,

and Regulators

of Physiological Processes

Many herbicides and pesticides are chelators

Two Factors to Understand

1. **Impact of the genetic change**

2. **Impact of the Chemical in the plant**

   A. **Herbicide containing**

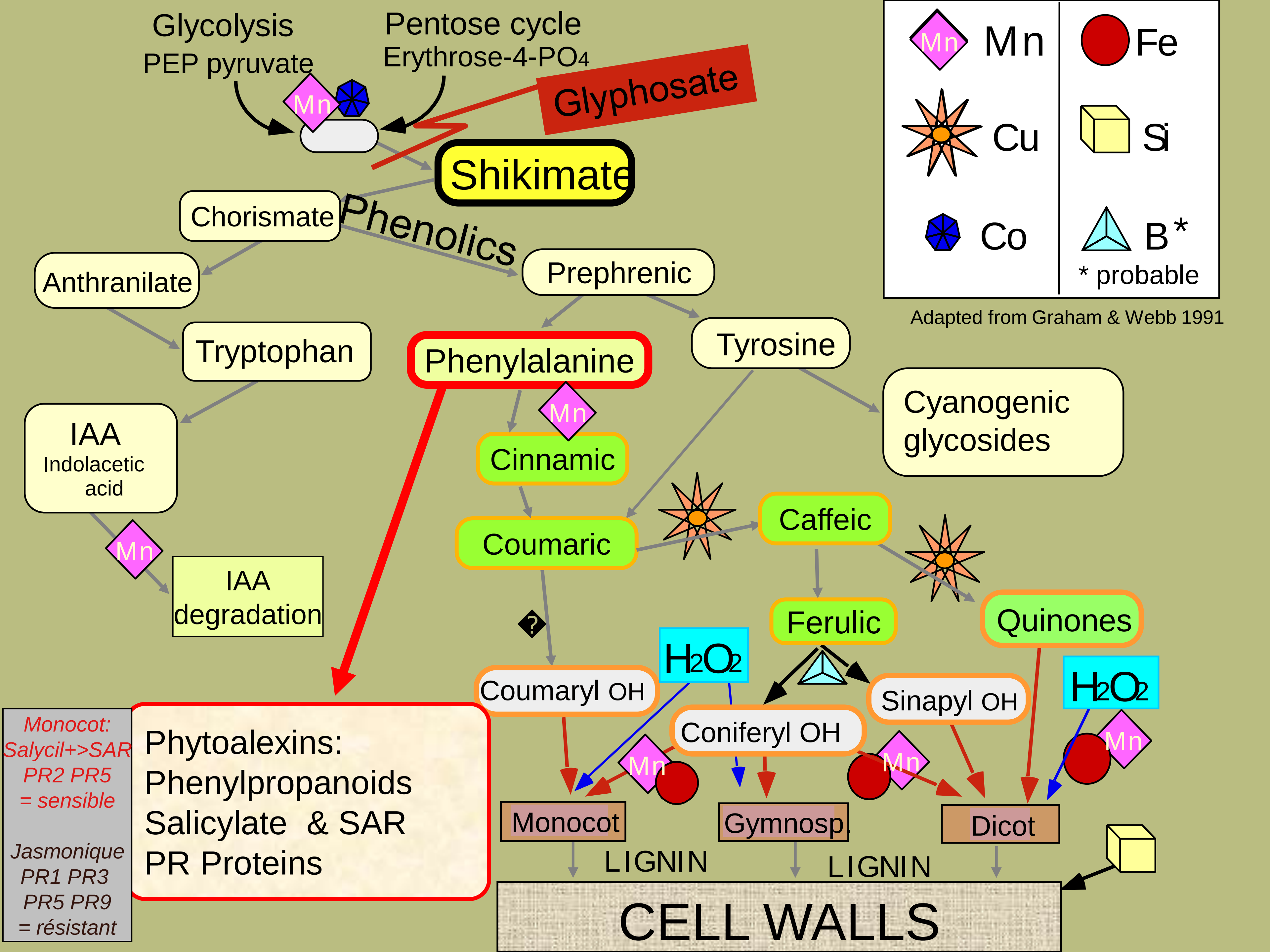
   B. **Insecticide producing**

   C. **Other products produced**

Some Activities of Glyphosate

Some of the 291 Enzymes Glyphosate Down Regulates

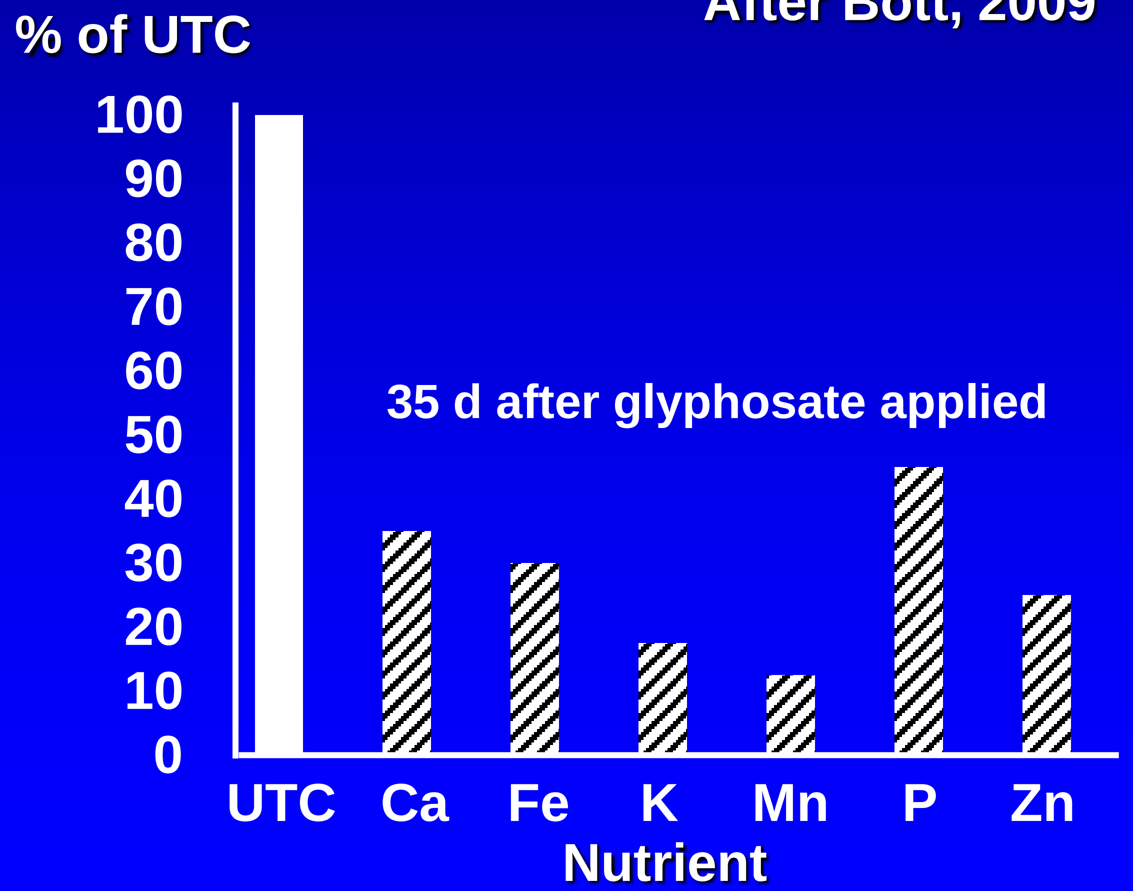
Enzyme	-Fold change
Taurine ATP-bindingsystem	11.07
Glutamate synthase	6.06
Aminomethyl transferase	5.58
Tyrosine aminotransferase	4.36
Thioredoxin reductase	4.20
NADH dehydroenase	4.04
Riboflavin synthase	3.57
3-phosphoadenosine-5-phosphosulfte reductase	3.75
Membrane bound ATP synthase	3.67
Acetolactate synthase	3.59
Pyridine nucleotide transhydrogenase	3.50
Shikimate kinase	3.36
3-deoxy-D-arabino-heptulosonate-7-phosphatase	3.38
Sulfite reductase	3.19
RNAase	3.18
Glutathione S-transferase	3.04
D-amino acid dehydrogenase	3.00
Glucose-6-phosphate dehydrogenase	2.67
ATP sulfurulase	2.65
5-enolpyruvylshikimate-3-phosphate synthetase (EPSPS)	2.62

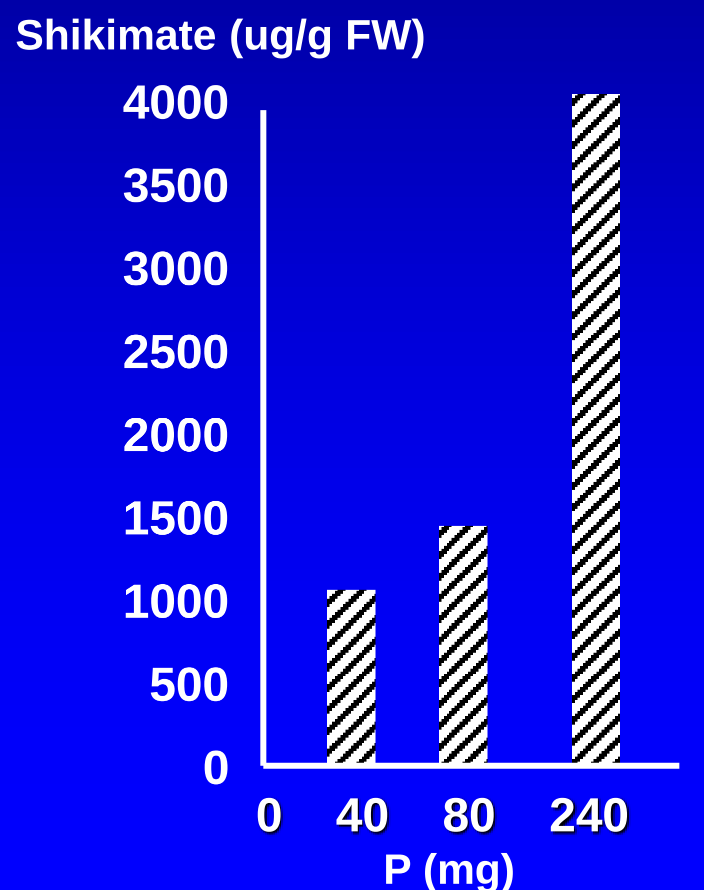


Glycolysis
PEP pyruvate
Pentose cycle
Erythrose-4-PO4
Glyphosate
Shikimate
Chorismate
Phenolics
Anthranilate
Prephrenic
Tryptophan
Phenylalanine
Tyrosine
IAA
Indolacetic acid
Cyanogenic glycosides
Cinnamic
Coumaric
Caffeic
IAA degradation
Ferulic
Quinones
Coumaryl OH
H2O2
Sinapyl OH
Coniferyl OH
H2O2
Monocot: Salycil+>SAR PR2 PR5 = sensible
Jasmonique PR1 PR3 PR5 PR9 = résistant
Phytoalexins:
Phenylpropanoids
Salicylate & SAR
PR Proteins
Monocot
Gymnosp.
Dicot
LIGNIN
LIGNIN
CELL WALLS
Mn
Fe
Cu
Si
Co
B *
* probable
Adapted from Graham & Webb 1991

Effect of Phosphorus Desorption/Remobilization of Glyphosate in Soil on Nutrient Content

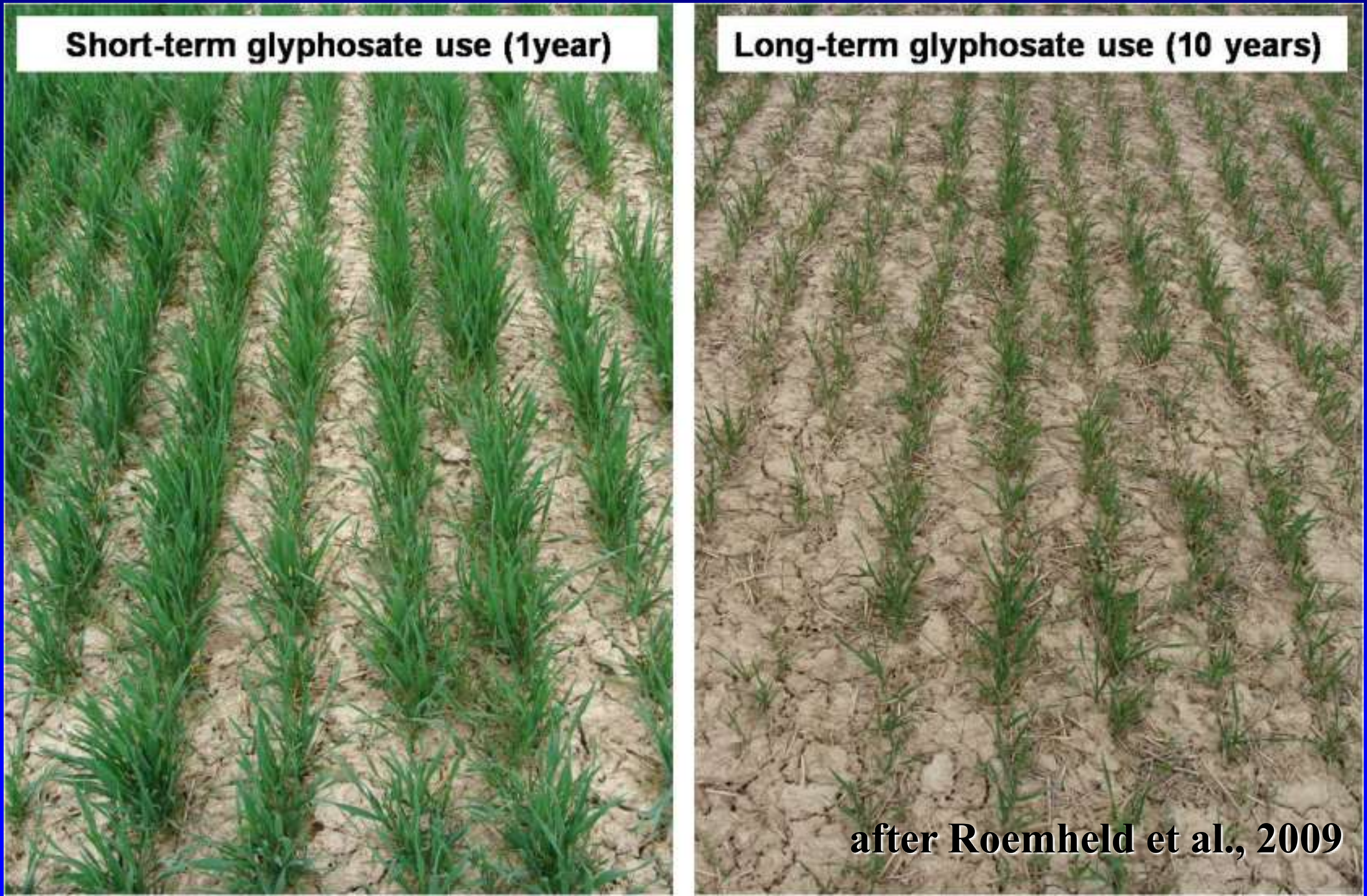
After Bott, 2009





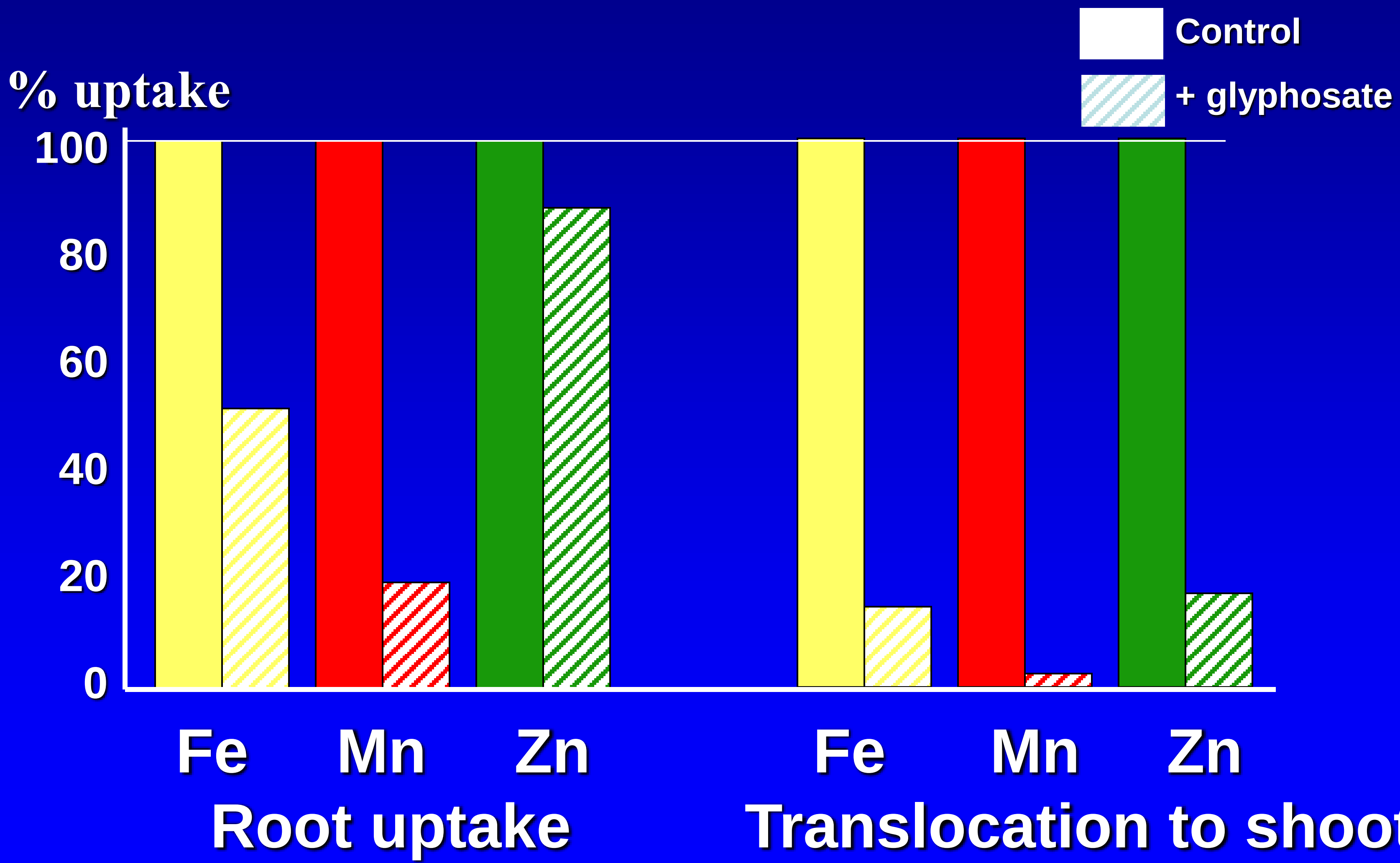
Long-term Effect of Glyphosate

Negative side-effects of long-term glyphosate use, 2008 & 2009



Effect of Residual or ’drift’ Glyphosate on % Nutrient Uptake and Translocation by Plants

After Eker et al 2006*



* 1/40th of recommended herbicidal rate = 11 g/a = < 1/2 oz/a

Foliar application of glyphosate

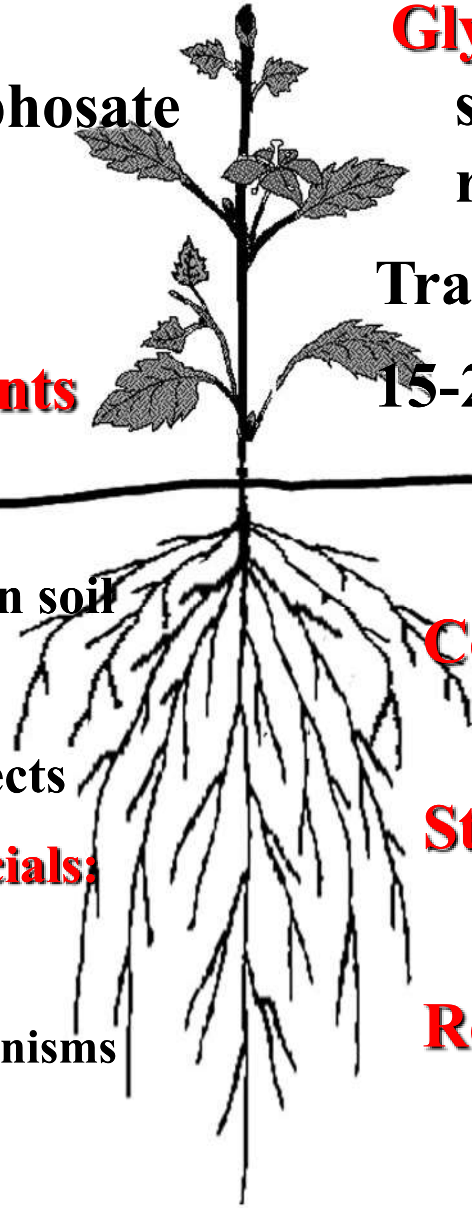
Systemic movement
throughout the plant

Chelation of micronutrients

Glyphosate accumulates in
shoot, root and
reproductive tissues

Translocated to roots

15-20% released into soil



Glyphosate can accumulate in soil
(slow to little degradation)

Residual soil and residue effects

Glyphosate is toxic to beneficials:
- N-fixing microbes
- Mycorrhizae
- Biological control organisms
- Earthworms
- PGPR organisms

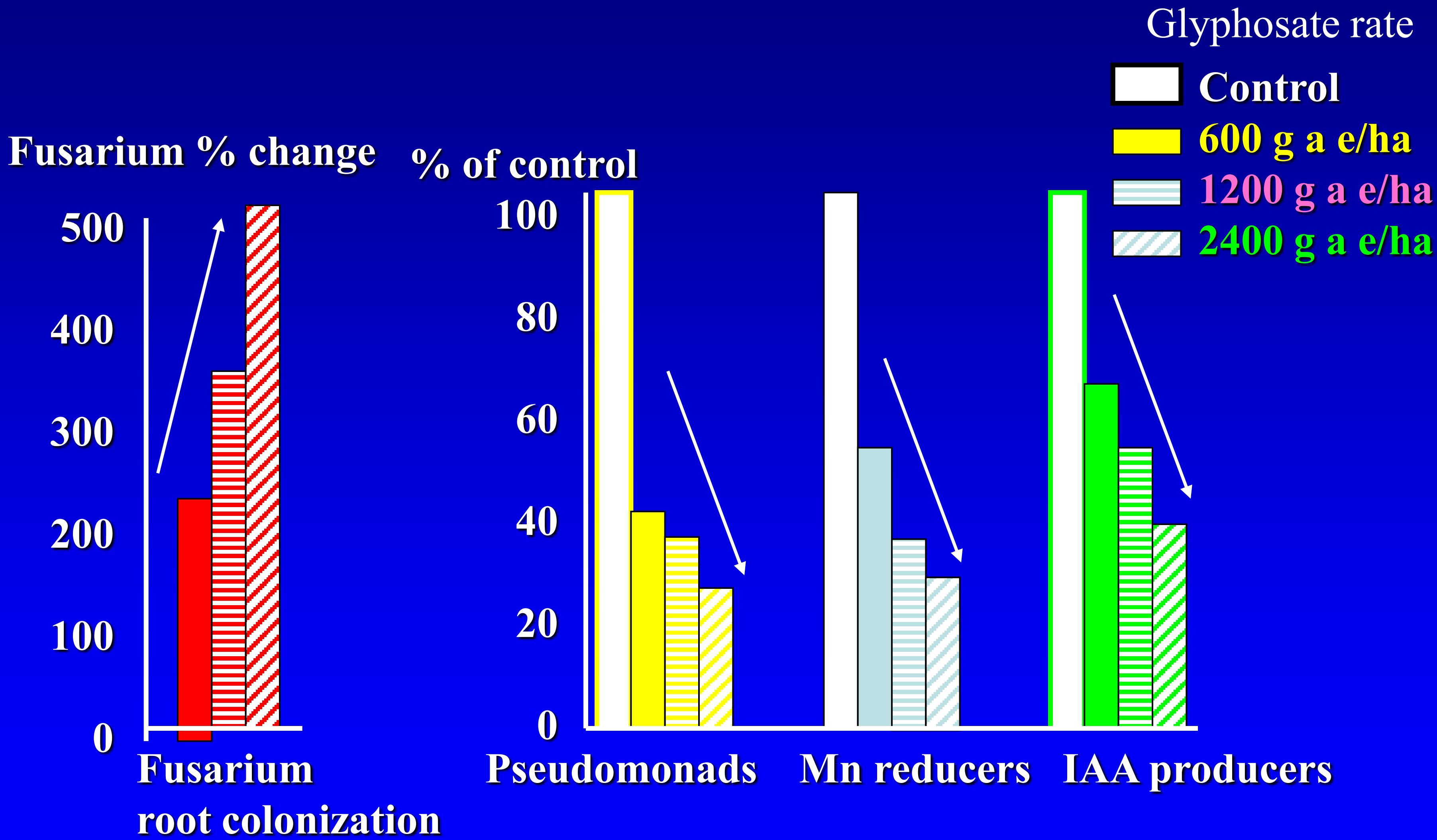
Compromises plant
disease resistance

Stimulates soilborne
diseases

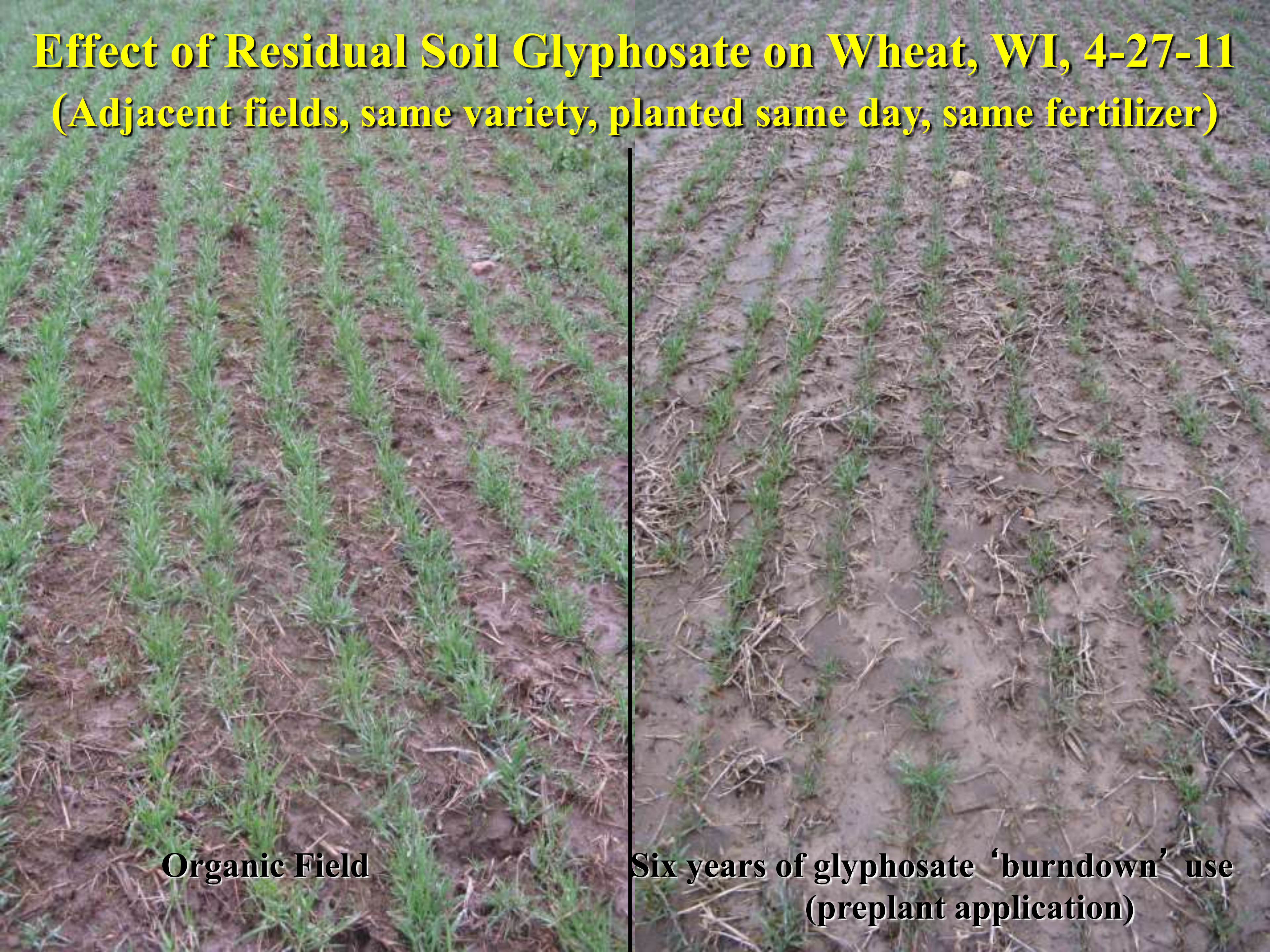
Reduces nutrient uptake

Schematic of glyphosate interactions in soil

Microbiocidal Activity of Glyphosate

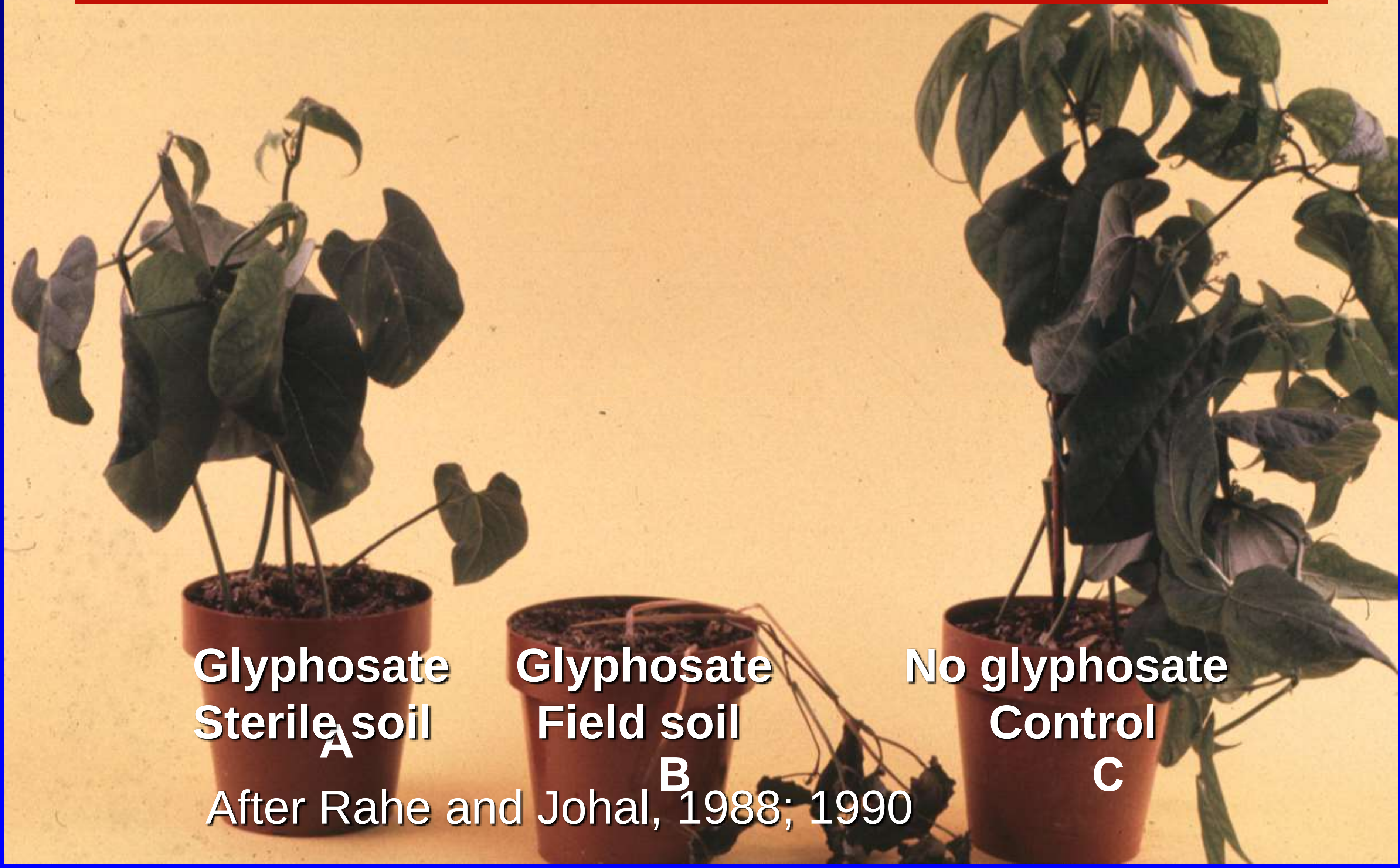


After Zobiole et al., 2010


Effect of Residual Soil Glyphosate on Wheat, WI, 4-27-11
(Adjacent fields, same variety, planted same day, same fertilizer)
Organic Field
Six years of glyphosate ‘burndown’ use
(preplant application)

Herbicide action is by soil-borne fungal pathogens

Glyphosate Increases Disease Susceptibility



Some Diseases Increased by Glyphosate

Host plant	Disease	Pathogen
Apple	Canker	*Botryosphaeria dothidea*
Banana	Panama	*Fusarium oxysporum* f.sp. *cubense*
Barley	Root rot	*Magnaporthe grisea*
Beans	Root rot	*Fusarium solani* f.sp. *phaseoli*
Bean	Damping off	*Pythium* spp.
Bean	Root rot	*Thielaviopsis bassicola*
Canola	Crown rot	*Fusarium* spp.
Canola	Wilt	*Fusarium oxysporum*
Citrus	CVC	*Xylella fastidiosa*
Corn	Root and Ear rots	*Fusarium* spp.
Cotton	Damping off	*Pythium* spp.
Cotton	Bunchy top	Manganese deficiency
Cotton	Wilt	*F. oxysporum* f.sp. *vasinfectum*
Grape	Black goo	*Phaeomoniella chlamydospora*
Melon	Root rot	*Monosporascus cannonbalus*
Soybeans	Root rot, Target spot	*Corynespora cassicola*
Soybeans	White mold	*Sclerotina sclerotiorium*
Soybeans	SDS	*Fusarium solani* f.sp. *glycines*
Sugar beet	Rots, Damping off	*Rhizoctonia and* Fusarium
Sugarcane	Decline	*Marasmius* spp.
Tomato	Wilt (New)	*Fusarium oxysporum* f.sp. *pisi*
Various	Canker	*Phytophthora* spp.
Weeds	Biocontrol	*Myrothecium verucaria*
Wheat	Bare patch	*Rhizoctonia solani*
Wheat	Glume blotch	*Septoria* spp.
Wheat	Root rot	*Fusarium* spp.
Wheat	Head scab	*Fusarium graminearum*
Wheat	Take-all	*Gaeumannomyces graminis*


Fusarium scab


Take-all root rot


Control
Inoculated
Inoculated
+ glyphosate
Corynespora Root Rot of Soybean


Goss' Wilt of Corn
Non-glyphosate
Non-GMO
GMO+glyphosate


Take-all of Wheat
Glyphosate
No glyphosate


Sudden Death Syndrome
Non-glyphosate
Glyphosate

Factors Predisposing to Fusarium Head Scab

(*Fusarium* spp.; *Gibberella zeae*)

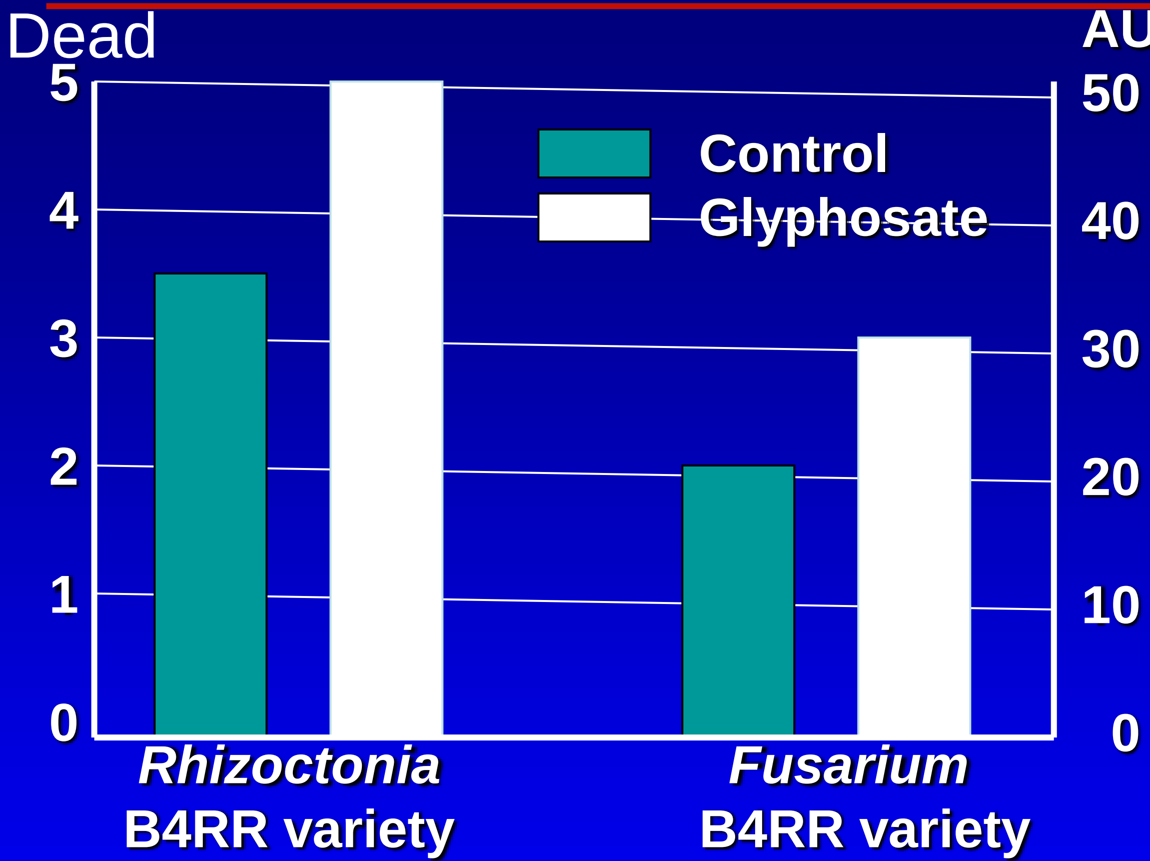
- ✓ ***Environment*** **was the most important factor in FHB development in eastern Saskatchewan, from 1999 to 2002**
- ✓ ***Application of glyphosate formulations*** **was the most important agronomic factor associated with higher FHB levels in spring wheat**
- ✓ **Positive association of glyphosate with FHB was *not affected by environmental conditions* as much as that of other agronomic factors…**

Number of glyphosate applications the previous three years	% Increase in head scab
None	00
1 to 2	152 ***
3 to 6	295 ***

(Fernandez et al. 2005, *Crop Sci. 45: 1908-1916*)

(Fernandez et al., 2007, Crop Sci. 47:1574-1584)

Impact of Glyphosate on Sugar Beet



"Precautions need to be taken when certain soil-borne diseases are present if weed management for sugar beet is to include post-emergence glyphosate treatments."

Larson et al., 2006

Poor Boll Retention, Sterile Locules in RR Cotton. WHY?

Disruption of Plant Hormones by Glyphosate*

	Hormone			
Treatment	Indole acetic acid	Gibberellic acid	Cytokinin	Abscisic acid
Untreated	100 %	100 %	100 %	100 %
Roundup®	4 %	32 %	20 %	183 %
MegaGro**	497 %	103 %	250 %	60 %
RU+MegaGro	47 %	50 %	53 %	112 %

*Research by LT Biosyn., Riverwoods, IL

**Natural plant growth stimulant

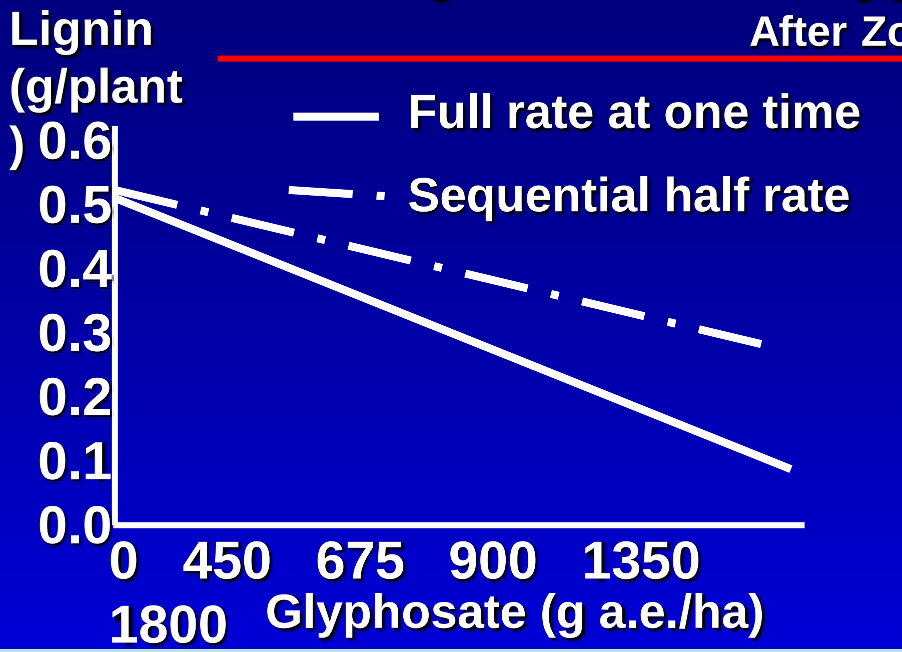
Genetic Engineering for Glyphosate Tolerance

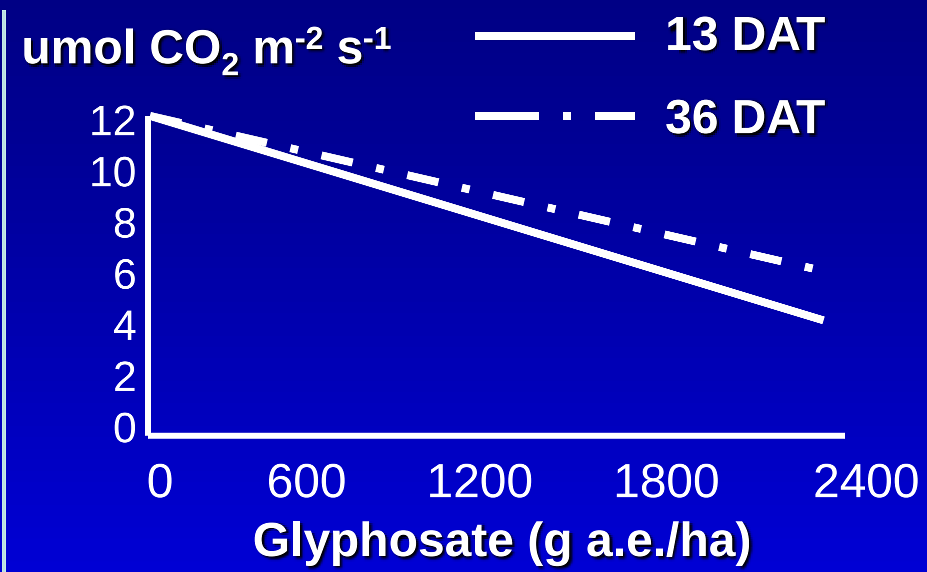
“Roundup Ready® Genes”

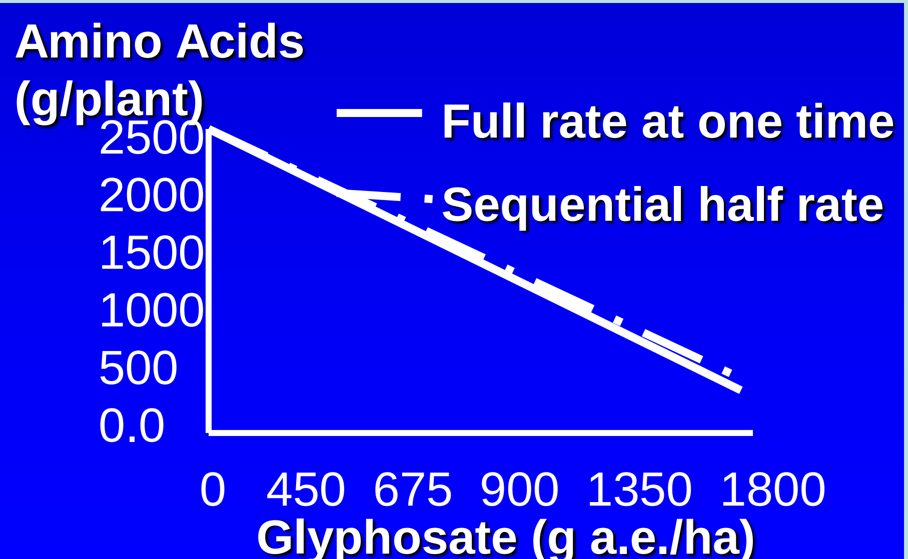
- The technology inserts alternative EPSPS genes (not blocked by glyphosate in *mature* tissue
- More like a virus infection than plant breeding!
- Nothing in the RR plant affects the glyphosate applied to the plant! - Reduces nutrient uptake and function
- Causes a “Yield Drag”
- Glyphosate is there for the life of the plant
- Inserted “genes” are promiscuous
- Fossil Science: Flawed Theology

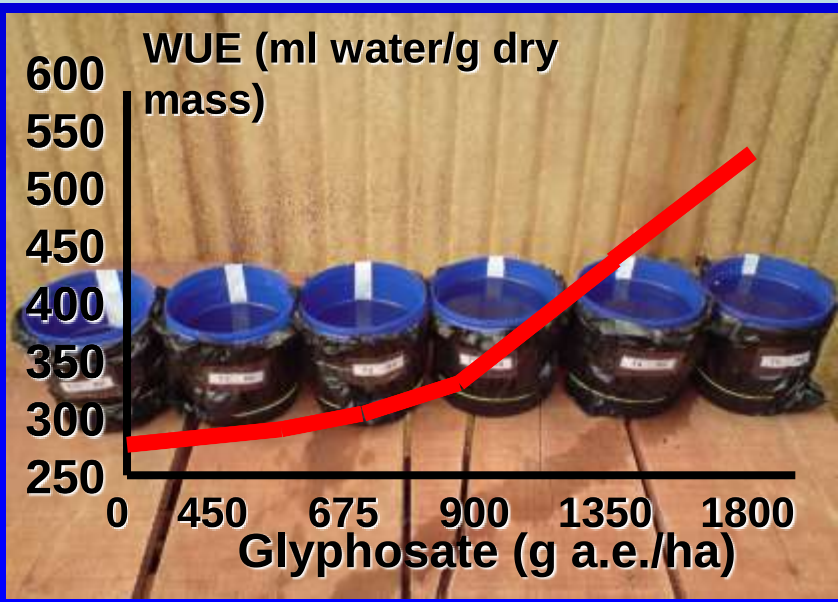
Effect of Glyphosate on Lignin, AA, Water Use Efficiency, and Photosynthesis of Glyphosate-Resistant Soybeans

After Zobiole, 2009

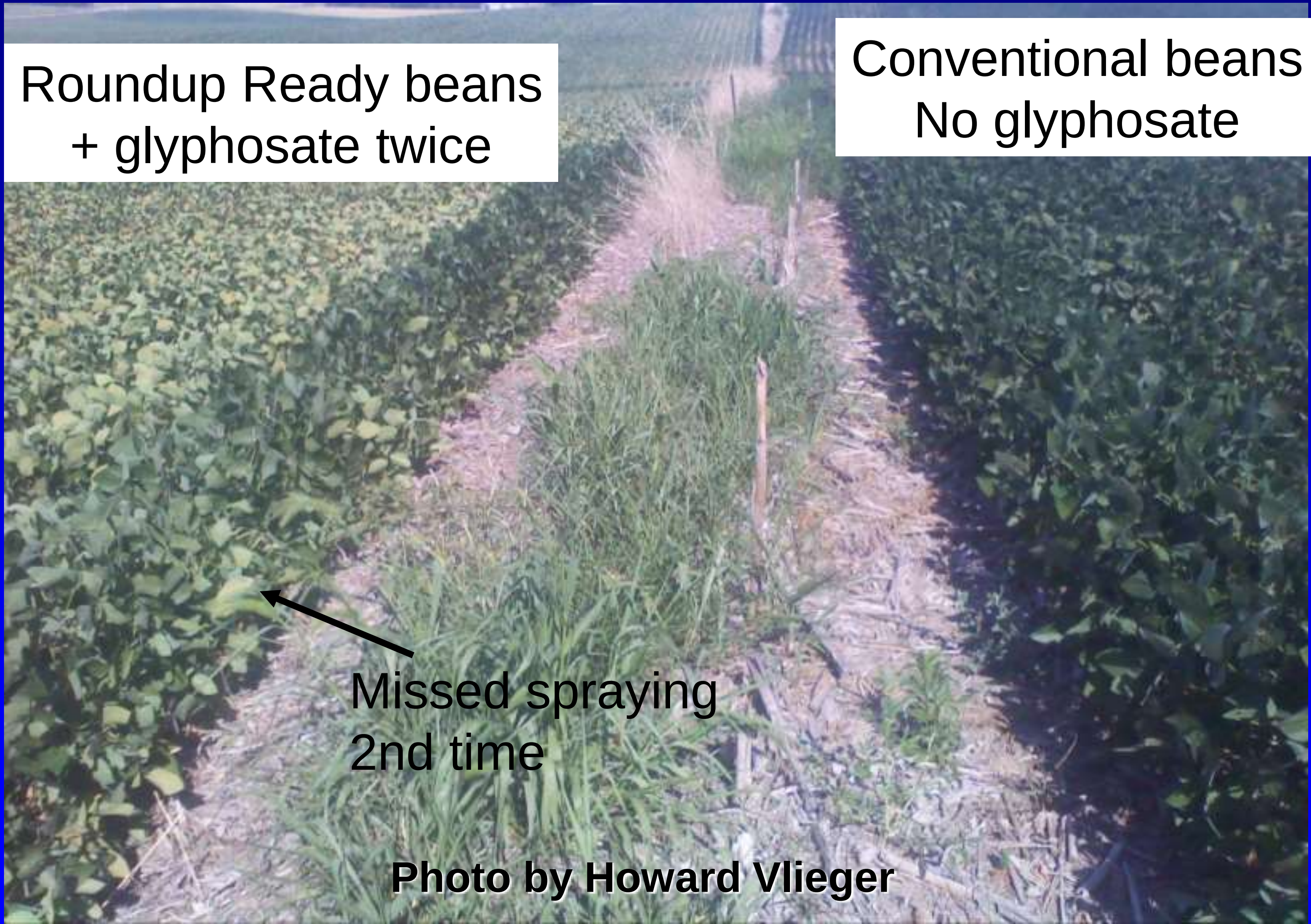








Does Genetic Engineering Make a Difference? NE Nebraska, 2012 - Severe Drought



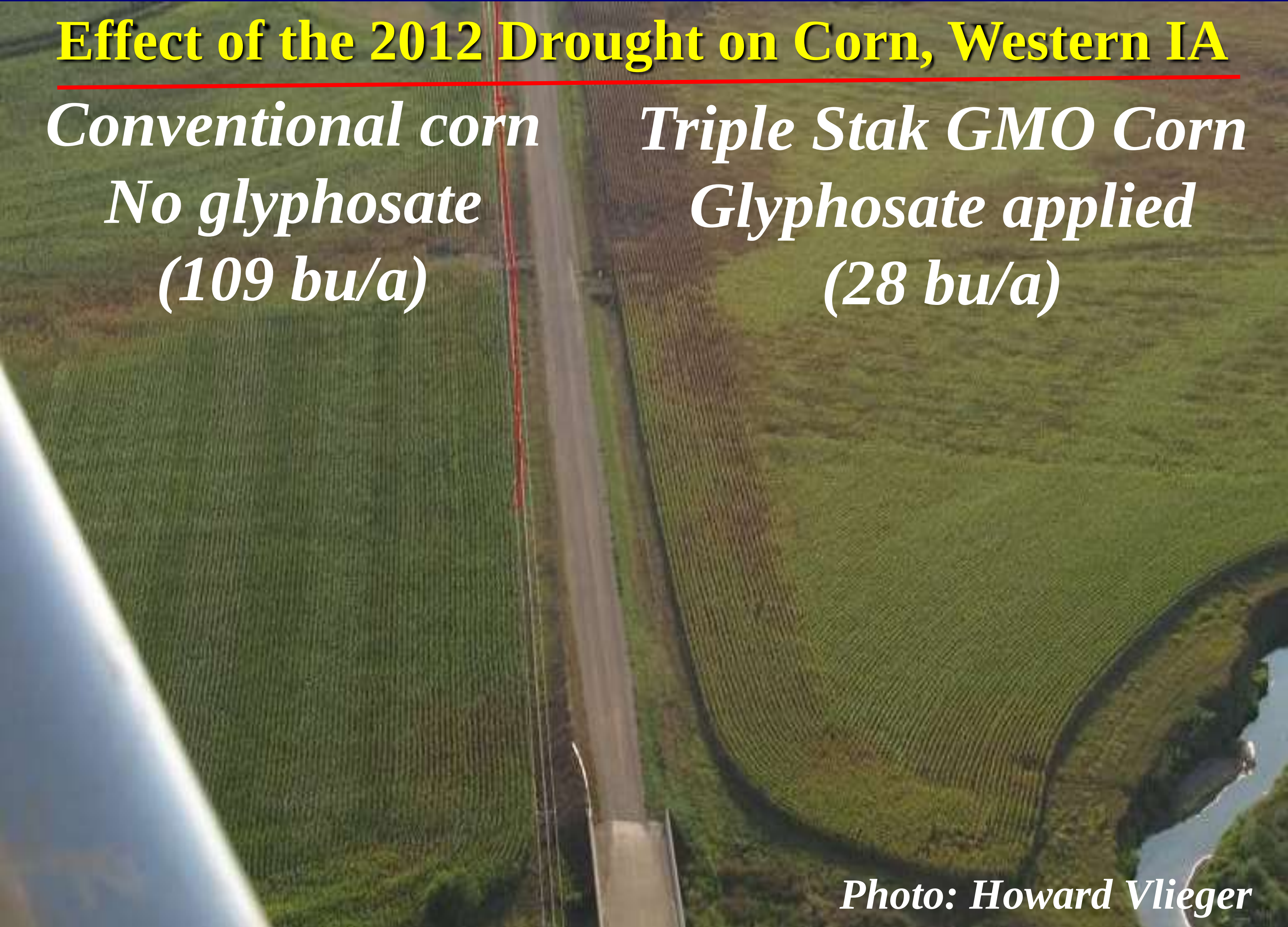
Does Genetic Engineering Make a Difference? Maurice, Iowa, 2012 - Severe Drought

(these two fields have a gravel road between them)

Triple Stak GMO Corn
+ Glyphosate herbicide

Normal, Non-GMO Corn
No glyphosate herbicide

Effect of the 2012 Drought on Corn, Western IA



Reduced Nutrient Efficiency of Isogenic RR Soybeans (After Zobiole, 2008)

Tissue:	Mn	Zn
Isoline	%	%
Normal	100	100
Roundup Ready®	83	53
RR + glyphosate	76	45

Copper, iron, and other essential nutrients Were also lower in the RR isoline and reduced further by glyphosate!

After Zobiole et al., 2009

% Mineral Reduction in Roundup Ready® Soybeans Treated with Glyphosate

Plant tissue	Ca	Mg	Fe	Mn	Zn	Cu
Young leaves	40	28	7	29	NS	NS
Mature leaves	30	34	18	48	30	27
Mature grain	26	13	49	45		

Reduced:

Yield	26%
Biomass	24%

After Cakmak et al, 2009

% Reduced Nutrient Density in RR versus Non-RR*

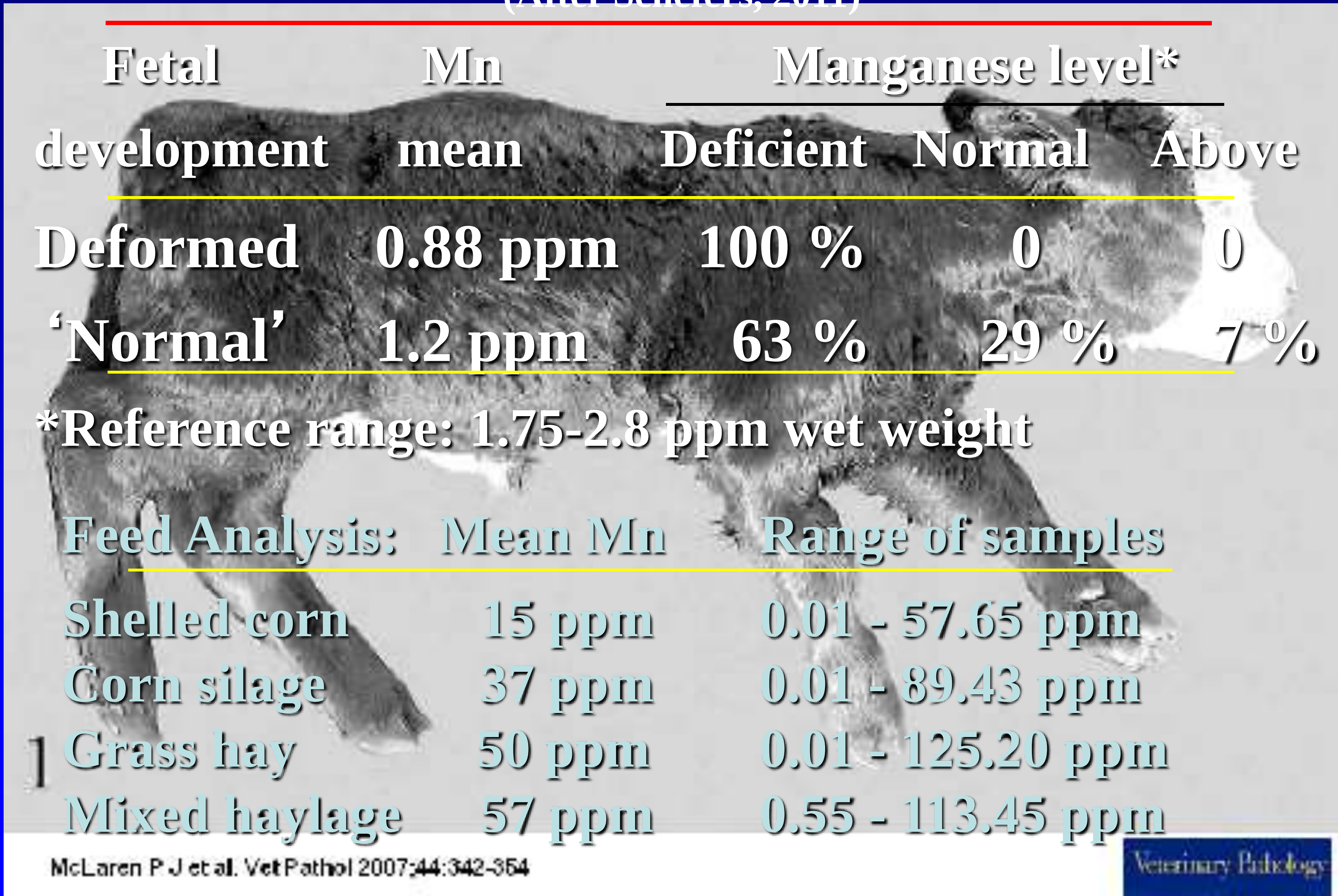
Nutrient	Alfalfa	Soy Beans**
Nitrogen	13 %	40 %
Phosphorus	15 %	------
Potassium	46 %	16 %
Calcium	17 %	26 %
Magnesium	26 %	30 %
Sulfur	52 %	------
Boron	18 %	------
Copper	20 %	27 %
Iron	49 %	18 %
Manganese	31 %	48 %
Zinc	18 %	30 %

*Third year, alfalfa, second cutting analysis; Glyphosate applied one time in the previous year

**Mature leaf

Manganese Sufficiency in Bovine Fetus Livers

(After Schefers, 2011)

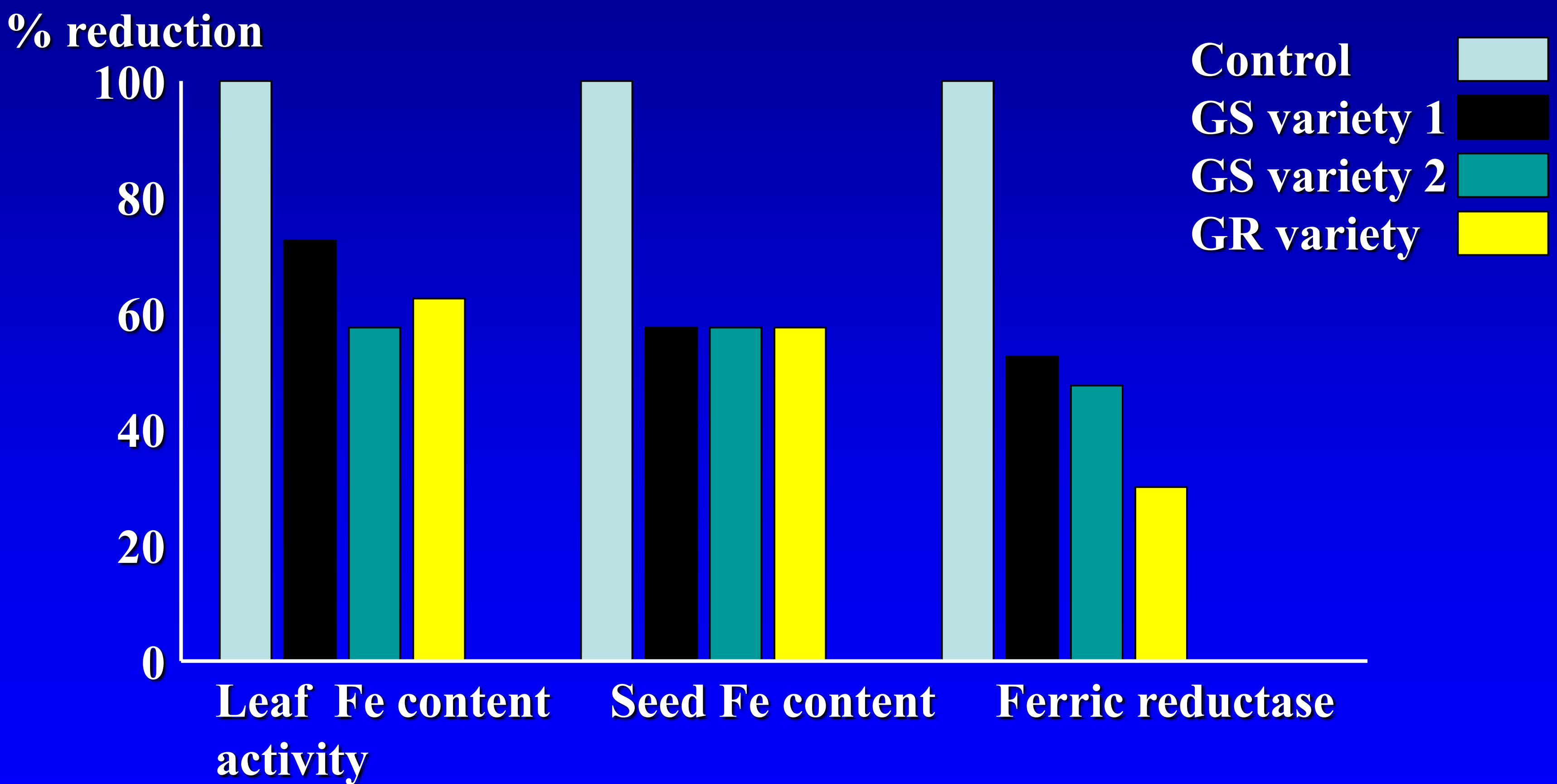


Fetal development	Mn mean	Manganese level*: Deficient	Normal	Above
Deformed	0.88 ppm	100 %	0	0
'Normal'	1.2 ppm	63 %	29 %	7 %

*Reference range: 1.75-2.8 ppm wet weight

Feed Analysis:	Mean Mn	Range of samples
Shelled corn	15 ppm	0.01 - 57.65 ppm
Corn silage	37 ppm	0.01 - 89.43 ppm
Grass hay	50 ppm	0.01 - 125.20 ppm
Mixed haylage	57 ppm	0.55 - 113.45 ppm

Effect of Glyphosate Drift* on Soybean Leaf, and Seed Iron and Ferric Reductase Activity



***Drift rate = 12.5 % of herbicide rate**

After Bellaloui et al, 2009

Special Considerations in Fertilizing RR Crops

Two factors: 1) Chemical; 2) gene

1. Providing nutrient availability for yield and quality

Compensate for reduced plant efficiency
Compensate for reduced soil availability
[Timing and formulation are important]

2. Detoxifying residual glyphosate

In meristematic root, stem, flower tissues, etc.
In soil [Ca, Co, Cu, Mg, Mn, Ni, Zn]

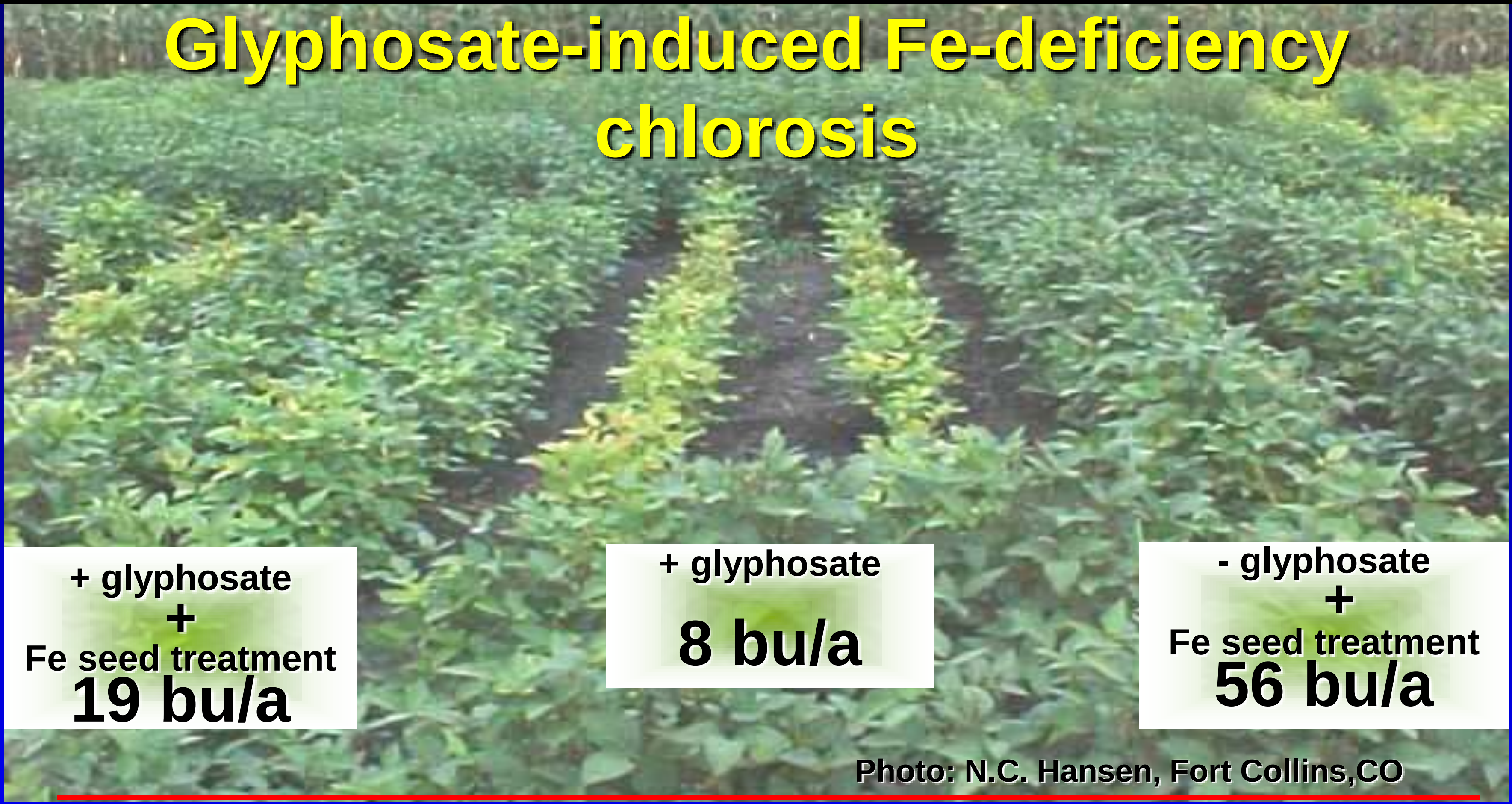
3. Restoring soil microbial activity

Nutrient related (N-fixation, Fe, Mn, Ni, S, Zn, etc.)
Disease control related (nutrition, pathogen antagonists, etc.)
Biological amendment (N-fixers, PGPRs, etc.)

4. Judicious use of glyphosate

Interaction of seed-applied Fe and glyphosate application on Fe deficiency chlorosis in soybeans; Wisconsin, USA

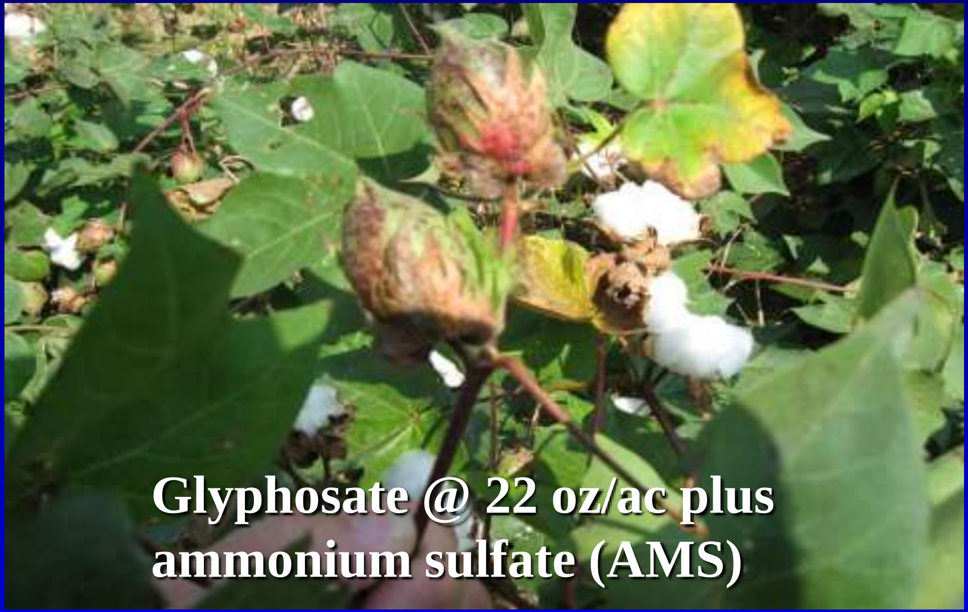
Glyphosate-induced Fe-deficiency chlorosis



	Visual chlorosis score [1 = green; 5 = yellow]		Grain yield (bu/a)	
Treatment	- Fe	+ Fe	- Fe	+ Fe
Control (no herbicide)	3.1	2.8	33	56
Glyphosate	3.7	3.3	8	19

Jolley et al., 2004, Soil Sci. and Plant Nutrition 50:973-981

Glyphosate & Manganese Effects on Cotton



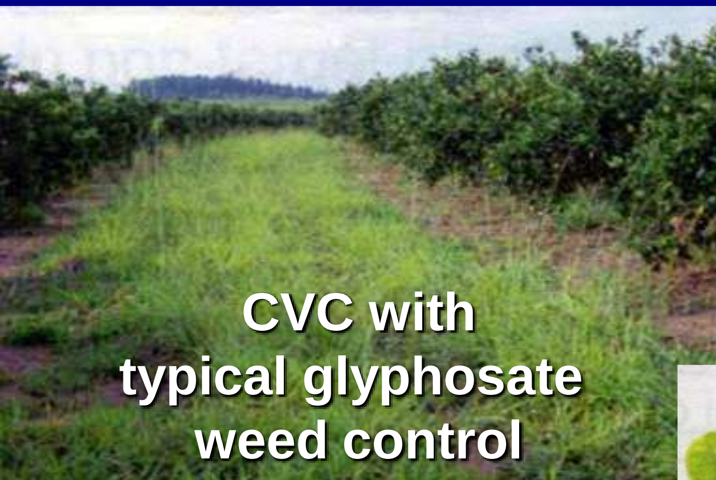
Effect of glyphosate and Manganese on Cotton Yield (Texas)

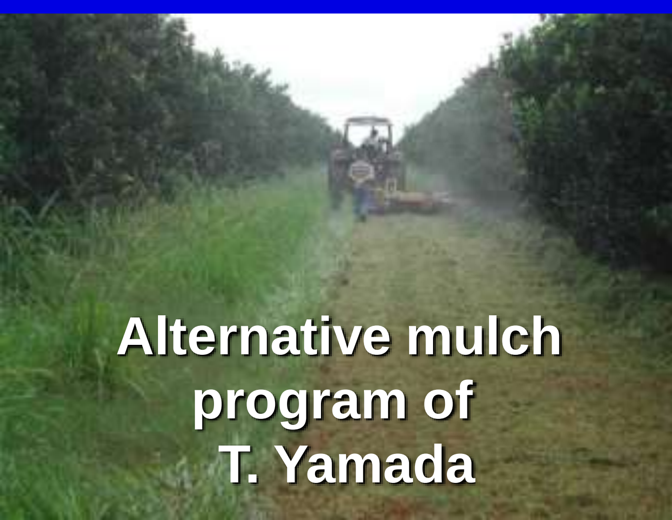
Treatment	% chlorotic plants	# seed cotton
Conventional herbicide	5	4885
Glyphosate	97	2237
Glyphosate + Mn	2	4693

after Ronnie Phillips, 2009

Citrus Variegated Chlorosis

Predisposition to CVC (*Xylella fastidiosa*) by glyphosate





Glyphosate Resistant Weeds Affect Bee Health & Honey Quality

Food and Feed Safety Concerns

- **Nutrient deficiency**
  - Co, Cu, Fe, Mg, Mn, Zn
- **Increased levels of toxic products**
  - Mycotoxins [Fusarium toxins (DON, NIV, ZEA), aflatoxins]
  - Allergenic proteins and metabolic toxins
- **Premature ageing, reproductive failure**
- **Ecological disruption**
  - bees, amphibians, plant diversity, etc.
- **Gene flow** - weeds, soil microbes, intestinal microbes
- **Direct toxicity of glyphosate**
  - Cell death, immune failure, disease resistance
  - Endocrine system, infertility, birth defects, teratogenicity

Erosion of Pig Stomachs, Intestines with GMO Soybean/Corn Feed, Iowa

Carman, Vlieger, 2011, 2013

Normal color

Inflamed, irritated

Mice (below) and Squirels (top) Ignore GMO Corn

Isogenic Triple Stax (GMO) corn ears

Isogenic normal corn ears

Photos: Gilbert Hostetler and Howard Vlieger

U.S. Cattlemen's Association Statement to Congress

"Cattle ranchers are facing some puzzling - and, at times, economically devastating problems with pregnant cows and calves. At some facilities, **high numbers of fetuses are aborting for no apparent reason.** Other farmers successfully raise what look to be normal young cattle, only to learn when the animals are butchered that their **carcasses appear old and, therefore, less valuable.**"

"The sporadic problem is so bad both in the United States and abroad that in some herds around **40-50 percent of pregnancies are being lost.**"

"Many pesticides and industrial pollutants also possess a hormonal alter ego."

"The viability of this important industry is threatened."

Source: Testimony of the Ranchers-Cattlemen Action Legal Fund, United Stock-growers of America, to the Senate Agriculture Committee July 24, 2002.

Effect of Feed Source on Pre-mature Ageing, Iowa, 2010

Why are so many cows losing pregnancies? Losing up to 20 percent of pregnancies is not acceptable.

By Jenks Britt, D. V. M. and Fernando Alvarez, M. V. Z.

	Herd					
Characteristics	A	B	C	D	E	F
Total cows	1,805	1,211	721	2,007	226	1,083
% herd pregnant	47	49	48	61	47	50
1st service conception	28	27	30	32	41	41
Services for all cows	4.3	4.1	3.6	3.0	2.5	2.4
% pregnant now open	27	25	27	10	6	2

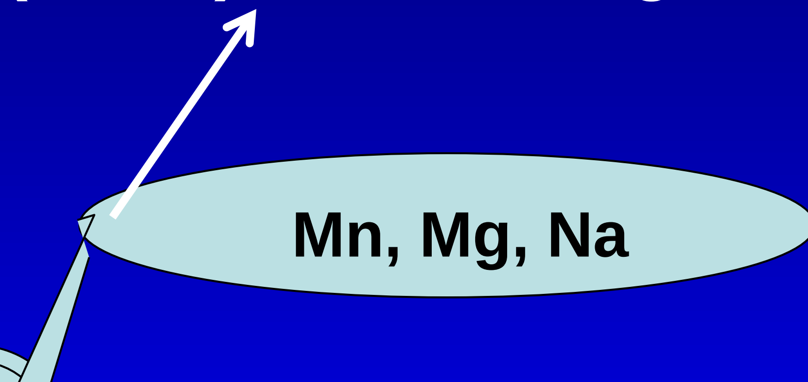
Source: Hoards Dairyman, November 2011, p 751.

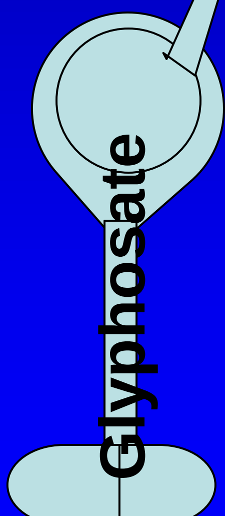
Nitrate Poisoning, Grass Tetny, Glyphosate

after Swerczek, 2012

High NO_3 in tissues

Alfalfa (roots), Grass, Sugar beets





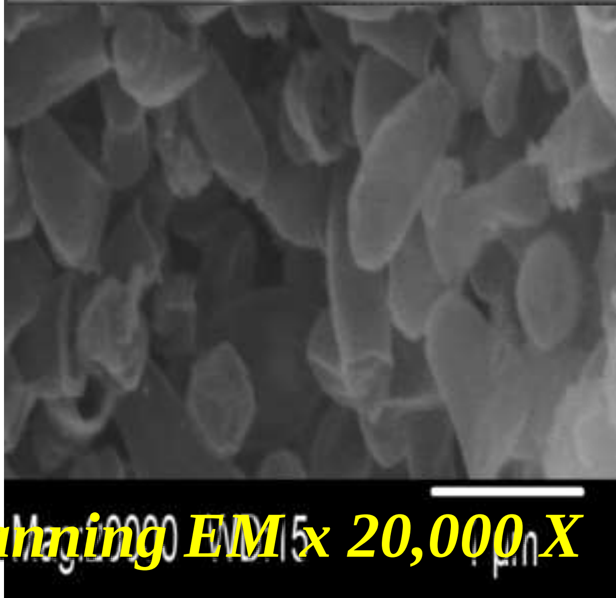
Rotting Roundup Ready Sugar Beets

Prion-like Protein Causing Reproductive Failure

Miscarriage

Appearance of growth in pure culture

38,250 X magnification



Scanning EM x 20,000 X

Prions in Plants

‘Malformed’ proteins that self-replicate w/out DNA,RNA

Cause ‘encephalies’ in animals - neurodegenerative

- Bovine spongiform encephalopathy (BSE , cattle), - Scrapie (sheep),
- Chronic wasting disease (CWD, deer, etc.), - Kuru (humans),
- Creutzfeldt-Jacob Disease (CJD, humans) and four variants, - 4 others

Transferred as infectious entities from plants to animals

Normal proteins that prions come from are well defined

- On membranes of normal cells of plants, microbes, animals
- Separated by centrifugation, proteinase K, posphoinositide phospholipase C, sensitivite to heat (autoclaving)

Prions are morphologically similar but also <u>highly pleomorphic</u>

- Extremely stable -resistant to chemical and physical agents
- Host barrier (plant-animal-animal) may not be stable
- Grow by external chelating action (for Cu, etc.)

(Alzheimer, Parkinson, ALS, Tauopathies, etc. may involve prions)

Toxicity to and Impact of Glyphosate on Poultry Intestinal Microflora

after Clair et al, 2012;Shehata et al, 2012; Krueger et al, 2012

Beneficials (Sensitive)

Enterococcus faecalis

Enterococcus faecium

Bacillus badius

Bifidobacterium adolescentis

Lactobacillus spp.

Campylobacter spp.

Geotrichum candidum

Lactococcus lactis subsp. *cremoris*

Lactobacillus delbrueckii subsp. *bulgaricus*

Pathogens (Resistant)

Salmonella entritidis

Salmonella gallinarum

Salmonella typhimurium

Clostridium perfringens

Clostridium botulinum

Clostridium deficale

Escherichia coli

Enterobacter cloacae

Photos: Dr. Monika Krueger

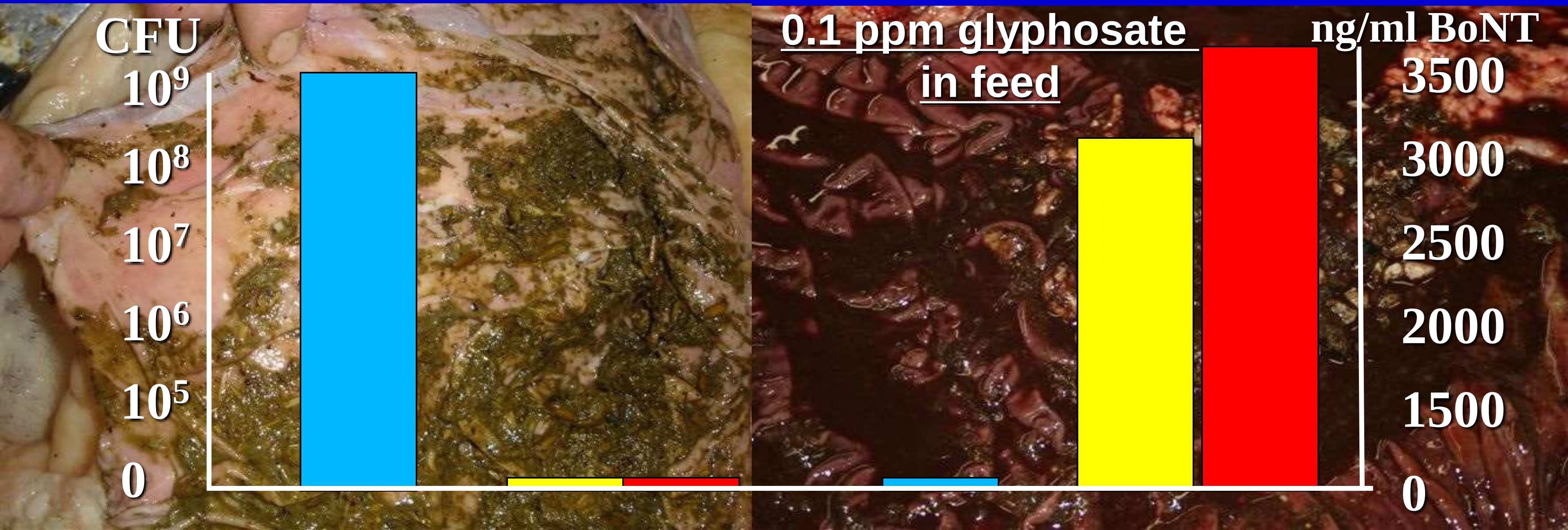
UNIVERSITÄT LEIPZIG

VMF Veterinärmedizinische Fakultät

Botulism in Dairy Cattle

Chronic, toxic co-infection, neurotoxin produced

Normal stomach in the animal Chronic botulism

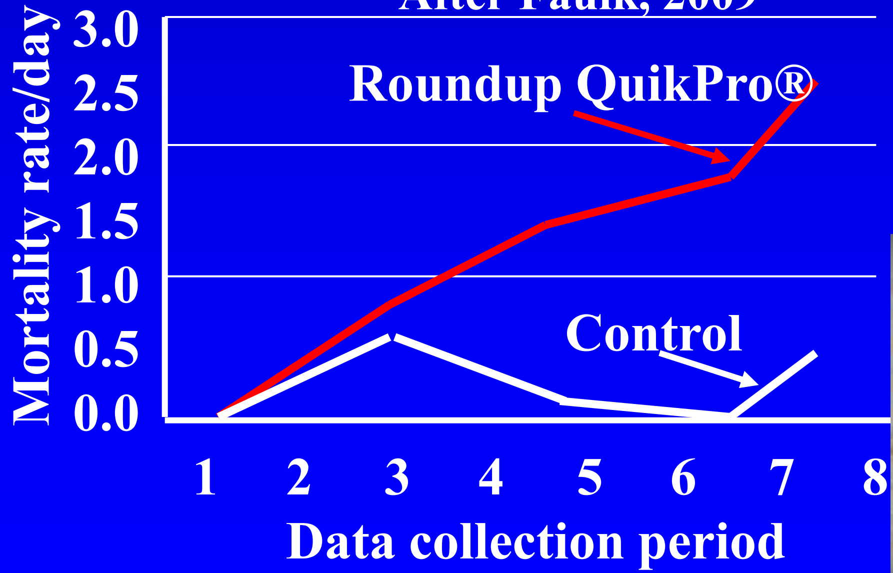


Environmental Impact of Glyphosate

Bee Colony Collapse Disorder

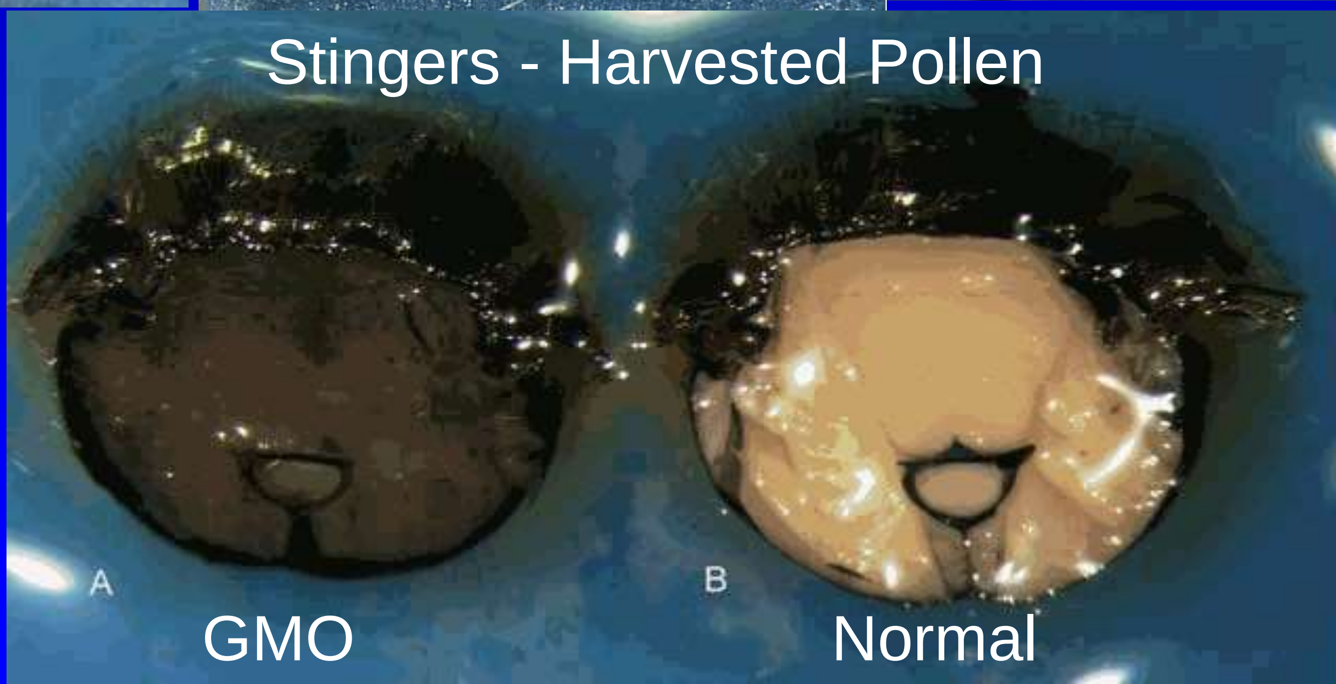
- **Lower mineral availability in plant products**
  Malnutrition
- **Biocidal to *Lactobacillus/Bifidobacterium* in 'stomach'**
  Starvation & immunity to mites, viruses, bacteria, stress, etc.
- **Direct toxicity - endocrine disruption, neurotoxicity**
  Reproduction, disorientation

After Faulk, 2009



Effect of Glyphosate on Bee Digestion

(After Amos, 2011)



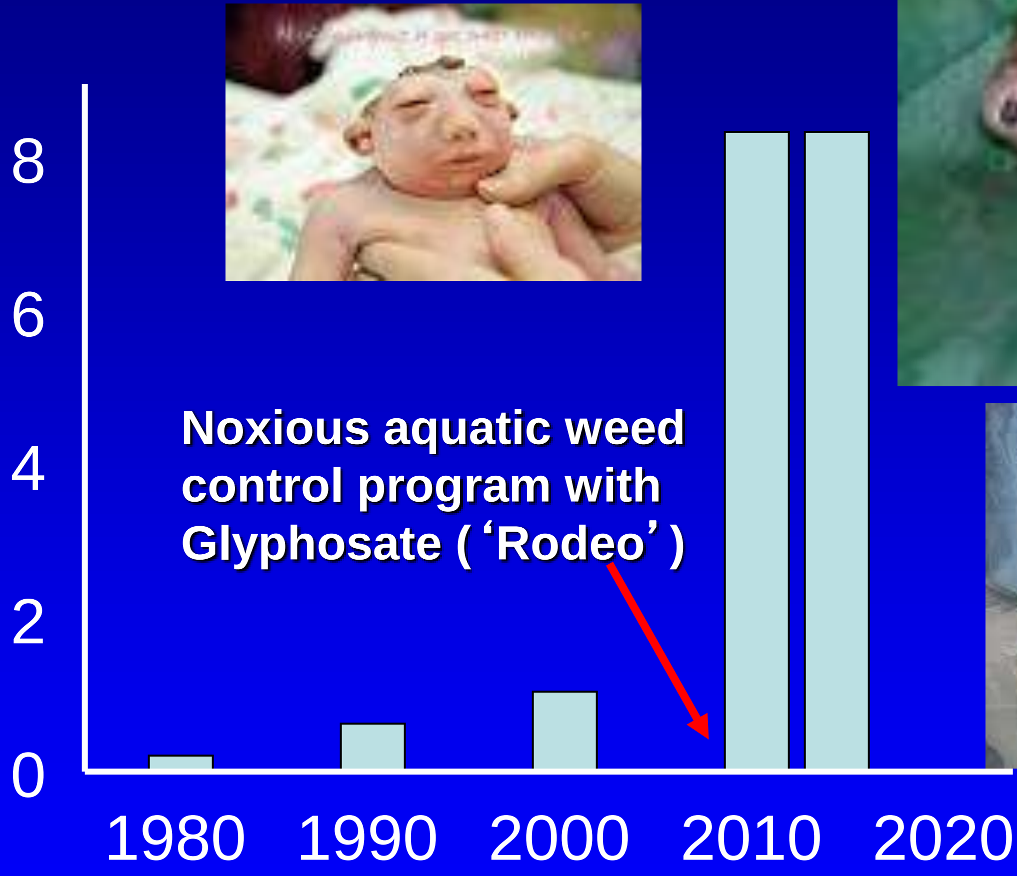
Some Common Honeybee Concerns

- **Colony Collapse Disorder**
  - Micronutrient deficient bees
  - Starving with food available
  - Disoriented foraging
  - Pest susceptible

- **European Foul Brood**
- **Varroa mites**
- **Amoeba and Nosema diseases**
- **Viruses**

'Glyphosate, Brain Damaged Babies, and Yakima Valley - A River Runs Through It"

Farm Wars 3/6/14



"Glyphosate, Three Rivers, and Anencephaly"

Yakima Harold Republic

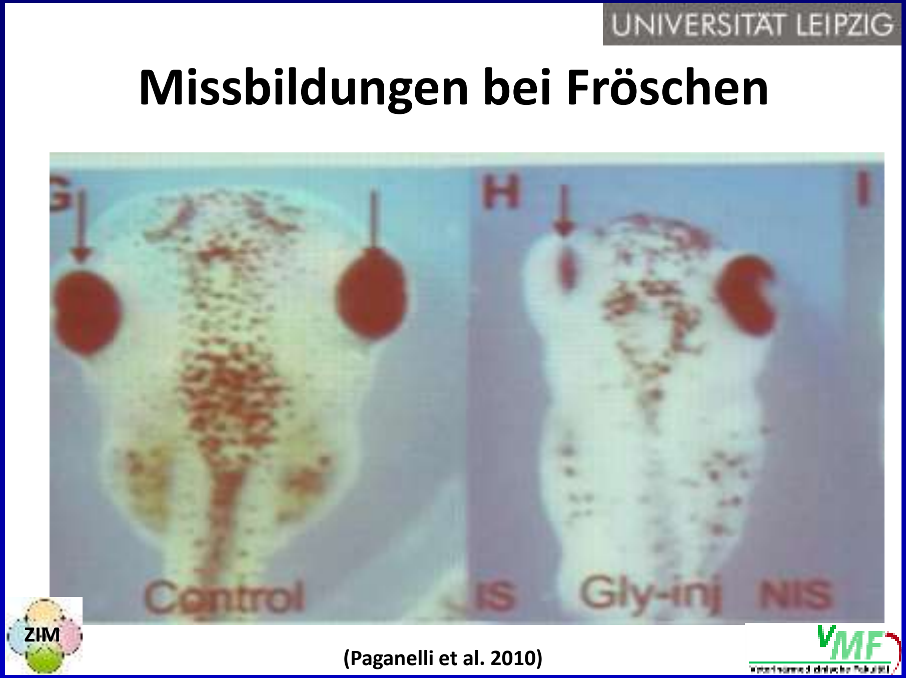
Future historians may well look back and write about our time, not about how many pounds of pesticide we did or did not apply; but about how willing we are to *sacrifice our children and jeopardize future generations* with this <u>massive experiment we call genetic engineering</u> that is based on <u>*false promises*</u> and <u>*flawed science*</u>, just to benefit the "bottom line" of a <u>commercial enterprise.</u>

Dr. Don M. Huber, Professor Emeritus, Purdue University

Direct Toxicity of Glyphosate

Rate (ppm)	System affected	Reference
0.5	Human cell endocrine disruption	Toxicology 262:184-196, 2009
0.5	Anti-androgenic	Gasner et al, 2009
1.0	Disrupts aramatase enzymes	Gasnier et al, 2009
1-10	Inhibits LDH, AST, ALF enzymes	Malatesta et al, 2005
1-10	Damages liver, mitochondria, nuclei	Malatesta et al, 2005
2.0	Anti-Oestrogenic	Gasnier et al, 2009
5.0	DNA damage	Toxicology 262:184-196, 2009
5.0	Human placental, umbilical, embryo	Chem.Res.Toxicol.J. 22:2009
10	Cytotoxic	Toxicology 262:184-196, 2009
10	Multiple cell damage	Seralini et al, 2009
10	Total cell death	Chem.Res.Toxicol.J. 22:2009
All	Systemic throughout body	Andon et al, 2009
1-10	Suppress mitochondrial respiration	Peixoto et al, 2005
Parkinson's		El Demerdash et al, 2001
POEA, AMPA even more toxic		Seralini et al, 2009

Birth Defects: The Many Tragedies at Home



Glyphosate Residues Allowed in:

Food (Crop)	ppm
Beet, sugar, dried pulp	25
Beet, sugar, roots	10
Canola, seed, oil	**20**
Corn, sweet	**3.5**
Grain, cereals(grp 15)	**30**
Oil seeds (ex. canola)	**40**
Pea, dry	**8**
Peppermint, tops	**200**
Quinoa, grain	5
Shellfish	3
Soybean seed	**20**
Spice (group 19B)	**7**
Sugar, cane	2
Sugarcane, molasses	30
Sweet potatoes	3
Vegetable, legume	**5** (ex. Soybean & dry peas)

Livestock Feed	ppm
Grass, forage,	300
fodder, hay, group 17	300
Grain, cereal,	100
forage, fodder, straw	100
Soybean, forage	100
Soybean, hay	200
Soybean, hulls	120
Cattle, meat byproducts	5
Hay, alfalfa	400

Where is the research and Rationale for such disparity?

Dietary Risk of Pesticides in Food*

(Soybean grain, Serving size = 93 gm = 3.3 oz)

Pesticide	Sample Size	% Positive	Ave (ppm) Residue	Range (ppm)	% DRI**
AMPA	300	95.7	2.28	0.26-18.8	45.9
Glyphosate	300	90.3	1.94	0.26-20.6	36.8
			4.22	**Combined risk:**	**82.7**
Chlorpyrifos	300	2.7	0.005	---	14.9
All Others	300	1.5	0.009	0.001-0.035	0.1

*USDA, NASS, 2011. **Dietary Risk Index, M2M/CSANR/WSU, 2014

Increased Probability of Health Impact

Health factor	Glyphosate alone	GMO+Glyphosate
Parkinson's disease	450 %	160 %
Alzheimer's disease	800 %	300 %
Dementia	1,600 %	400 %
Autistic child	40,000 %	10,000 %
Intestinal infection	200 %	800 %
Hepatitis infection	400 %	600 %
Inflamatory bowel disease	200 %	210 %
Acute kidney failure	120 %	190 %
Lipoprotein metabolic death	400 %	280 %
Diabetis prevalence	140 %	180 %
Obesity death	130 %	206 %
Hemorrhagic stroke	300 %	250 %
Hypertension death	280 %	180 %
Thyroid,bladder cancer	120 %	230 %
Kidney,Liver cancer	140 %	149 %

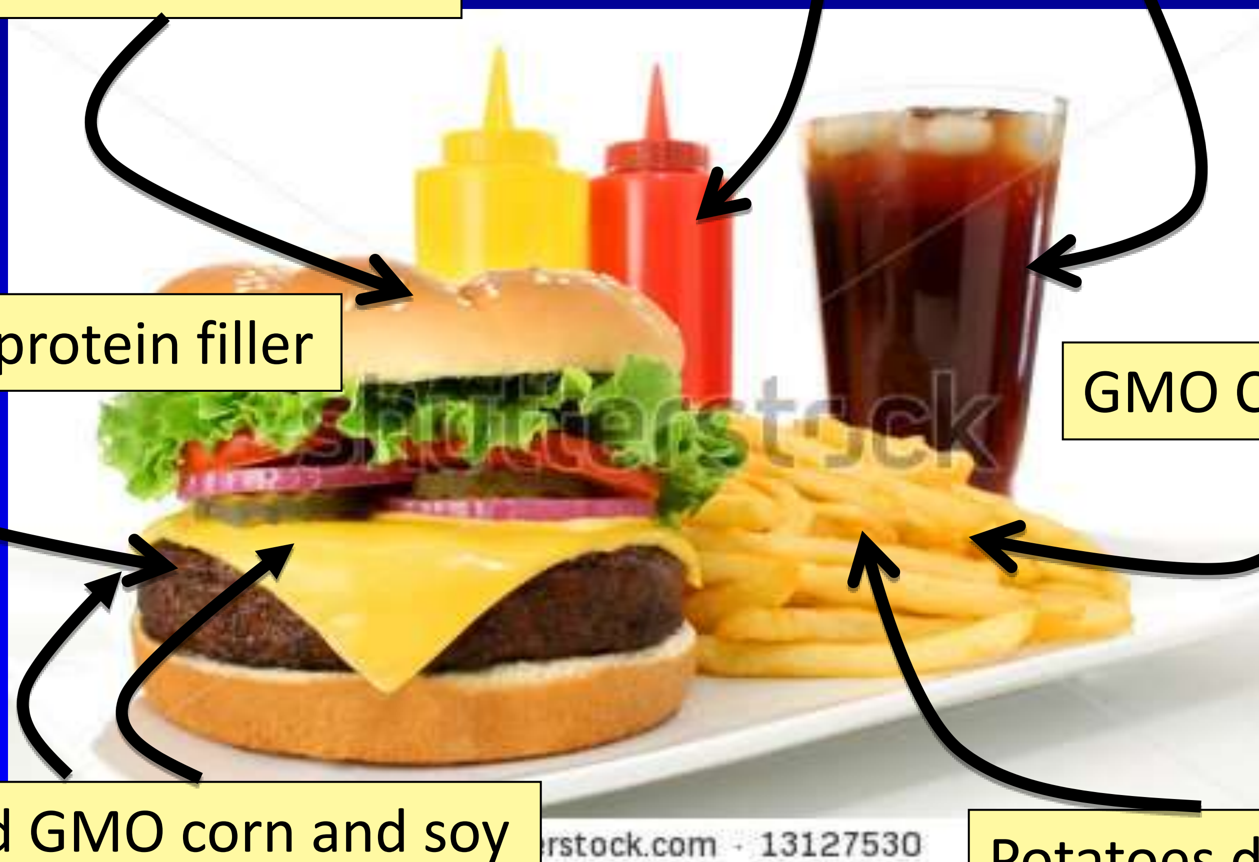
Is Glyphosate in Our Food?

Wheat desiccated with Roundup

High fructose GMO corn syrup

GMO soy protein filler

GMO Canola Oil



Cows fed GMO corn and soy

Potatoes desiccated with herbicides

Glyphosate in Human Breast Milk

Mom's Across America Study - 2014

Glyphosate Concentration (PPB)

Urine U.S.	Europe	US Breast Milk	Drinking Water (MCL) U.S.	Europe	5 % Increase[X] in Birth Defects	Mis-carriage
18.8	0.16	76-166	700	0.70	0.028*	0.048**

*PPM, had 0.2 PPM in feed

**PPM, had 1.1 PPM in feed

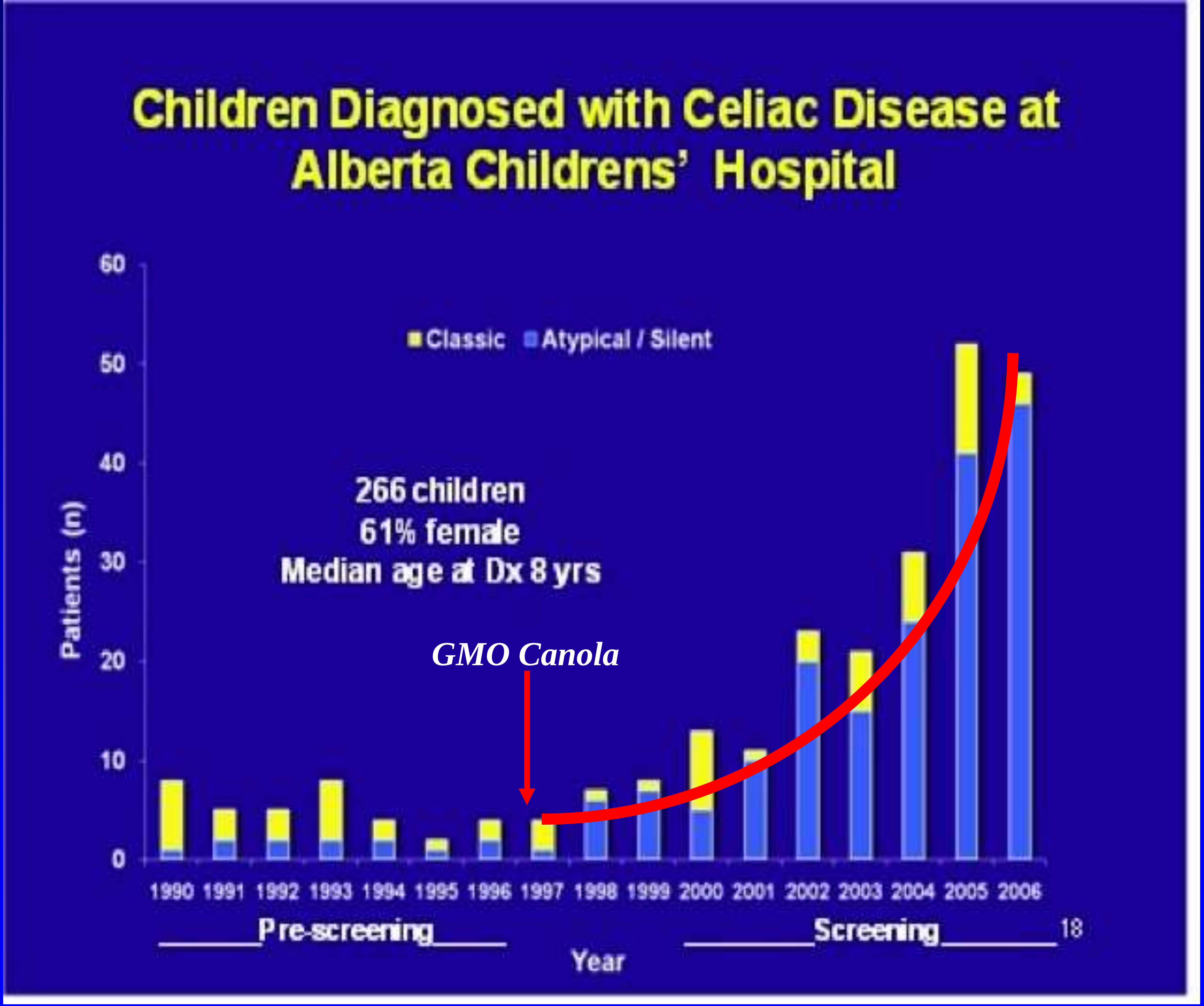
[X]Pig study

From 10-400 PPM permitted in food products

0.1 PPM toxic to beneficial GI microbials

Agent Orange Deformities

Our 2,4-D Legacies for Viet Nam


Children Diagnosed with Celiac Disease at Alberta Childrens' Hospital
60
50
40
30
20
10
0
Patients (n)
Classic
Atypical / Silent
266 children
61% female
Median age at Dx 8 yrs
GMO Canola
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
Pre-screening
Screening
18
Year

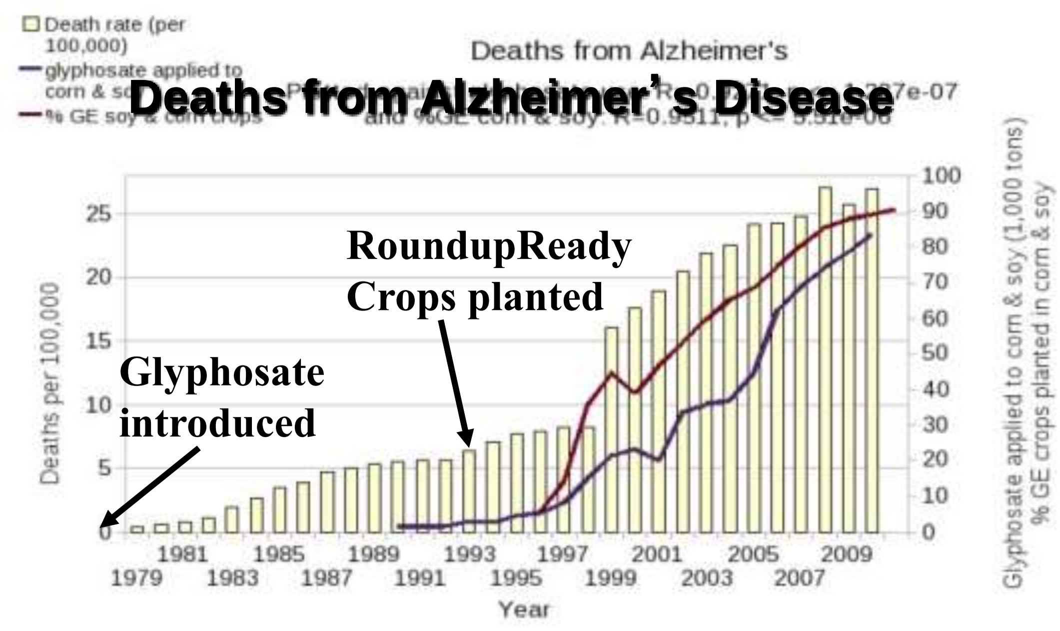
Diseases Increasing in Incidence (Epidemic)

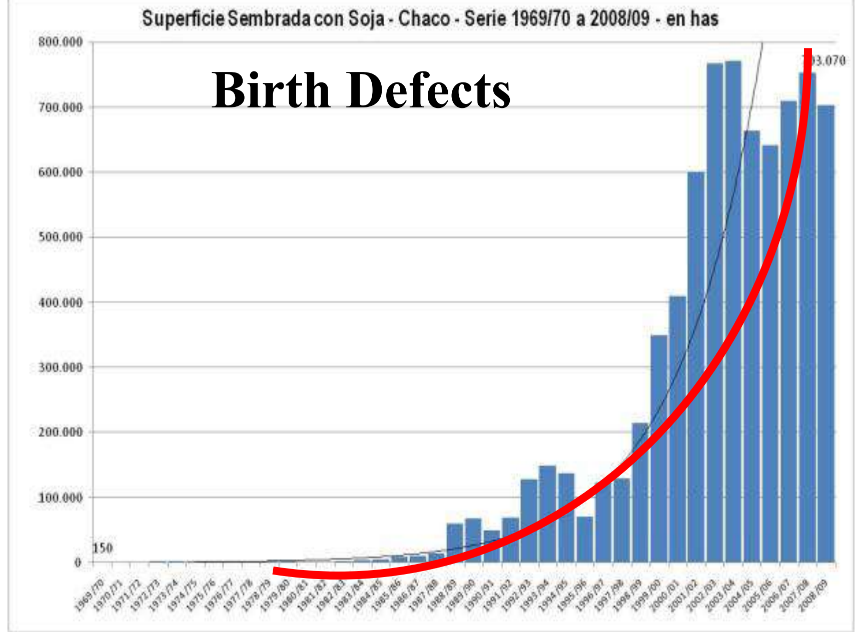
(after Fox, 2012; Antoniou et al., 2012, Samsel & Seneff, 2013; Swanson, 2013)

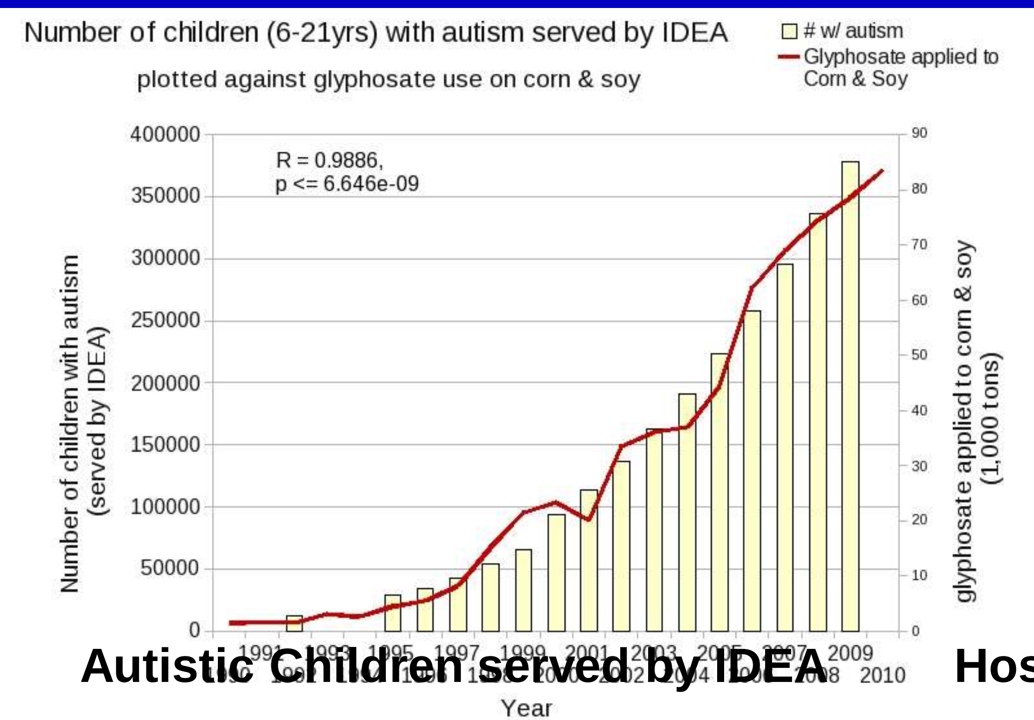
Allergies, Asthma
Alzheimer's
Arthritis
Atopic dermatis
Autism
Autoimmune diseases
Bipolar, Attn deficit (ADHD)
Birth defects
Bloat (fatal)
Bowel disease
Cancer (some)
Celiac disease
Chronic fatigue syndrome
Colitis
Crohn's
Dementia

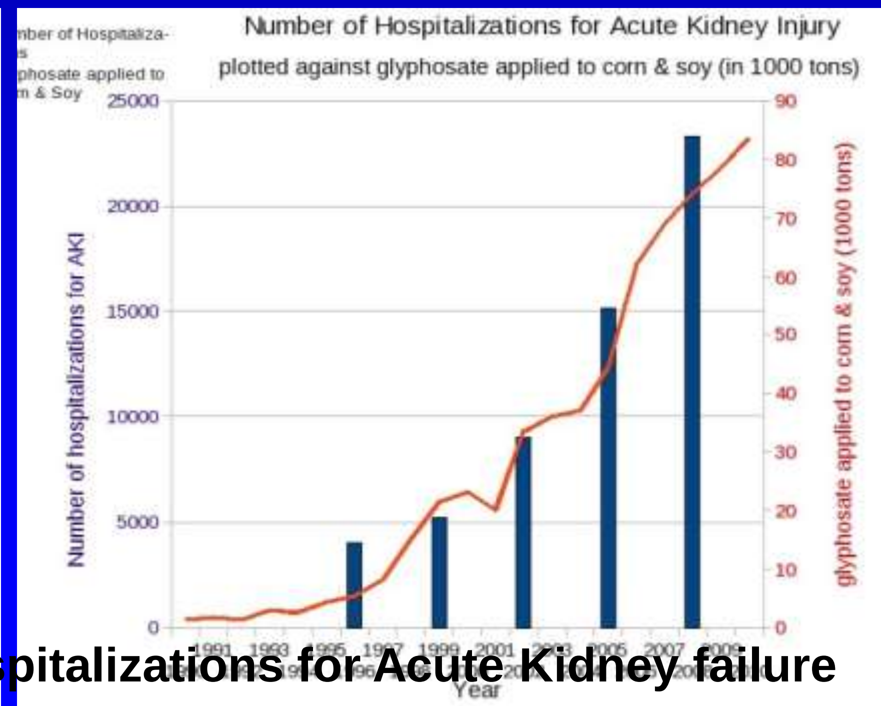
Diabetes
Difficale diarrhea
Gluten intolerance
Indigestion
Infertility
Inflammatory bowel disease
Irritable bowel disease
Leaky gut syndrome
Liver abnormalities
Miscarriage
Morgellan's (NEW)
Multiple sclerosis
Obesity
Pancreas abnormalities
Parkinson's
Sudden Infant Death Syndrome

1995 1997 1999 2001 2003 2005 2007 2009 2011


Deaths from Alzheimer's Disease
Deaths from Alzheimer's
Death rate (per 100,000)
glyphosate applied to corn & soy
% GE soy & corn crops
RoundupReady Crops planted
Glyphosate introduced
Deaths per 100,000
Glyphosate applied to corn & soy (1,000 tons)
% GE crops planted in corn & soy
Year

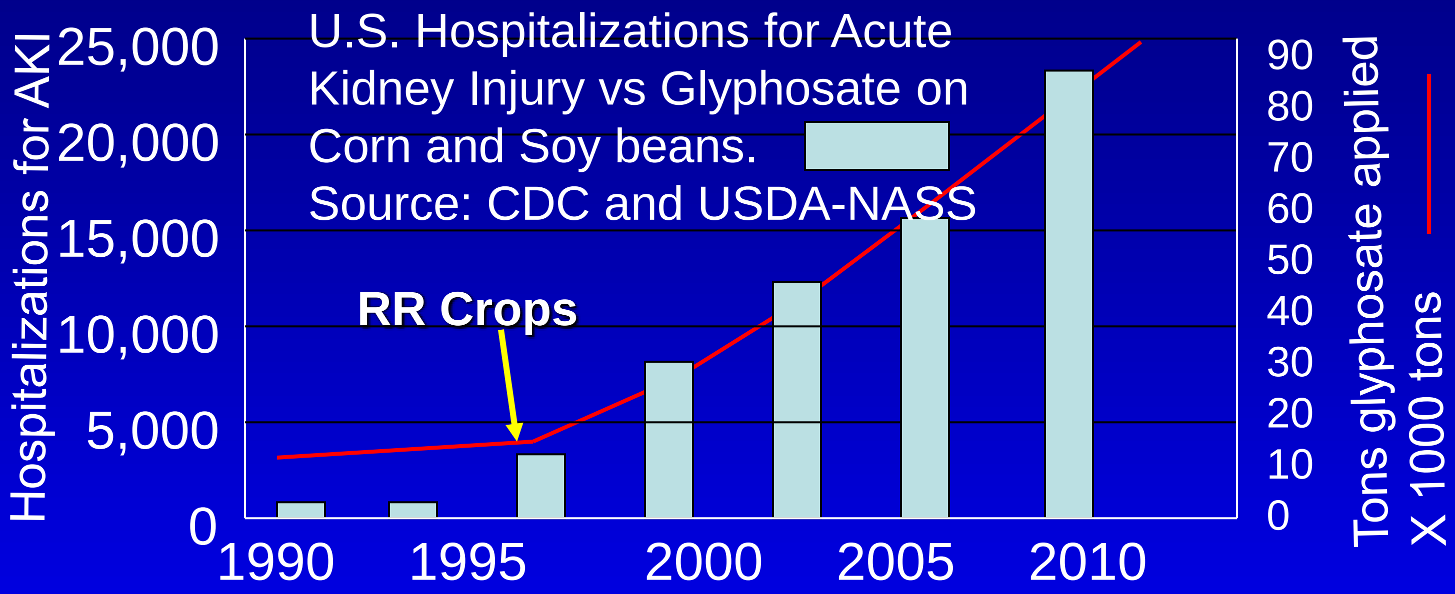

Superficie Sembrada con Soja - Chaco - Serie 1969/70 a 2008/09 - en has
Birth Defects


Number of children (6-21yrs) with autism served by IDEA
plotted against glyphosate use on corn & soy
w/ autism
Glyphosate applied to Corn & Soy
R = 0.9886,
p <= 6.646e-09
Number of children with autism (served by IDEA)
glyphosate applied to corn & soy (1,000 tons)
Year
Autistic Children served by IDEA


Number of Hospitalizations for Acute Kidney Injury
plotted against glyphosate applied to corn & soy (in 1000 tons)
Number of hospitalizations for AKI
glyphosate applied to corn & soy (1000 tons)
Year
Hospitalizations for Acute Kidney failure

"The Perils of Ignoring History: Big tobacco Played Dirty and Millions Died. How Similar is Big Food?"

Brownell, K.D. and Warner, K.E. 2009. The Milbank Quarterly 87:259-294.



"1 in 4 El Salvadore sugar cane workers die of end-stage kidney failure"

"20,000 sugar cane workers die from end-stage Kidney failure in Panama and Niceragua"

"Glyphosate, hard water and nephrotoxic metals: …Sri Lanka?"
Jayasumana et al. 2014. Int. J. Environ. Res. Public Health 11:2125-2147

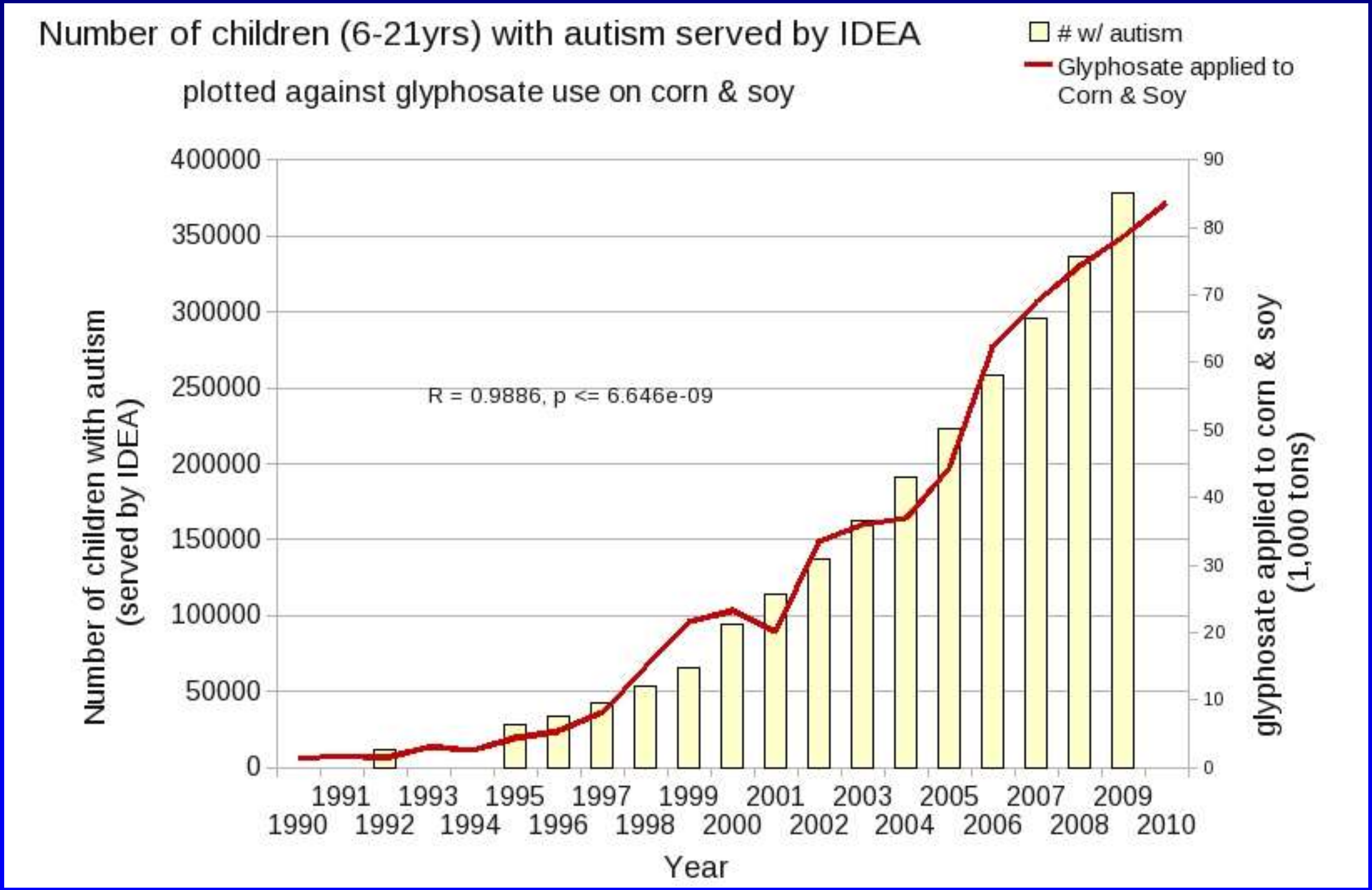
The Autism Epidemic in the U.S. (US CDC Data)

One in 50 kids diagnosed on Autism Spectrum in Mar. 2013

One in Two in 2025?

The rate was 1 in 10,000 in 1970

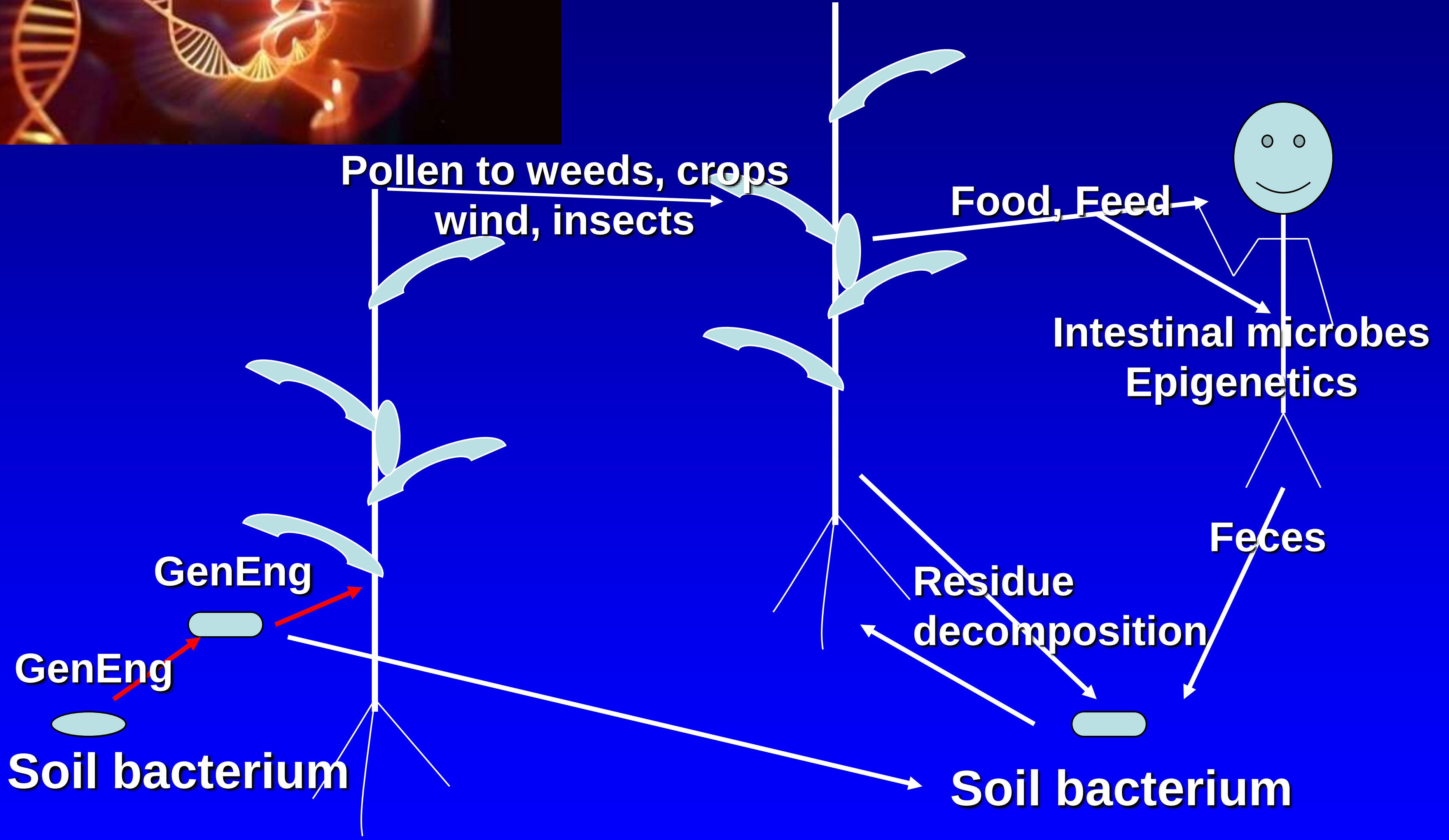
Glyphosate and Autism*



Pearson Correlation Coefficient = 0.99

*Dr. Nancy Swanson, http://www.examiner.com/article/data-show-correlations-between-increase-neurological-diseases-and-gmos

Foreign Gene Flow



Bt insecticide in Mother and Fetal Blood

In January 2012, Bt insecticide was found in 93% of 60 Canadian women tested at the Sherbrooke Medical Center in Montreal. 70% of the 30 fetuses tested had Bt insecticide in their cord blood. **Aris et al, 2012**

Flawed Safety Evaluations

Consistency

1983 Tests associated with fraudulent practices

1991 Laboratory fraud found on plums, potatoes, grapes, and sugar beets:
"Falsifying laboratory notebook entries"
"Manually manipulating scientific equipment to produce false reports"
"Falsification of test results"

Indictment of the Laboratory Director and 14 employees on 20 felony counts
Laboratory President sentenced to five years in prison and fined $50,000
Laboratory fined $15.5 million + $3.7 million restitution

1995 "Mode of action (still listed as) unknown"
1995 Company terminated study when animals died after feeding GMO corn

1996 NY Attorney General charged "False and Misleading advertising"

2003 Kawata, Japan. Reported fraudulent safety-testing data

2007 Monsanto convicted in France of false advertising (biodegradability)

2009 Convicted of false advertising in France

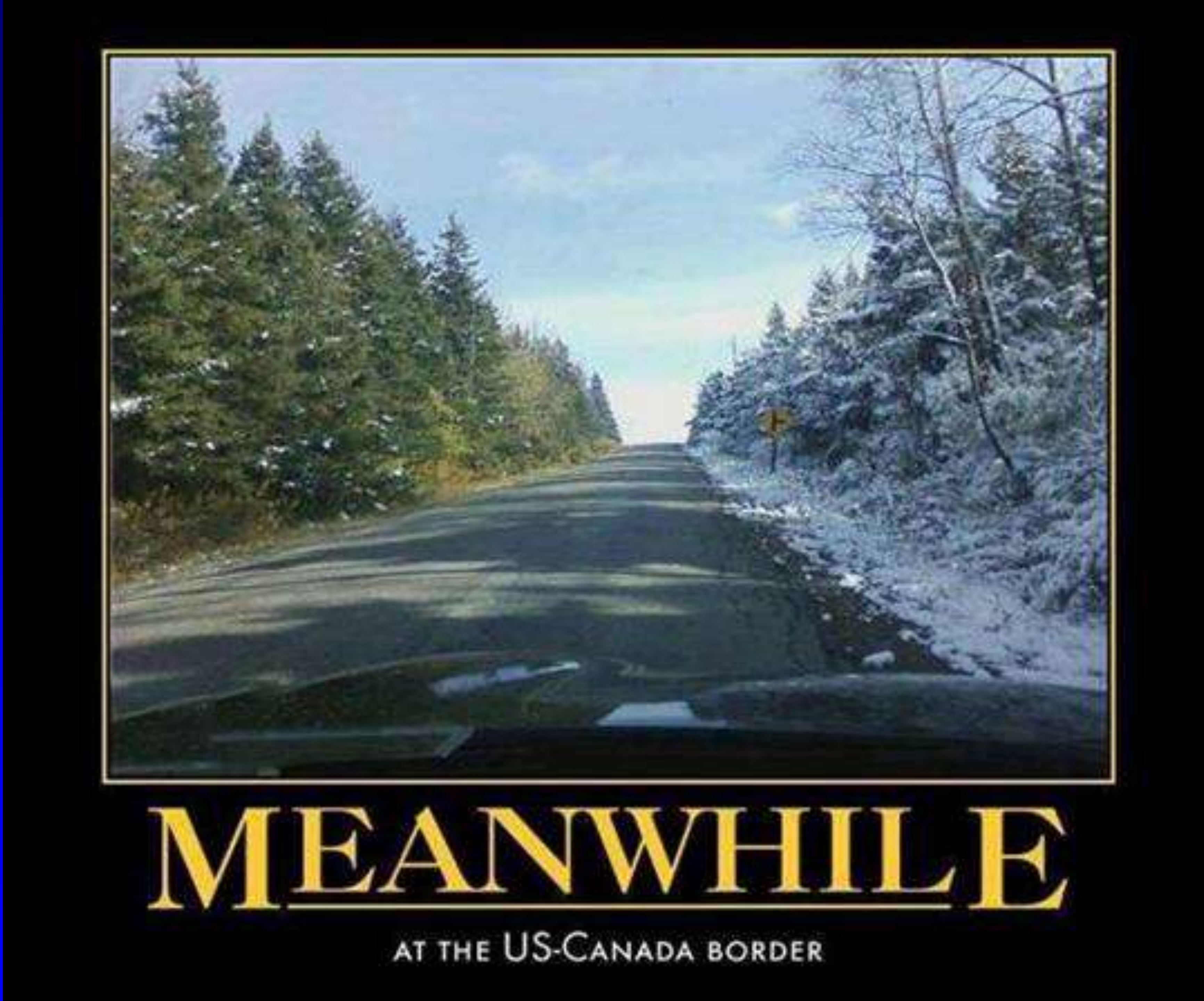
2011 India, Gallagher, "Failed International standards"-"woefully inadequate"


THE
ULTIMATE
KILLING
MACHINE
KILLS THE ROOTS!
GUARANTEED!*
Roundup
WEED & GRASS KILLER
CONCENTRATE PLUS
THE ULTIMATE
KILLING MACHINE
SPRAYER
FOLLOW THE LATEST GMO NEWS AT: sustainablepulse.com

Flawed Roundup Ready Safety Evaluations
(Mesnage et al, 2014)

Control diet contained:

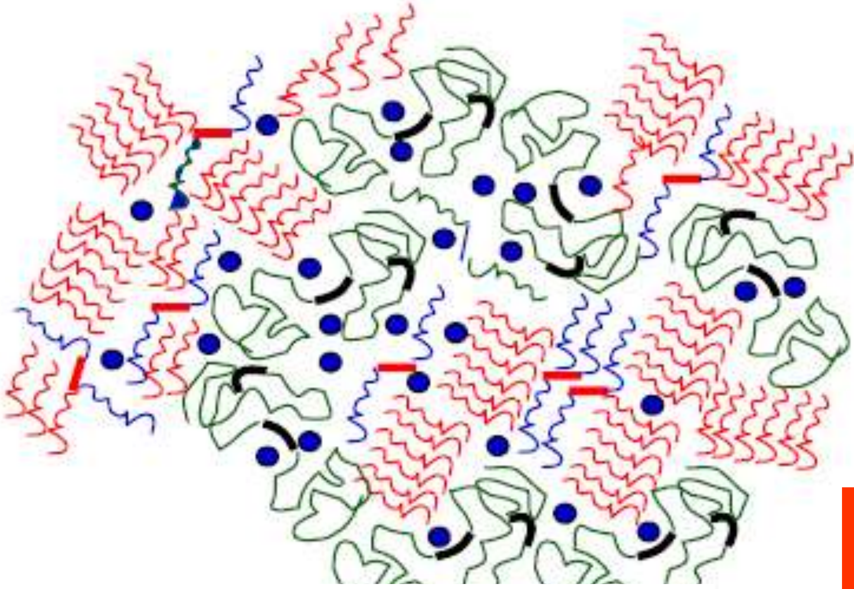
- 18 % Roundup Ready maize (NK603)
- 14.9 % Bt tolerant maize (Mon810)
- 110 ppb glyphosate
- 200 ppb AMPA


MEANWHILE
AT THE US-CANADA BORDER

Detoxification of Glyphosate

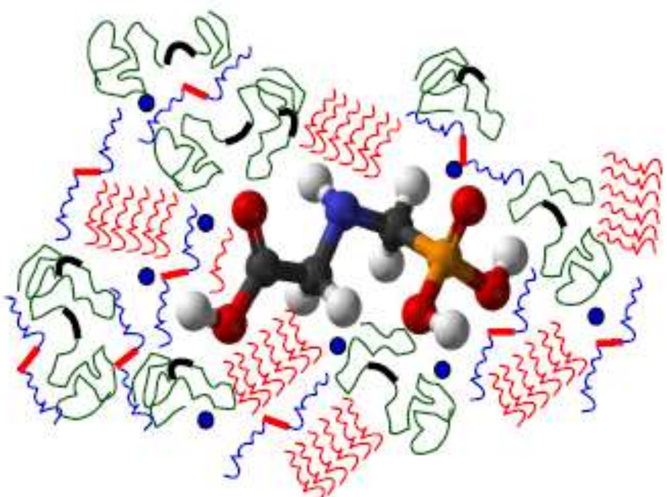
UNIVERSITÄT LEIPZIG

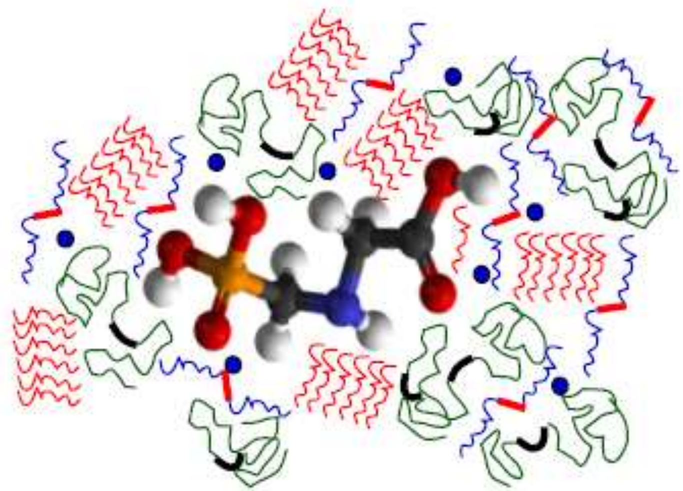
Huminsäure



Glyphosat

+

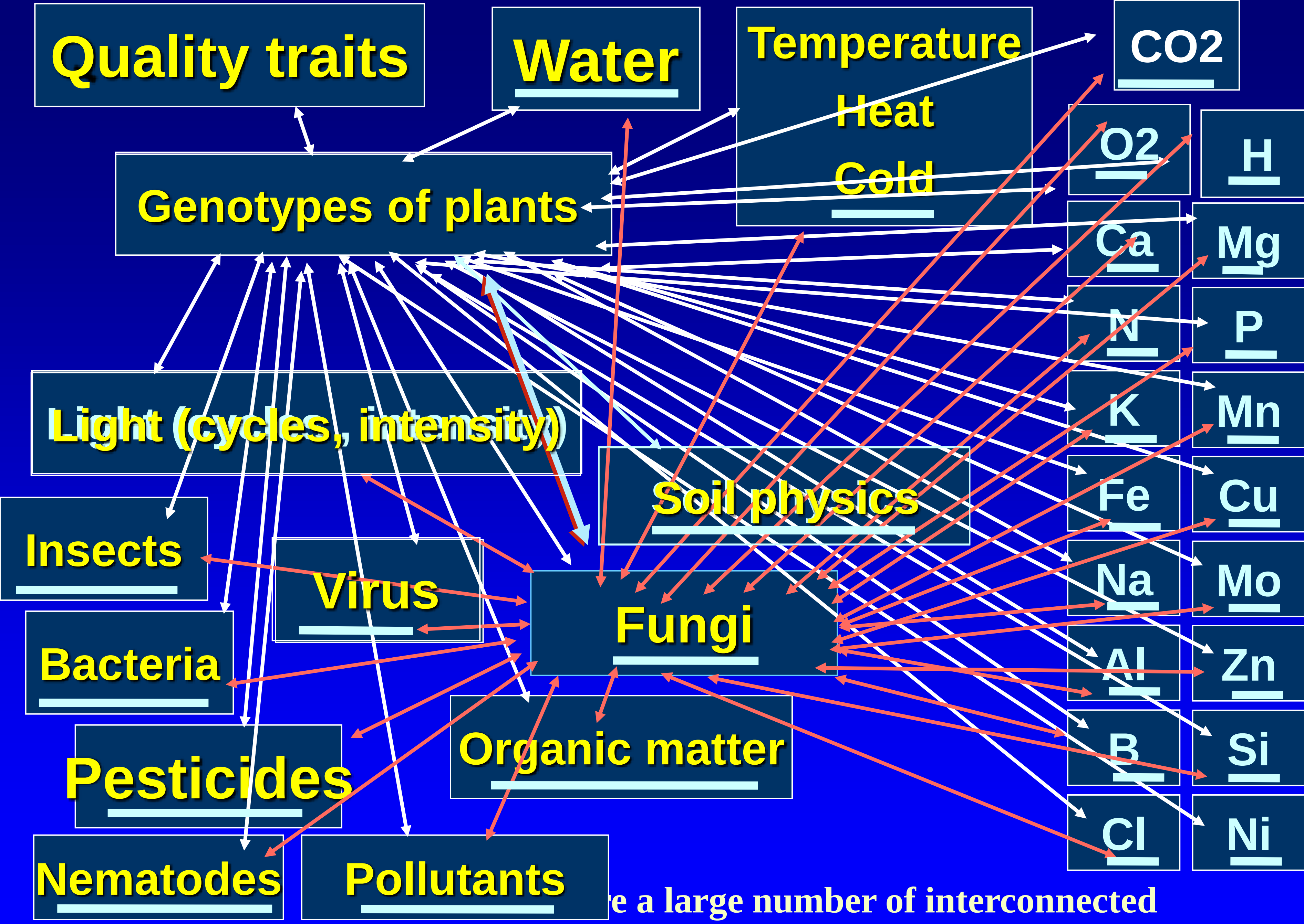




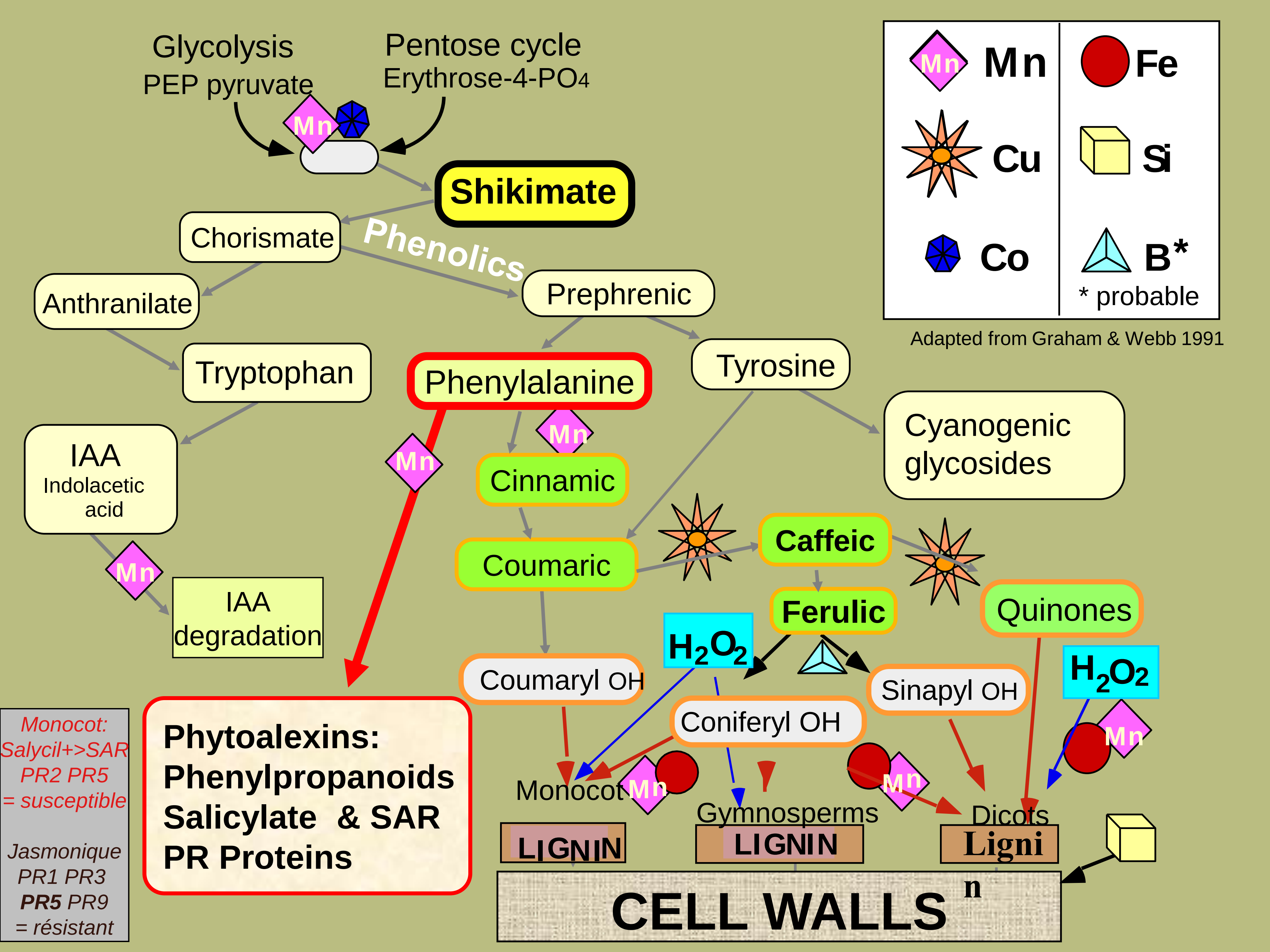
Glyphosat-Huminsäure-Komplexe

ZIM

VMF Veterinärmedizinische Fakultät



e a large number of interconnected plant properties and responses to physical and biological environmental factors.



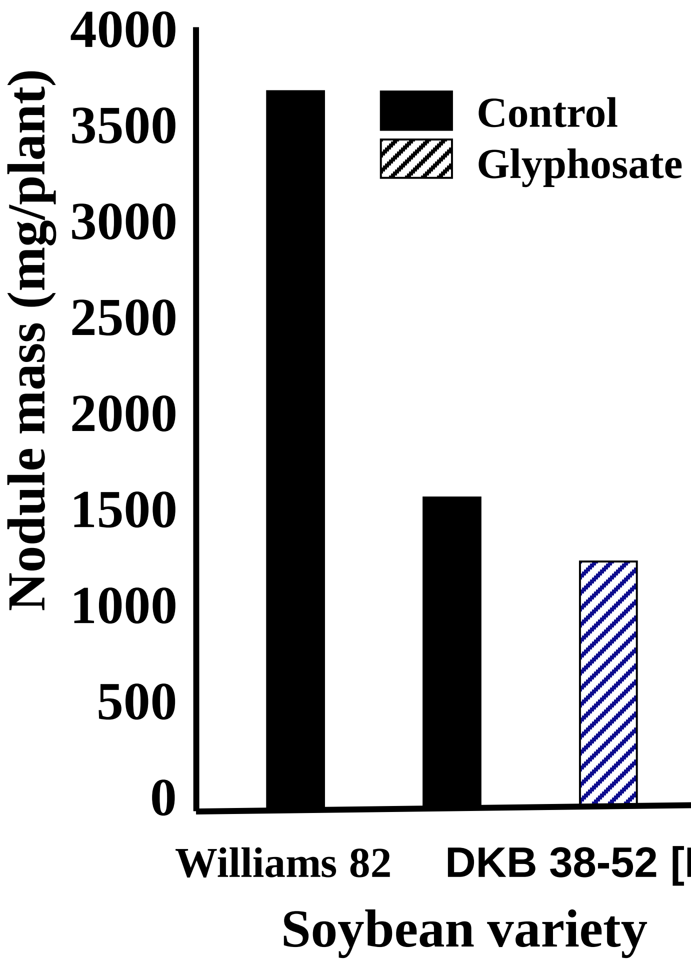
Glycolysis
PEP pyruvate
Pentose cycle
Erythrose-4-PO4
Mn
Mn
Fe
Cu
Si
Co
B*
* probable
Adapted from Graham & Webb 1991
Shikimate
Chorismate
Phenolics
Anthranilate
Prephrenic
Tryptophan
Phenylalanine
Tyrosine
Cyanogenic glycosides
IAA
Indolacetic acid
Mn
Mn
Mn
Cinnamic
Coumaric
Caffeic
Ferulic
Quinones
Mn
IAA degradation
H_2O_2
H_2O_2
Coumaryl OH
Sinapyl OH
Coniferyl OH
Monocot
Mn
Mn
Mn
Gymnosperms
Dicots
LIGNIN
LIGNIN
Lignin
CELL WALLS
Phytoalexins:
Phenylpropanoids
Salicylate & SAR
PR Proteins
Monocot:
Salycil+>SAR
PR2 PR5
= susceptible
Jasmonique
PR1 PR3
PR5 PR9
= résistant

Effect of Planting Delay after Glyphosate (Residual Glyphosate in Soil)

Winter Wheat

Effect of the RR Gene & Herbicide on Root Nodule Mass

After Kremer & Means, 2009



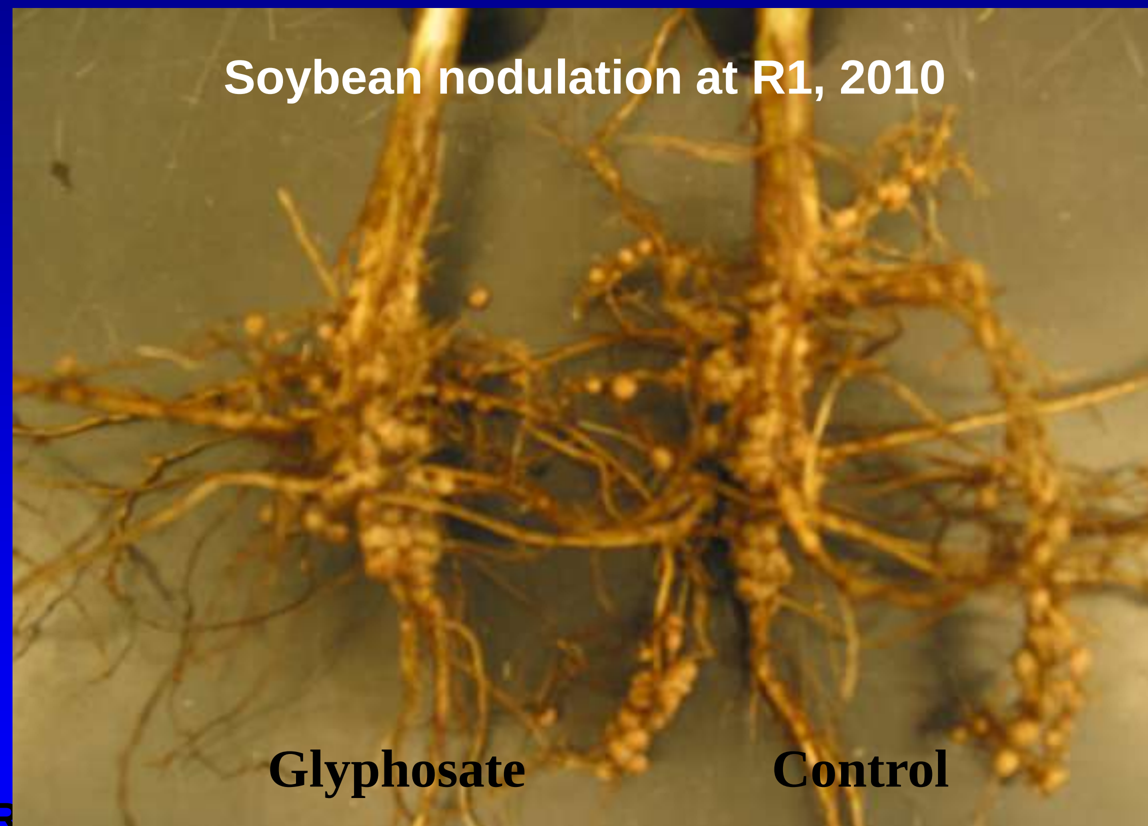
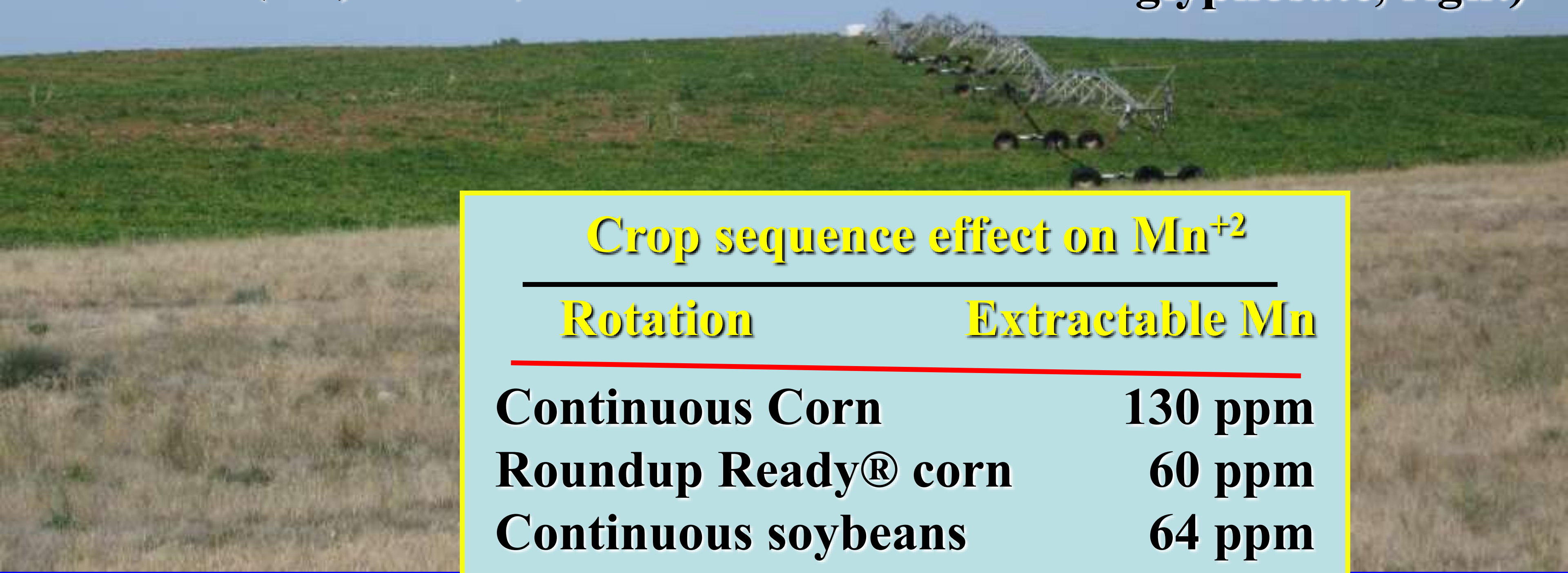


Photo by R. Kremer

Residual Soil & Crop Sequence Effects of Glyphosate

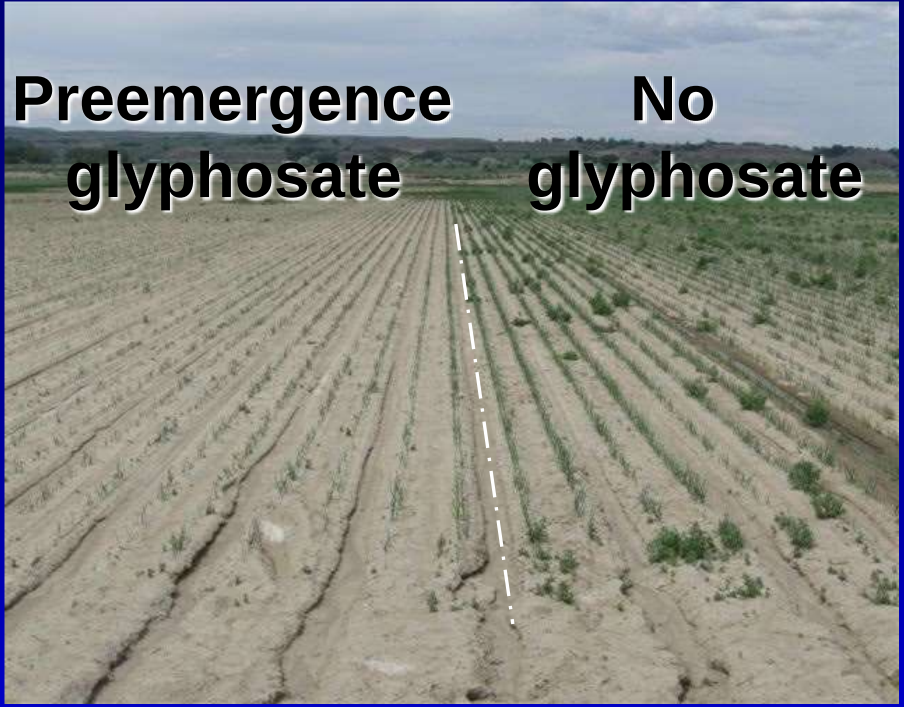
Severe Verticillium wilt after 1 year of RR corn (left) Idaho, 2009

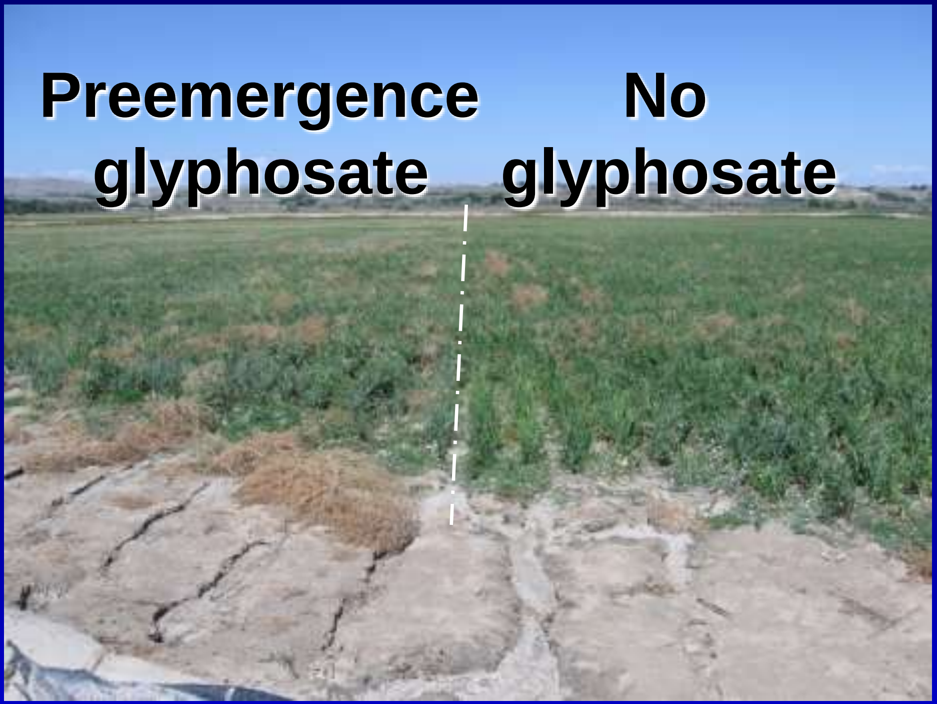
Mild Verticillium after wheat (no glyphosate, right)



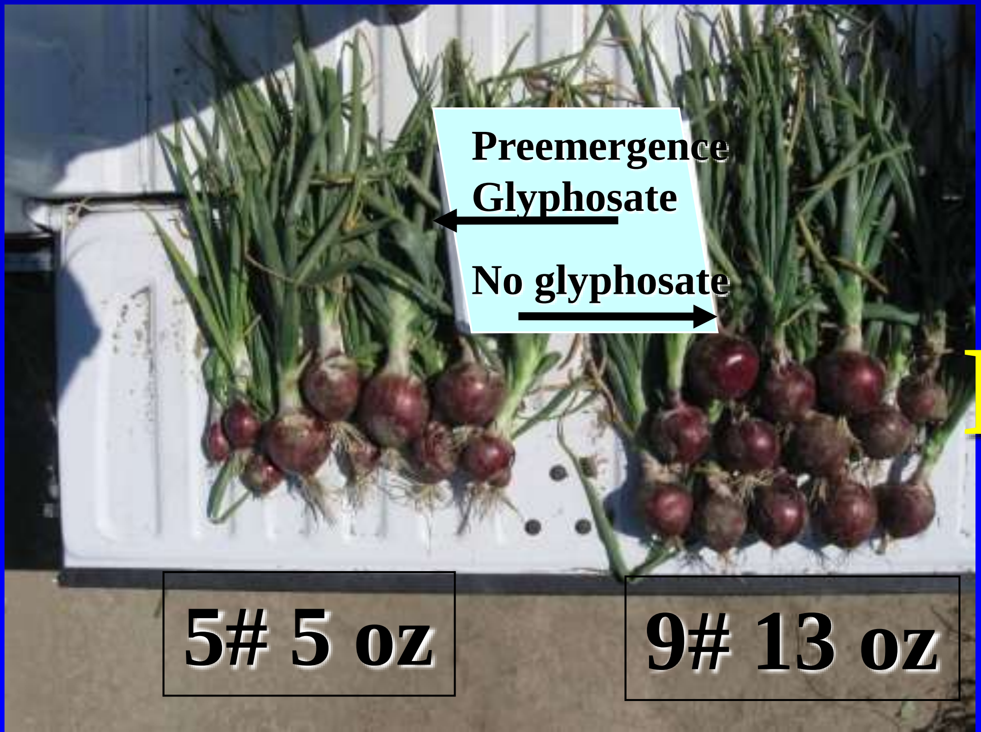
Crop sequence effect on Mn^{+2}

Rotation	Extractable Mn
Continuous Corn	130 ppm
Roundup Ready® corn	60 ppm
Continuous soybeans	64 ppm
Soybean, wheat, <u>corn</u>	91 ppm
Wheat, corn, <u>soybean</u>	79 ppm





Poor



Bulking

Failure to 'Bulk' of Russet Potatoes

Glyphosate frequency	How applied	No. growers	% Potatoes over 10 oz
None in the previous 2 yrs	None	5	35.3
1-2 in the previous 2 yrs	Burn down	17	20.2
Preceding year	RR crop	5	5.4
	Total #:	27	Ave : 20.3

Role of Soil Pathogens in Response to Glyphosate

In Inoculated and Sterile Soil

Glyphosate susceptible biotype 4 DAT

Pythium Control | **Pythium + glyphoste** | **Glyphosate control**

Glyphosate treated in Field Soil

Susceptible biotype | **Resistant biotype**

Ridomil | **None Ck** | **Ridomil** | **Ck**

Fungicide Treated

Effect of fungicide on Glyphosate-susceptible and Glyphosate-tolerant Lines

Effect of Glyphosate on Roundup Ready® Corn

Colorado State University, 2007

Mike Bartolo, Sr. Res. Scientist

Treatment	% grain moisture	Yield (bu/a)	% of control
Untreated*	15.6	234 a	100
Glyphosate**	15.6	195 d	83
Glyphosate + Zn, Mn	15.6	221 b	94
Glyphosate + Mn, Zn, Fe, B	15.6	208 c	89

*Hand weeded, **1 lb a.i. + 1 pt AMS per acre

Notes: UTC = genetic potential (with RR gene)

Glyphosate reduces genetic potential 39 bu/a

Application of high Mn & Zn recovers some genetic potential, lower Mn & Zn recovers less

Response of Roundup Ready® Corn to Zn & Mn, 2007*

NDSU Carrington

Treatment	Yield (bu/a)
Glyphosate control	144
Zn seed Treatment	156
Foliar applied Zn	158
Foliar applied Zn+Mn	173
Seed + Foliar Zn	175
Soil granular Zn sulfate	167

* All treatments received glyphosate

Herbicide Affects on RR Corn Yield Indiana, 2010

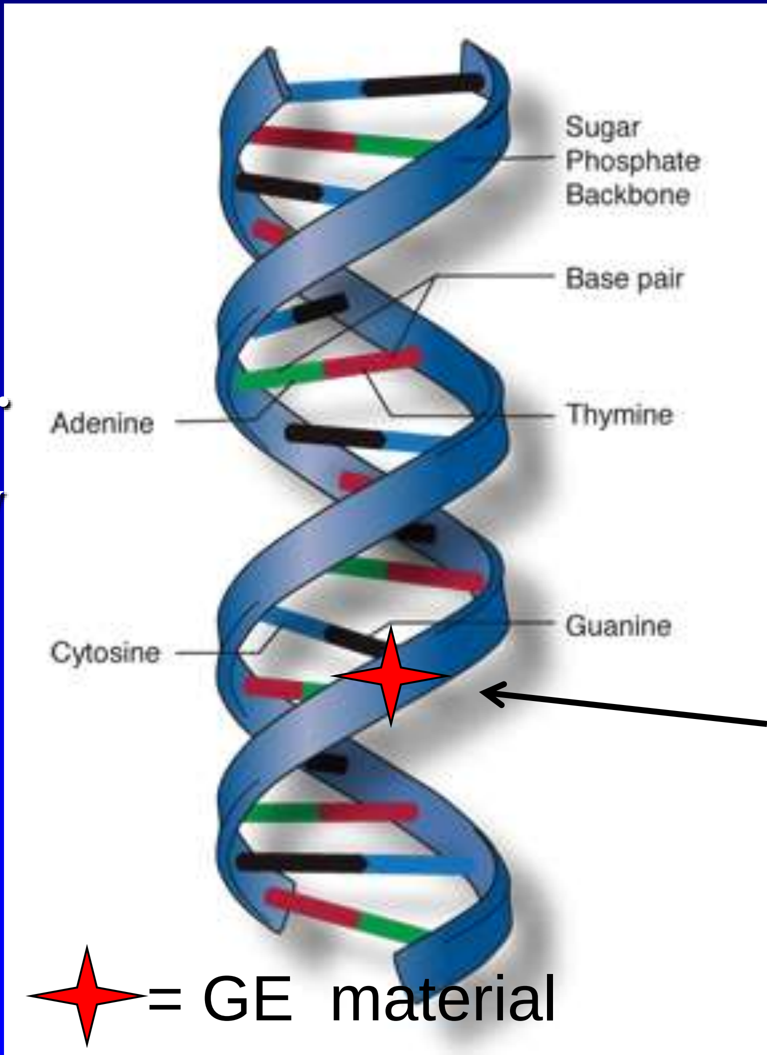
	RR Corn Hybrid			
Herbicide	6733HXR	6179VT3	5442VT3	5716A3
Surestart (11")	266*	216	223	219
Cadet (V6)	227	219	219	213
Laudis (V6)	224	218	214	214
Integrity (pre-E)	231	217	215	204
Glyphosate (V6)	212	207	206	210
Steadfast (V6)	207	204	201	196
Status (V6)	187	195	193	192

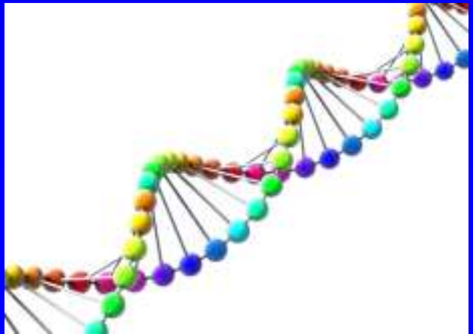
*125.6 % of glyphosate yield (yields in bu/a - rounded)

All plots were hand weeded

Genetic Engineering Impact on the Genetic Code

- The bases in DNA are cytosine, guanine, adenine and thymine so the code of DNA is written in C's, G's, T's and A's (codons).
- A & T are a "base pair" as are C & G.
- The code used in GM crops is radically changed from that of the recipient and also the named bacterial sources.
- GE changes the bases, spatial, amino acid, 'environmental' and internal relations.

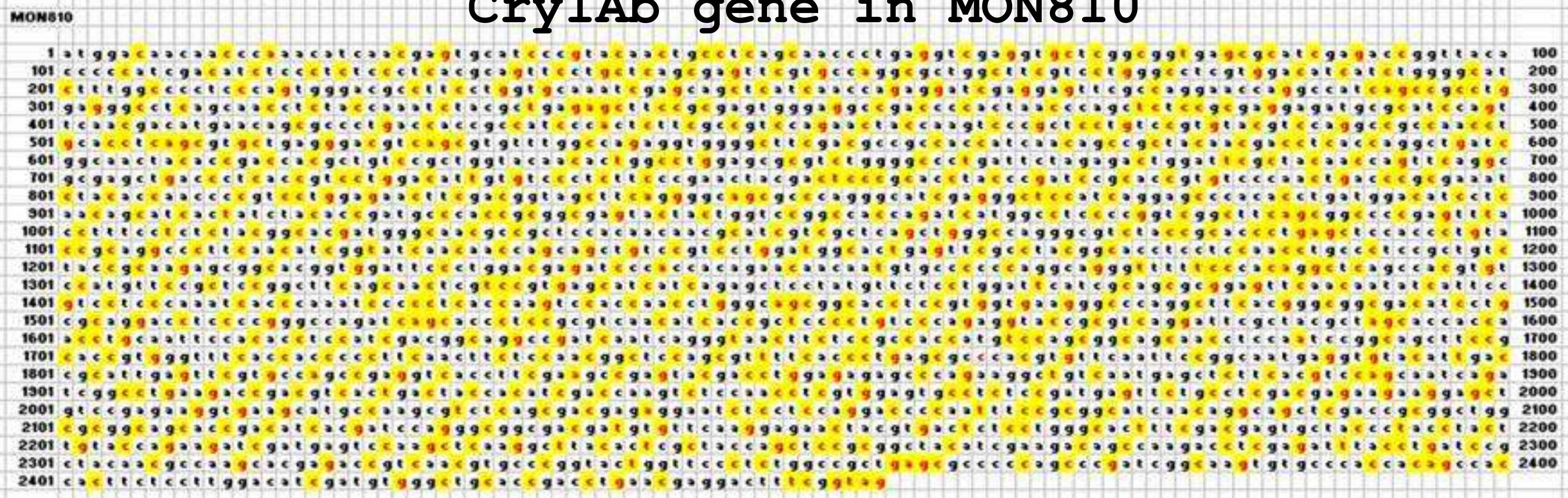




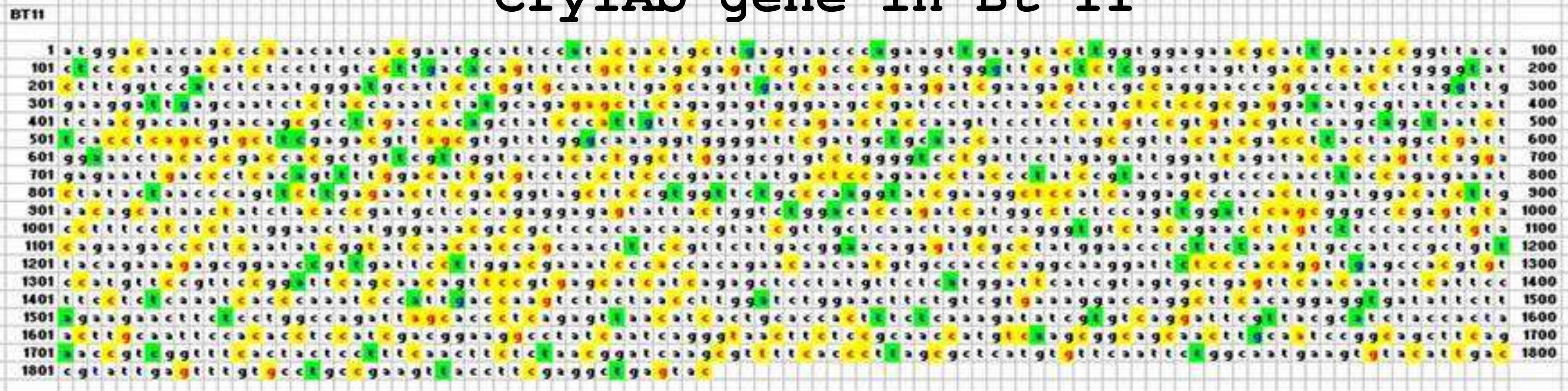
Codon Changes for Genetic Engineering Bt in Corn

[Every highlighted square represents a deliberately altered piece of genetic code]

Cry1Ab gene in MON810



Cry1Ab gene in Bt-11



Chronic Toxicity of GMO Crop or Roundup®

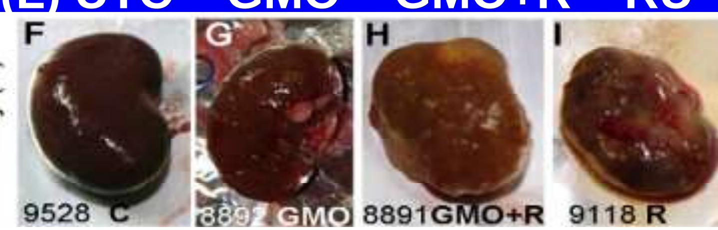
GMO and/or Roundup cause adverse health effects

- 50% males & 70 % females died prematurely
- (Tumors developed after 4-7 months vs 23 mo in control)
- Females = 2-3 X mammary tumors & pituitary disorders
- Males = kidney & skin tumors, liver & kidney damage
- All GMO and RU had digestive disorders

Livers (L) UTC; (R) GMO+R

Kidney damage (below)

(L) UTC GMO GMO+R RU



Mammary cancer: GMO, GMO+RU, RU @ (1 ppb)


BEE RESPONSIBLE!
Are honey bees in your spray area?
Find them at illinoisbees.com
Help preserve the honey and pollination industry of Illinois.

Effect of Tillage on Glyphosate Injury & Yield

Field History: 8 years Conservation Reserve Program

2 qt blyphosate burndown 2008

1 qt glyphosate on RR corn 2009

1 qt glyphosate burndown 2010

Mycotoxins in Straw and Grain

- ✓ *Fusarium* spp. act synergistically to cause death of glyphosate-treated plants
- ✓ Glyphosate-induced root colonization by *Fusarium* spp.
- ✓ Toxins (DON, ZEA) produced in roots are translocated to stem and grain - Well above 'clinically significant' levels!
- ✓ Toxin concentrations not always correlated with *Fusarium* damaged grain (FDG) - [Strobilurin fungicides increase mycotoxins]
- ✓ Head must be protected for 18 days (10 days after anthesis)

Deoxynivalenol and Zaeralenone Concentrations in plant parts

Toxin (ppm)	Grain	Chaff	Straw
Deoxynivalenol	4.7	16.9	3.5
Zaeralenone	4.4	42.9	55.5

Glyphosate & GMOs in IV feeding and *infant formula*

.12 PPM

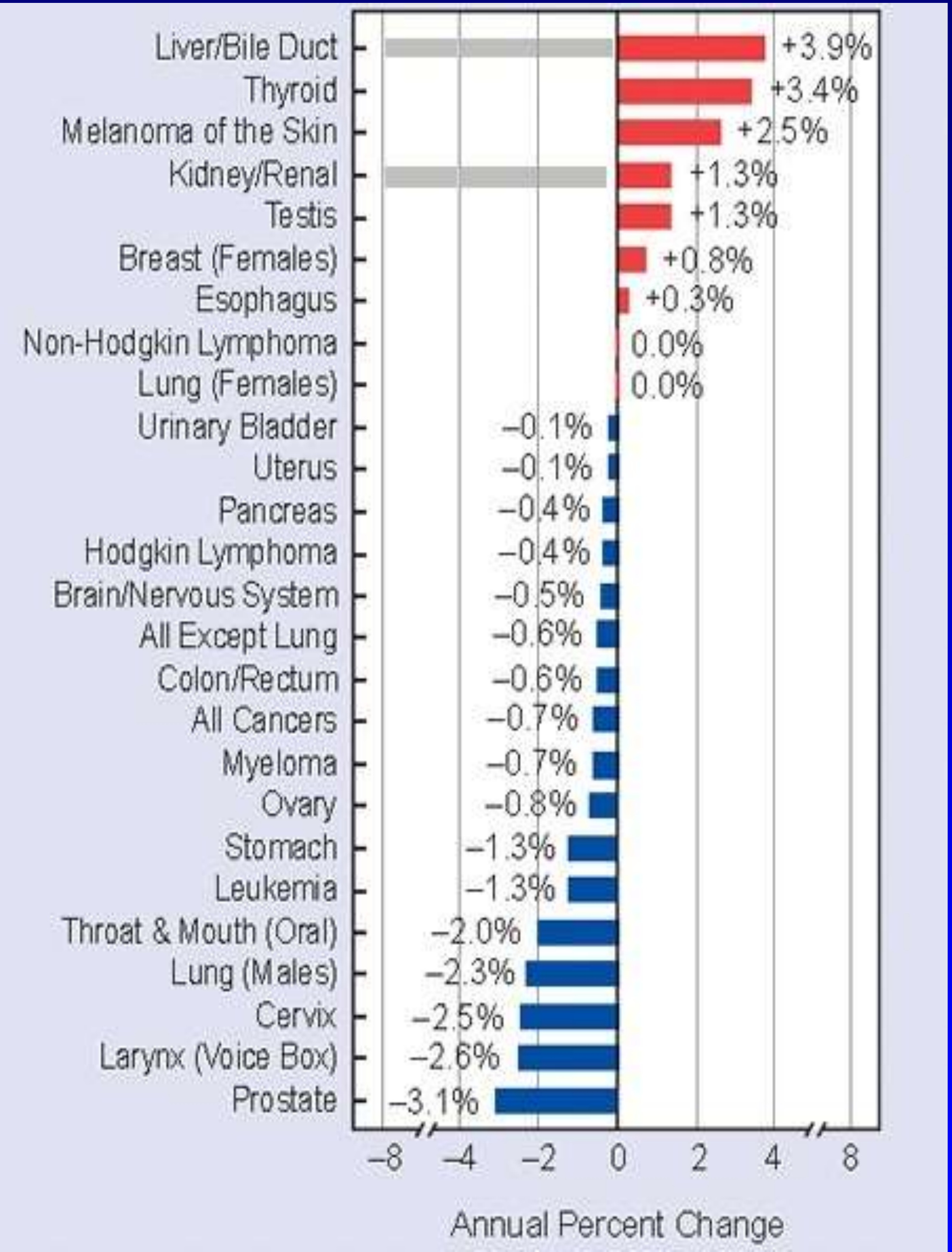
GMOs and Glyphosate Discovered in Kellogg's Froot Loops

Posted on Jan 29 2015 - 4:18pm by Sustainable Pulse

GMO Free USA today published the results of independent lab testing which documented that Kellogg's Froot Loops cereal contains high levels of insecticide-producing genetically engineered corn that is regulated by the EPA.

Birth Defects from Glyphosate in Feed

Annual % Change in Cancers



Target Tissues for glyphosate;

Liver

Kidney

Testicle

Hormone system

Bone (Ca, Mn chelation?)

Thyroid (Mn chelation?)

A Trojan Killer

Simple, subtle, and destructive of all things of value

When a company denies any responsibility

for* THEIR *product,

EVEN WHEN USED *in strict compliance*

with* THEIR *Label,

doesn't it tell you something

about both them and their product?

What the USDA Doesn't Want YOU to Know About GMO

- High chemical residue in food!
- Unknowns - what we don't know?
  - Mode of action
  - Safety
  - Remediation
- Increased diseases of crops, animals, humans
- Gene flow - soil, pollen, food, people

Other concerns (?)

- Damage to amphibians
- Killing bee populations
- Reproductive toxicity to many species
- Political misuse against domestic populations in the “War on Drugs”
- If these topics are completely new to you, then you should consider examining the following:
  - The size and weight of the rock that you are living under
  - How far you have your head buried under the sand
  - Media censorship that keeps you ignorant about issues that critically affect your life
  - Why you have placed blinders on yourself, insulating yourself from reality, despite the consequences
- All of the information in this presentation is readily and publically available

Congratulations to GLYPHOSATE

toxic chemical of the year!

Glyphosate—no chemical does more on a widespread basis to promote disease:

1. Inhibits cyp450 detoxification: Anything that blocks cyp450 by definition promotes xenobiotic accumulation and adverse drug effects

2. Genotoxic: Causes DNA damage in human cells even when massively diluted

3. Mitochondriopathic: In the combination of Monsanto's Roundup®, causes mitochondrial dysfunction per several in vitro studies, linked to nearly all diseases

4. Excellent tissue penetration: The added solvents, surfactants, and so-called inert chemicals help promote entry into cells

5. Carcinogenic: Activation of estrogen receptors stimulates growth of cancer cells in vitro; would be expected to promote growth of other cancer cells.

6. Estrogenic: Activation of estrogen receptors stimulates growth of cancer cells in vitro; would be expected to promote growth of other cancer cells, as well as promote autoimmunity.

7. Synergistic with GMO-promoted inflammation: Commonly applied to GMO corn which has been shown to promote proliferation of GammaDelta Tcells which promote allergy and autoimmunity, both of which would be exacerbated by 1) inhibition of detoxification, 2) genotoxicity, 3) mitochondrial dysfunction, and 4) estrogenic effects.

8. Unsurpassed political protection: Because of industry influence on politicians who have 1) no scientific training, and 2) receive pay-off money from the chemical industry, glyphosate is used in high doses internationally without concern for long-term effects, even when applied to fields, forests, water supplies and other ecosystems.

9. Widespread exposure via air and water: More than 75% of air and water samples in Mississippi USA are contaminated with glyphosate; that far exceeds the social acceptance of heroin, crack cocaine, tobacco use and second-hand smoke combined. No other chemical achieves such massive population-wide use.

10. Unsurpassed distribution to the population, routinely found in the food supply, especially soy: "GM-soy contains high residues of glyphosate and AMPA…" *Food Chemistry* 2014 Jun

Long-Term Toxicology of Roundup® & Roundup Tolerant Genes (Seralini et al, 2012)

- Protocol:
  - Two-year study - life expectancy of rats
  - Ten treatments with 20 rats each (10 male/10 female)
  - [UTC, 3 rates of Roundup®, GMO feed, GMO+Roundup]
  - Analysed blood & urine, necropsy at end of trial
- Results:
  - GMO and/or Roundup cause adverse health effects
  - 50% males & 70 % females died prematurely
  - (Tumors developed after 4-7 months vs 23 mo in control)
  - Females = 2-3 X mammary tumors & pituitary disorders
  - Males = kidney & skin tumors, liver & kidney damage
  - Digestive disorders

Effect of Glyphosate on *E. faecalis* & *C. botulinum*

After Krueger et al, 2011

*0.01 mg glyphosate ml^{-1}

Photos: Dr. M. Krueger

Birth Defects from Endochrine Hormone Disruption in Mammals

"Underbite and cleft palate are epidemic in human newborns. These malformations on human newborns are similar and comparable to underbites and cleft palate on other mammal young and to short upper bill and holes in the upper bills of hatchling birds. These malformations are definitive symptoms of disruption of the thyroid hormones during development in the womb or egg." (Hoy, 2011)

Tough Love Alternative to Spanking

When it comes to child discipline, most of us are looking for positive alternatives to spanking.

One that worked well when our child was having "one of those moments" was to take them for a car ride.

Some say it's the vibration from the car; others that its the time away from distractions such as TV, etc.

Either way, our kids usually calm down and behave after our car ride together.

Eye-to-eye contact helps a lot too as you can see from one of our sessions.

This works with grandchildren, nieces and nephews as well!

Effect of Late Application of Glyphosat

After E. Nafziger, Univ. Illinois, 2010

Role of Soil Pathogens in Response to Glyphosate

- *Fusarium* and *Pythium* readily colonized susceptible giant ragweed roots when treated with glyphosate
- Resistant Giant Ragweed in unsterile soil were killed by a 4x rate of glyphosate, yet susceptible biotypes were not killed with the same rate in sterile soil.
- Dry weight of susceptible biotypes treated with Ridomil Gold was not changed by glyphosate
- Resistant giant ragweed biotypes wer resistant to *Pythium*
- Glyphosate increased susceptibility to *Pythium*

Glyphosate susceptible biotype 4 DAT

Pythium Control | Pythium + glyphoste | Glyphosat control

Glyphosate treated

Susceptible biotype | Resistant biotype

Ridomil | Ck | Ridomil | Ck

Fungicide

Schafer et al, 2009, 2010

Some Plant Pathogens Increased by Glyphosate

Pathogen	Pathogen
Increased:	*Cercospora* spp.
Botryospheara dothidea	*Marasmius spp.*
Corynespora cassicola	*Monosporascus cannonbalus*
Fusarium spp.	*Myrothecium verucaria*
Fusarium avenaceum	*Phaeomoniella chlamydospora*
F. graminearum	*Phytophthora spp.*
F. oxysporum f. sp cubense	*Pythium spp.*
F. oxysporum f.sp (canola)	*Rhizoctonia solani*
F. oxysporum f.sp. glycines	*Septoria nodorum*
F. oxysporum f.sp. vasinfectum	*Thielaviopsis bassicola*
F. solani f.sp. glycines	*Xylella fastidiosa*
F. solani f.sp. phaseoli	*Clavibacter nebraskensis*
F. solani f.sp. Pisi	*Xanthomonas sterwartii*
Gaeumannomyces graminis	
Magnaporthe grisea	

("Emerging" and "reemerging diseases")

Abiotic: Nutrient deficiency diseases; bark cracking, mouse ear, 'witches brooms'

Goss' Bacterial Wilt of Corn, Midwest 2010

Ear Symptoms

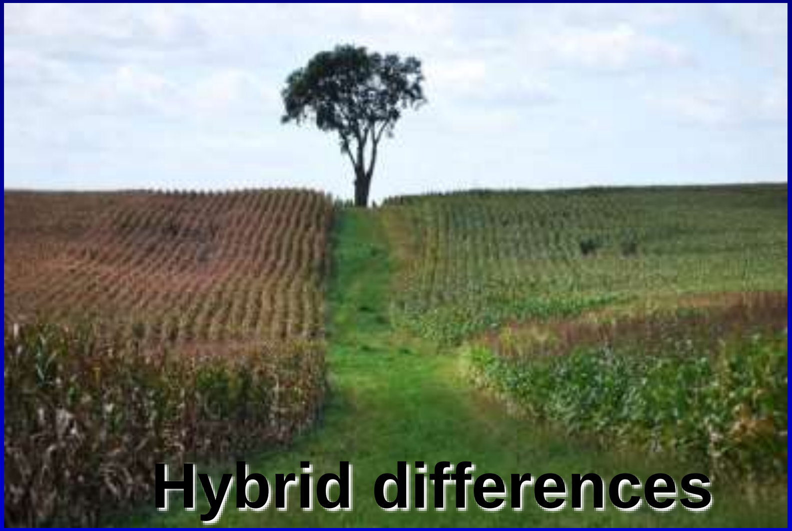



Goss' Bacterial Wilt of Corn, Midwest 2010

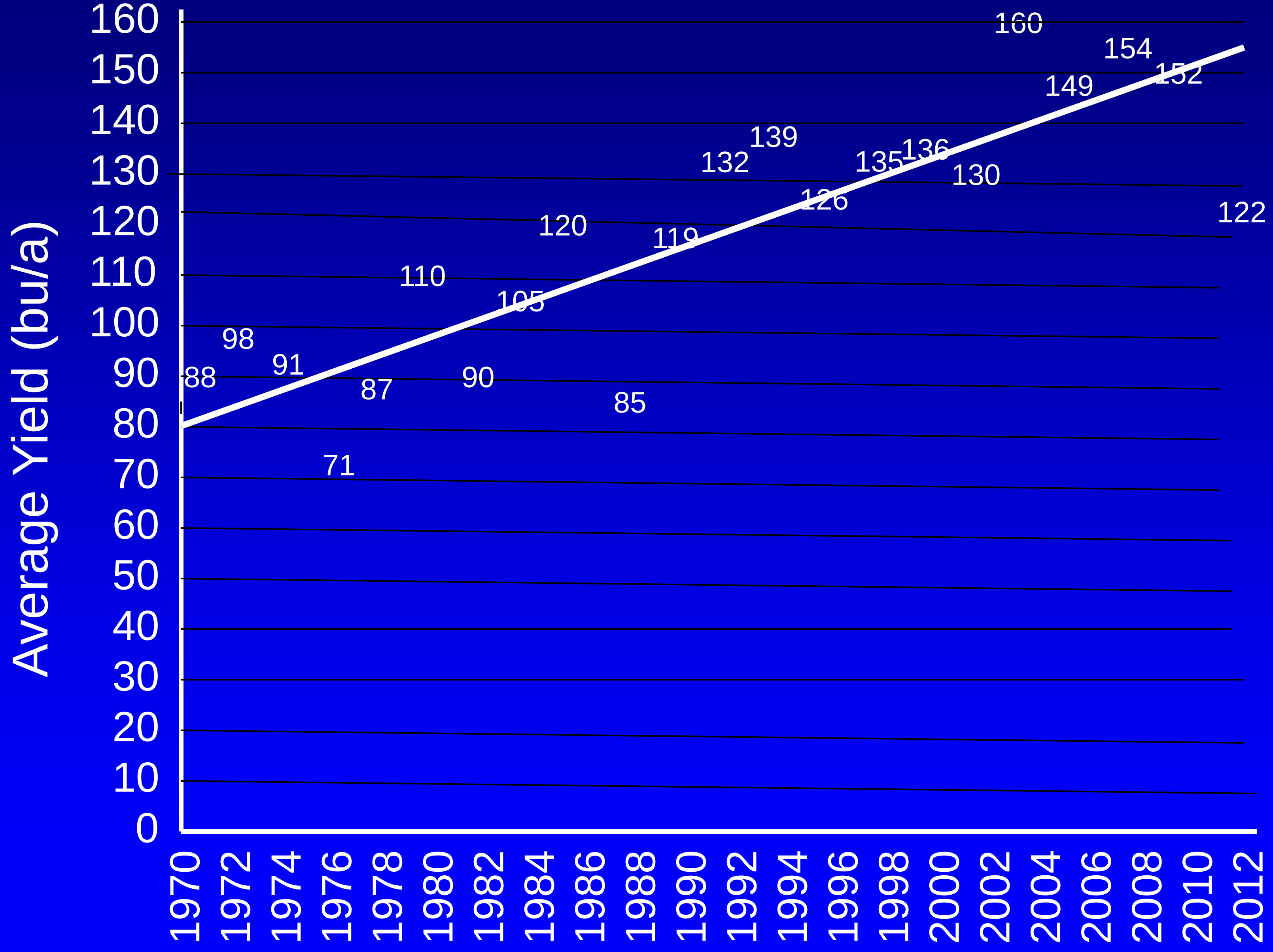
Root and Stalk Symptoms

Goss' Bacterial Wilt of Corn, Midwest 2010

Field and Plant Symptoms



U.S. Corn Yields By Year, USDA-NASS 01-2013



Fossil Science: Failed Promises

Genetic Engineering’s ‘Flat Earth’ Basis

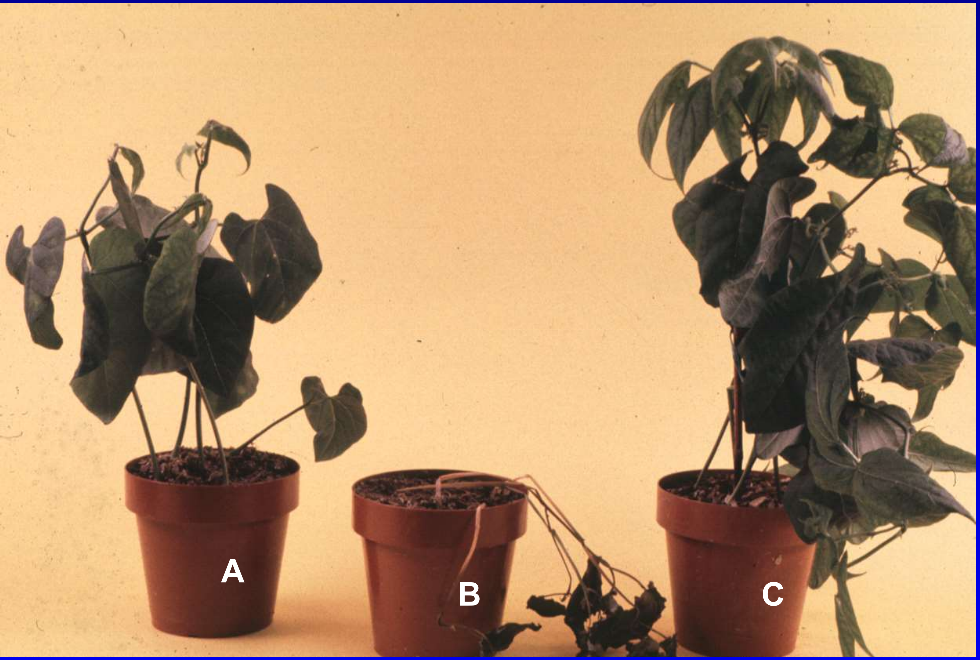
What You Should Get from this Presentation

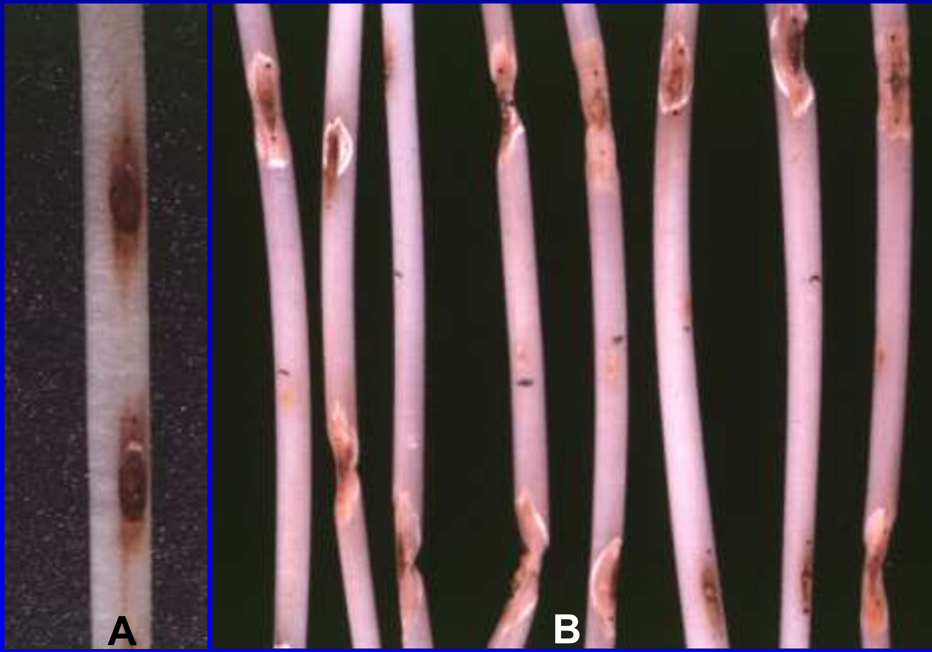
1. An appreciation for the interrelationships in Ag
2. How Pesticides work - Glyphosate
3. What genetic engineering is and isn‘t
4. Impact of GMO & glyphosate on soil health
5. Impact on plant health
6. Impact on animal helath
7. Impact on human health
8. Remediation approaches
9. The future

Agriculture is THE basic infrastructure of society

Herbicide action is by soil-borne fungal pathogens

Glyphosate Increases Disease Susceptibility





Glyphosate Sterile soil | **Glyphosate Field soil** | **No glyphosate Control**

Effect of glyphosate on susceptibility to anthracnose. A) hypersensitive response; b) non-limited response after glyphosate is applied.

After Rahe and Johal, 1988; 1990

Some Plant Pathogens Increased by Glyphosate

Corynespora cassicola
Fusarium spp.
Phytophthora spp.
Pythium spp.
Rhizoctonia solani
Thielaviopsis bassicola
Xylella fastidiosa
Myrothecium verucaria
F. solani f.sp. Pisi
Gaeumannomyces graminis
Magnaporthe oryzae

("Emerging" and "reemerging diseases")

Fungal Mn oxidation in soil (increased virulence)

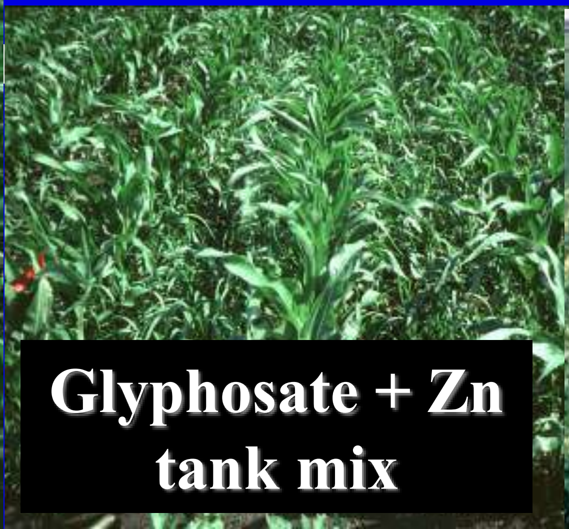
Abiotic: Nutrient deficiency diseases; bark cracking, mouse ear, 'witches brooms', drought stress, chill damage

Understanding the Characteristics of Glyphosate
Glyphosate has Changed Agriculture for 30+Years

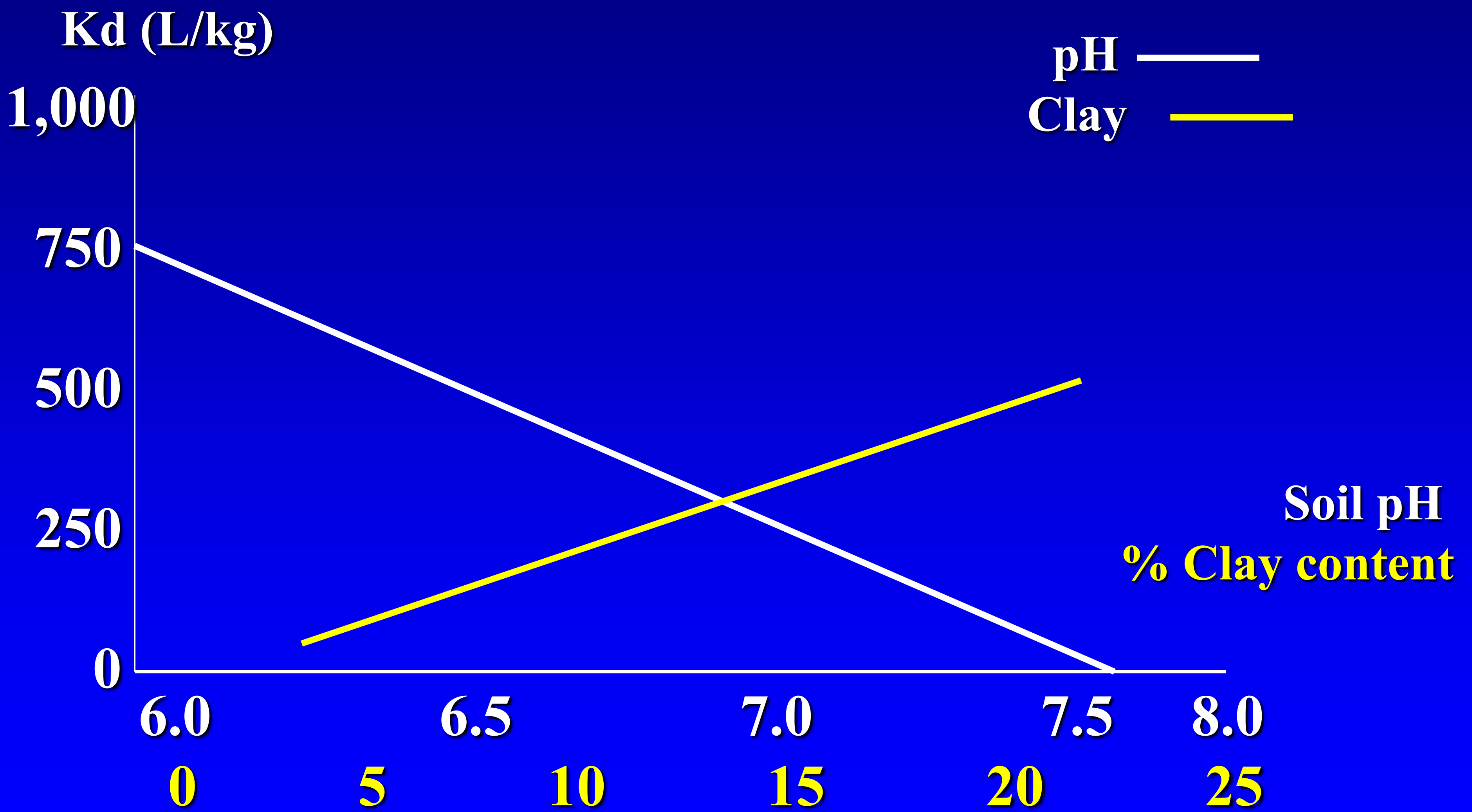
- **A strong chemical chelator**
  - **Chelates minerals in the spray tank**
  - **Chelates minerals in the plant**
  - **Chelates minerals in the soil**
  - **Reduces: B, Co, Cu, Fe, K, Mg, Mn, Ni, Zn**

Chelating stability constants of glyphosate

Metal ion	$\frac{[ML]}{[M][L]}$	$\frac{[MHL]}{[M][H][L]}$	$\frac{[ML_2]}{[M][L_2]}$
Mg^{2+}	3.31	12.12	5.47
Ca^{2+}	3.25	11.48	5.87
Mn^{2+}	5.47	12.30	7.80
Fe^{2+}	6.87	12.79	11.18
Cu^{2+}	11.93	15.85	16.02
Fe^{3+}	16.09	17.63	23.00



Effect of pH on Soil Sorption of Glyphosate
(After Farenhorst et al, 2009)



Glyphosate kd values = 19 - 547; 2,4-D kd values = 0.12 - 2.61

Mn Oxidation/Reduction in Soybean Rhizosphere Soil

Fungal Mn oxidation in soil (increased virulence)

Manganese Oxidation in Soybean Rhizosphere

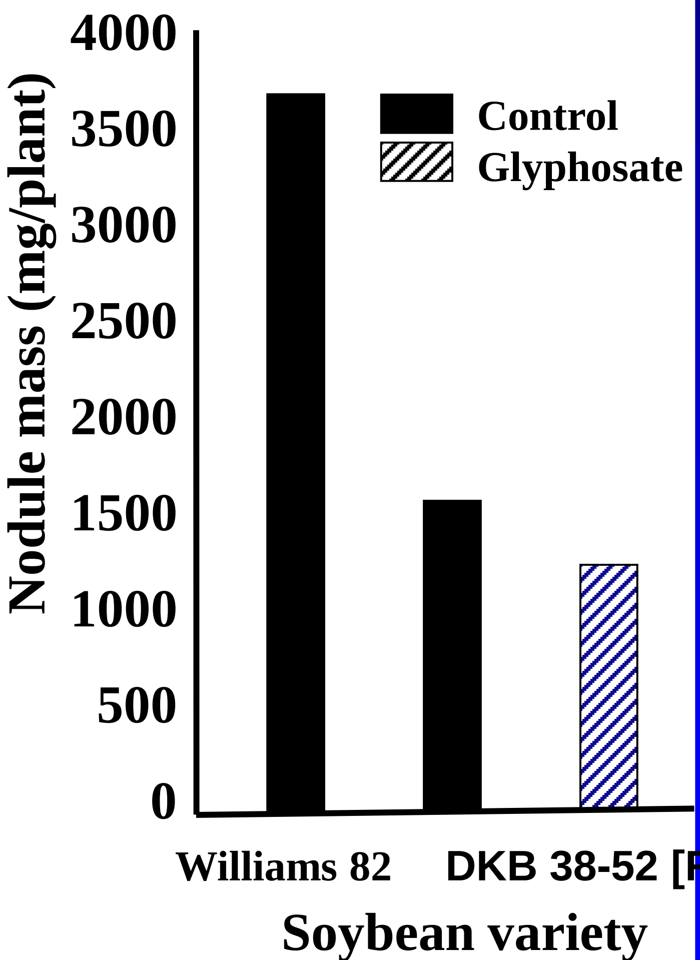
- In soybean rhizosphere soil (3 wks after glyphosate applied):

	Mn Reducing Organisms	Oxidizing Organisms
Control (no glyphosate)	7,250*	750
+ Glyphosate	740	13,250

*Colonies per gram of soil

Effect of the RR Gene & Herbicide on Root Nodule Mass

After Kremer & Means, 2009



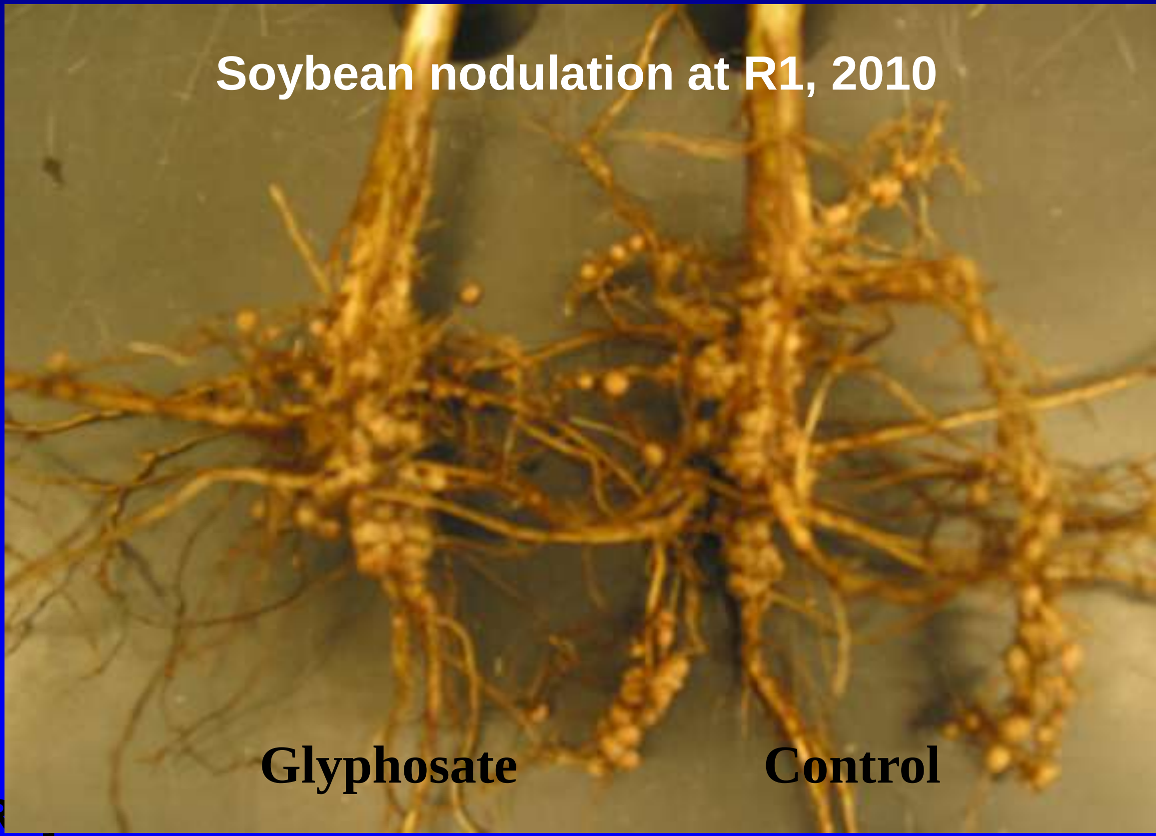


Photo by R. Kremer

Effect of Residual Glyphosate on RR2Y Soybeans, 2010*

Scenarios - Substrates & glyphosate release from grass roots; soil fungi proliferate on grass AND soybean seedling roots; effects of soil residual glyphosate.

2010 Soybean (Osage County, MO)

* Asgrow RR2Y

After Kremer, 2010

Role of Soil Pathogens in Response to Glyphosate

In Inoculated and Sterile Soil

Glyphosate susceptible biotype 4 DAT

Pythium Control | Pythium + glyphoste | Glyphosate control

Glyphosate treated in Field Soil

Susceptible biotype | Resistant biotype

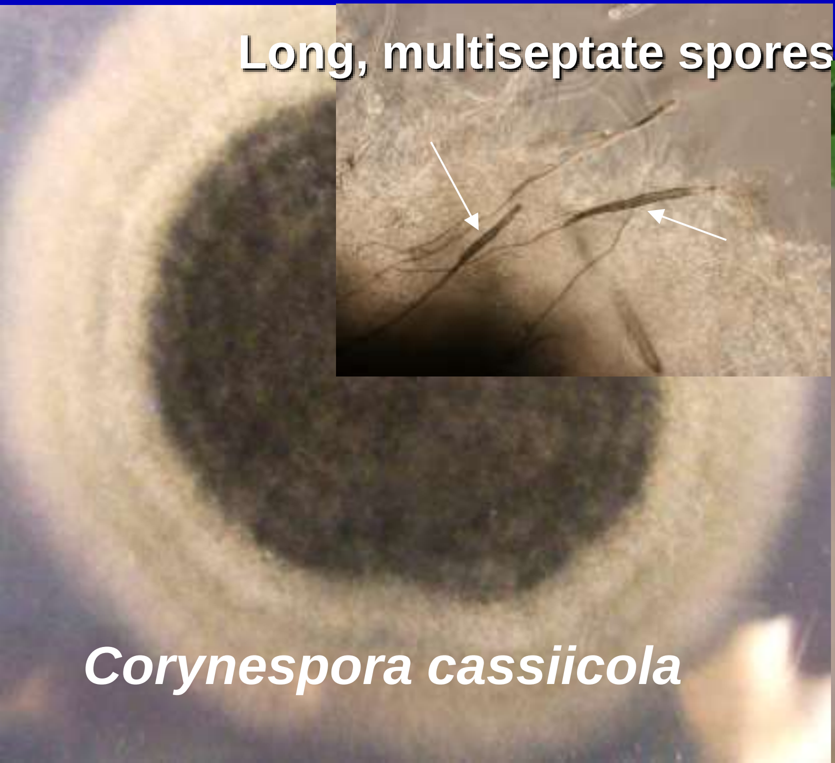
Ridomil | None Ck | Ridomil | Ck

Fungicide Treated

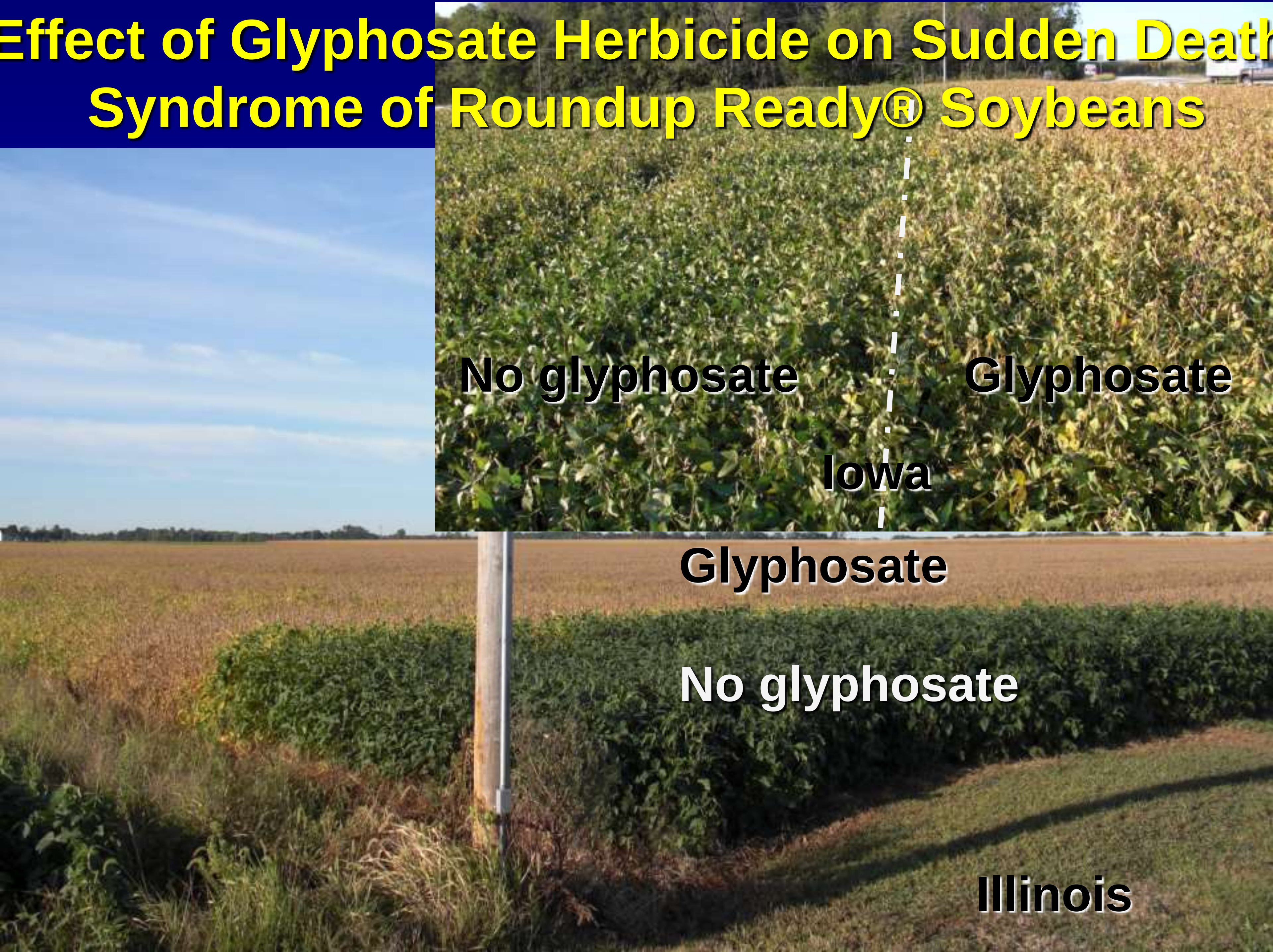
Effect of fungicide on Glyphosate-susceptible and Glyphosate-tolerant Lines

Corynespora Root Rot

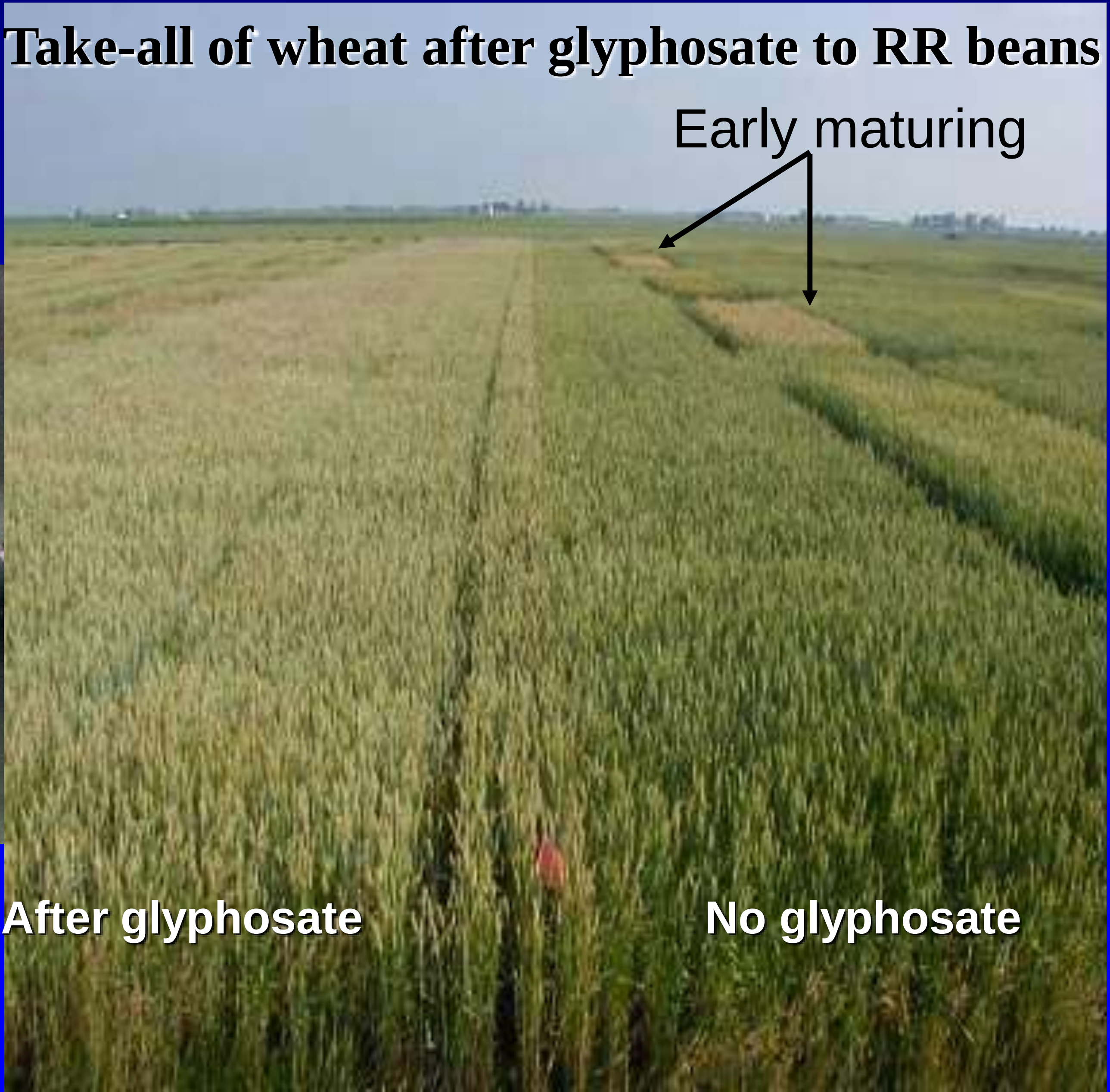
- An extensive dark brown to black rotting of small lateral roots
- Generally considered a root "nibbler"
- Especially severe when glyphosate is applied to near-by weeds
- Especially severe when glyphosate is applied to the plant



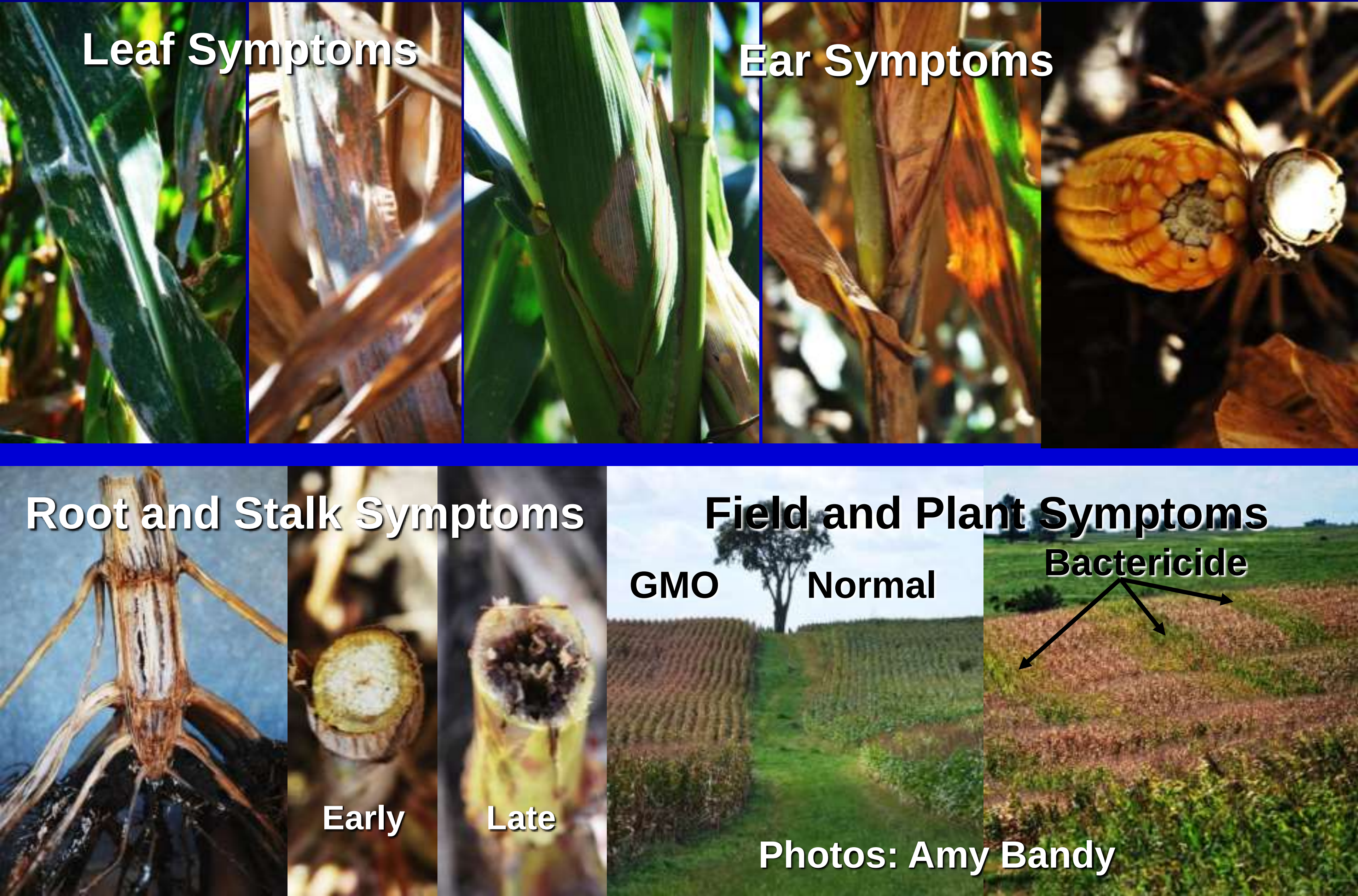
Effect of Glyphosate Herbicide on Sudden Death Syndrome of Roundup Ready® Soybeans



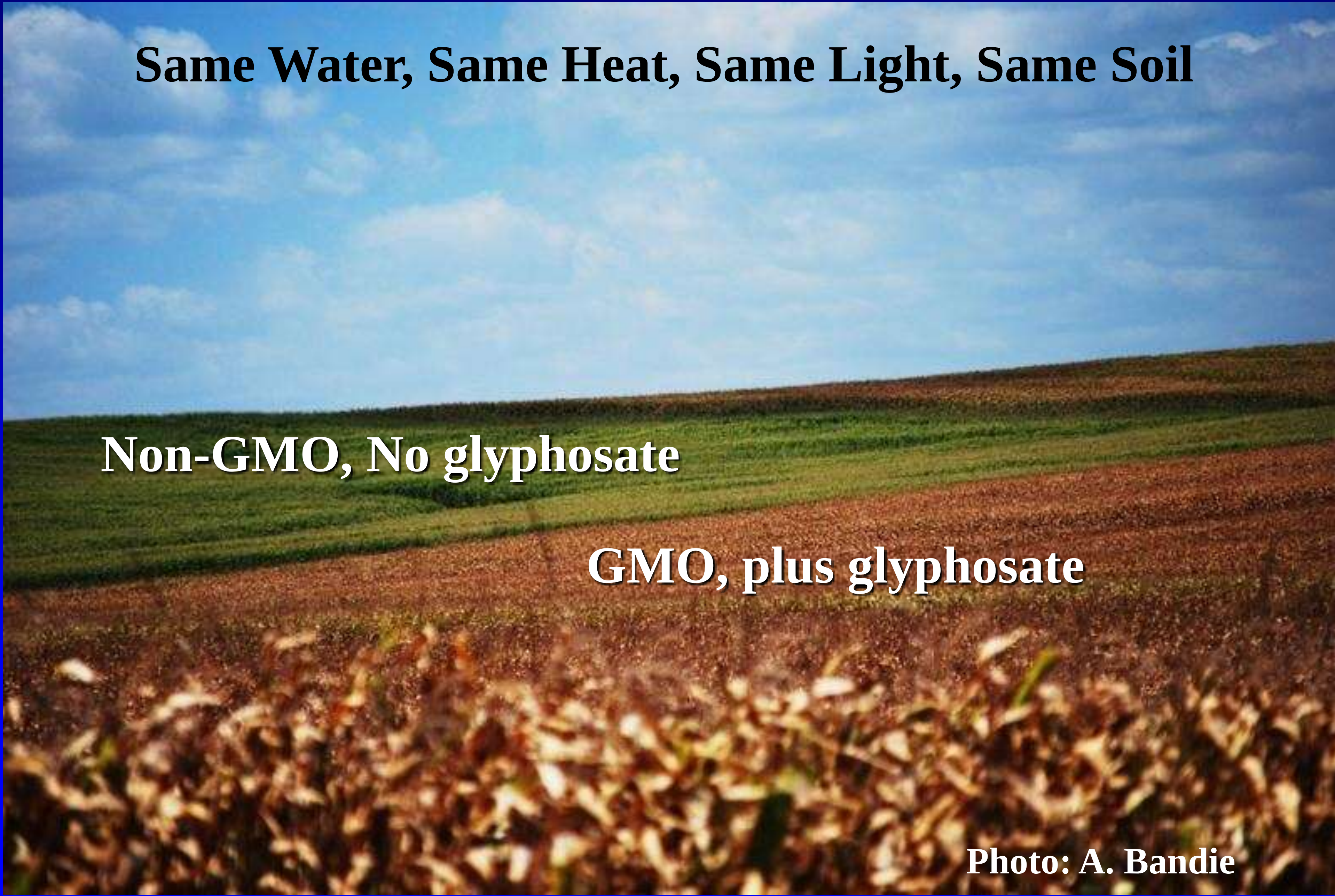
Impact of Glyphosate on Take-all



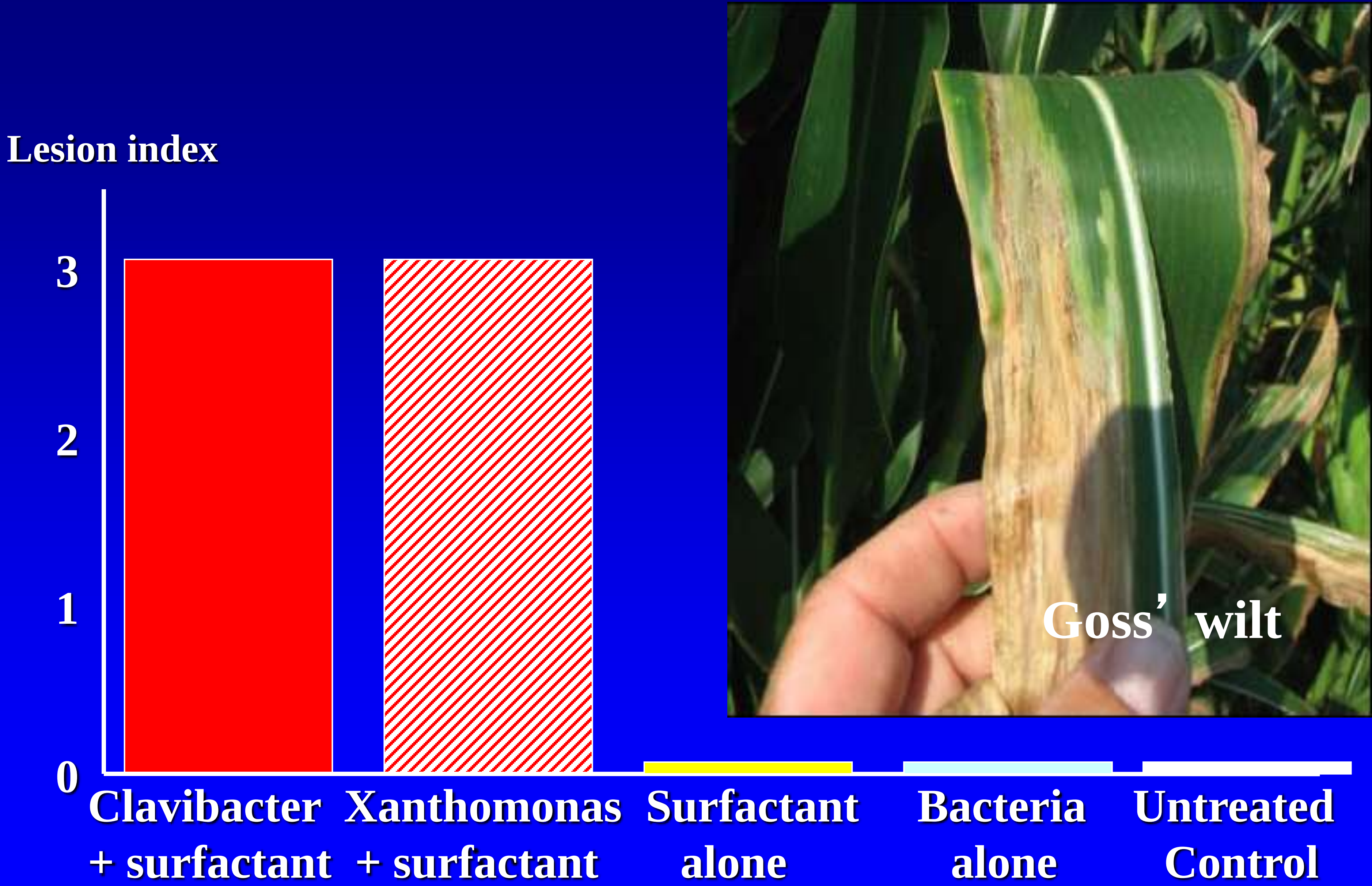
Goss' Bacterial Wilt of Corn, Midwest 2010

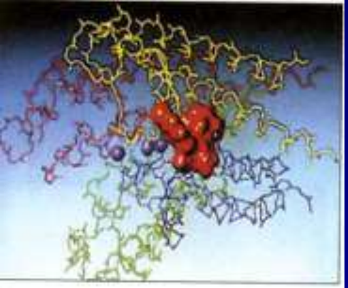


A Rose Amongst the Thorns - Goss' Wilt, 2010



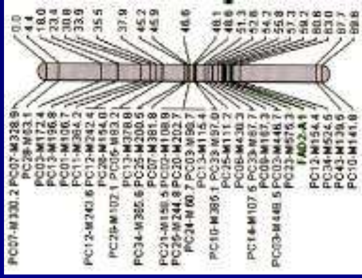
Effect of Surfactants on Goss' & Stewart's Wilt*





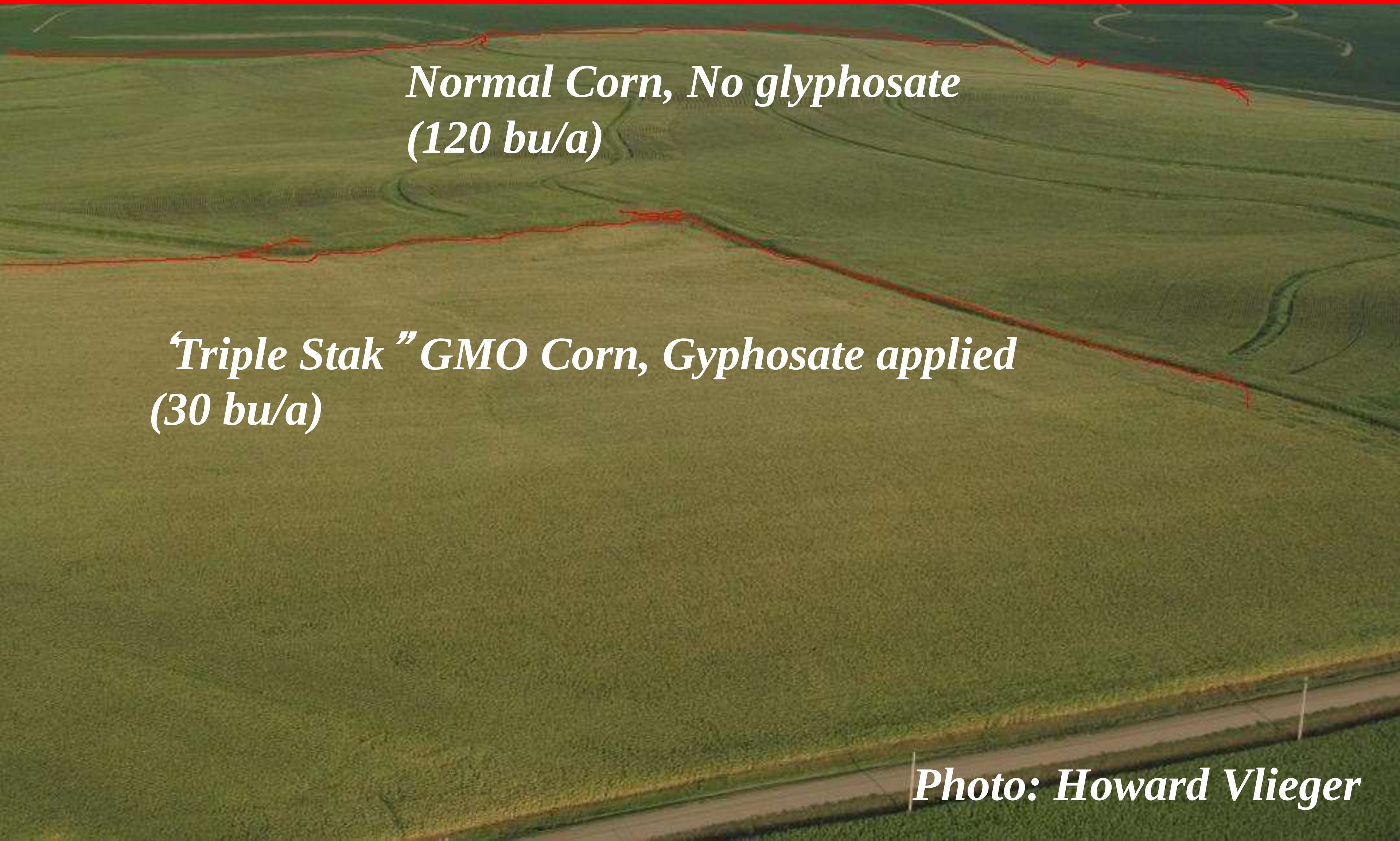
GMO for Glyphosate Tolerance

(Roundup Ready® Genes)



- The technology inserts alternative EPSPS genes (not blocked by glyphosate in *mature* tissue
- **More like a virus infection than plant breeding!**
- **Nothing in the RR plant affects the glyphosate applied to the plant!**
  - **Reduces nutrient uptake and function**
- **Causes a "Yield Drag"**
- **Glyphosate is there for the life of the plant**
- **Inserted "genes" are promiscuous**

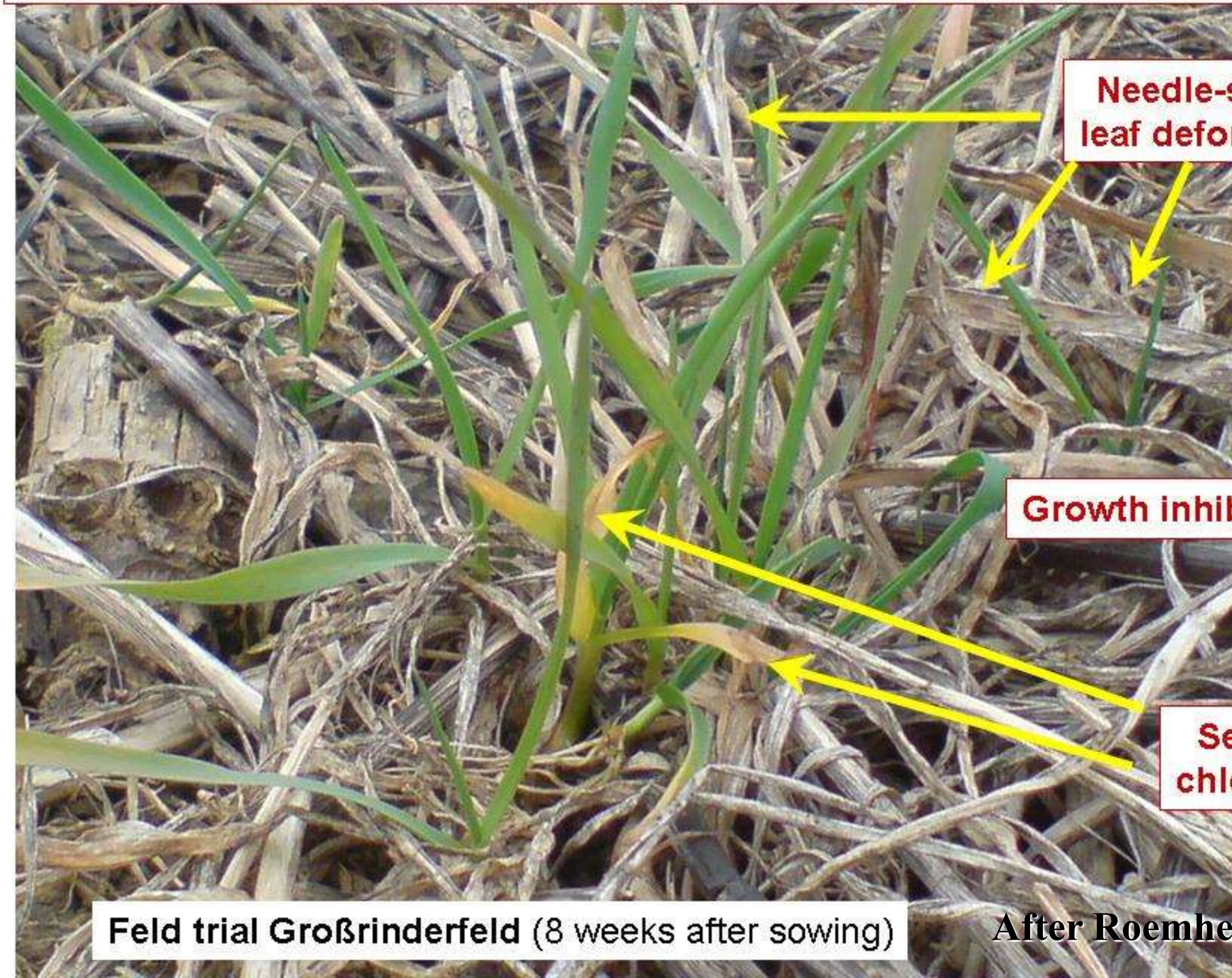
Drought Tolerance of GMO versus Normal Corn, Western Iowa, 2012



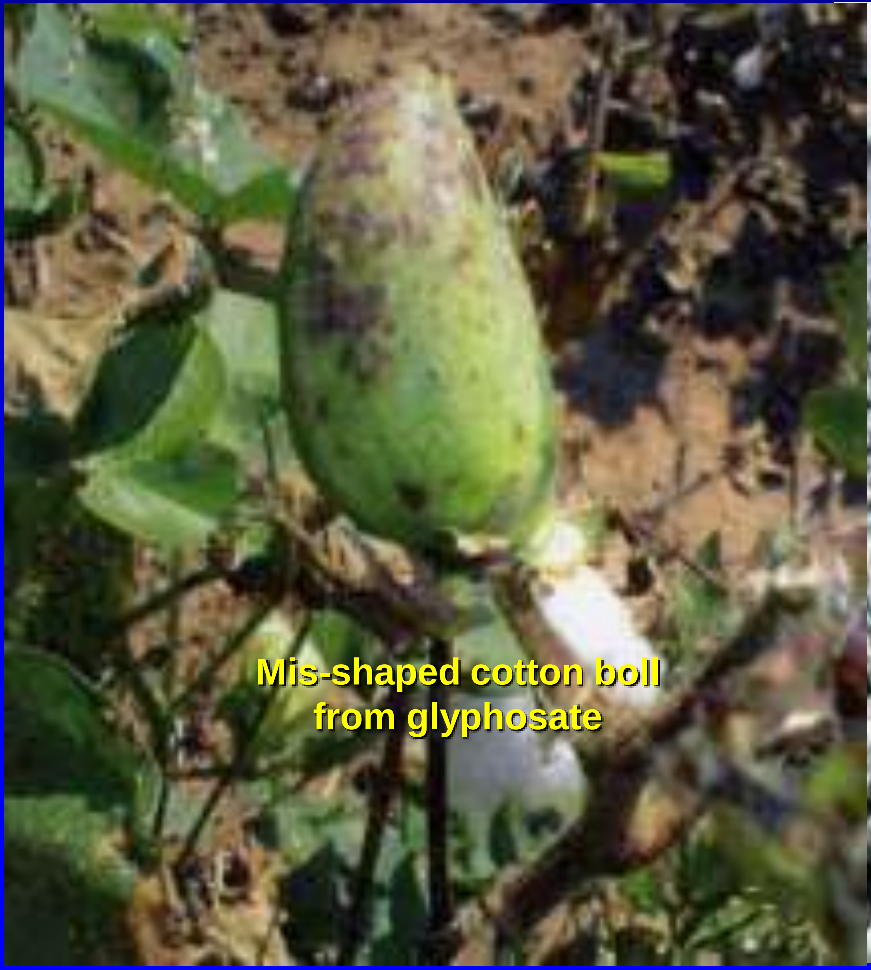
Importance of High Nutrient Seed

After Andre Comeau, 2008

Close up of field symptoms of plant damage in treatments with short waiting times (1 d) after Glyphosate pre-crop application



Poor Boll Retention, Sterile Locules in RR Cotton. WHY?

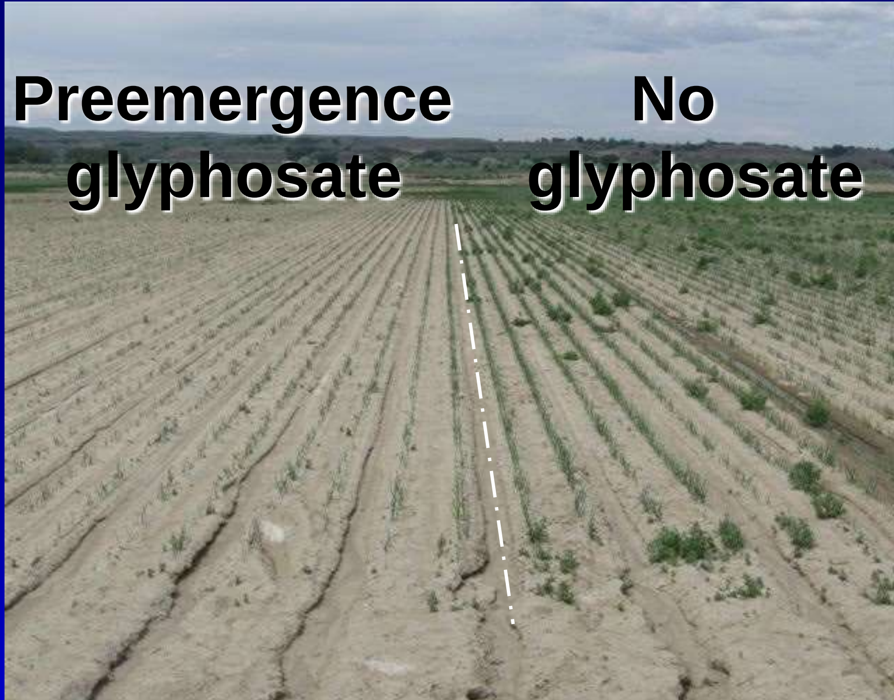


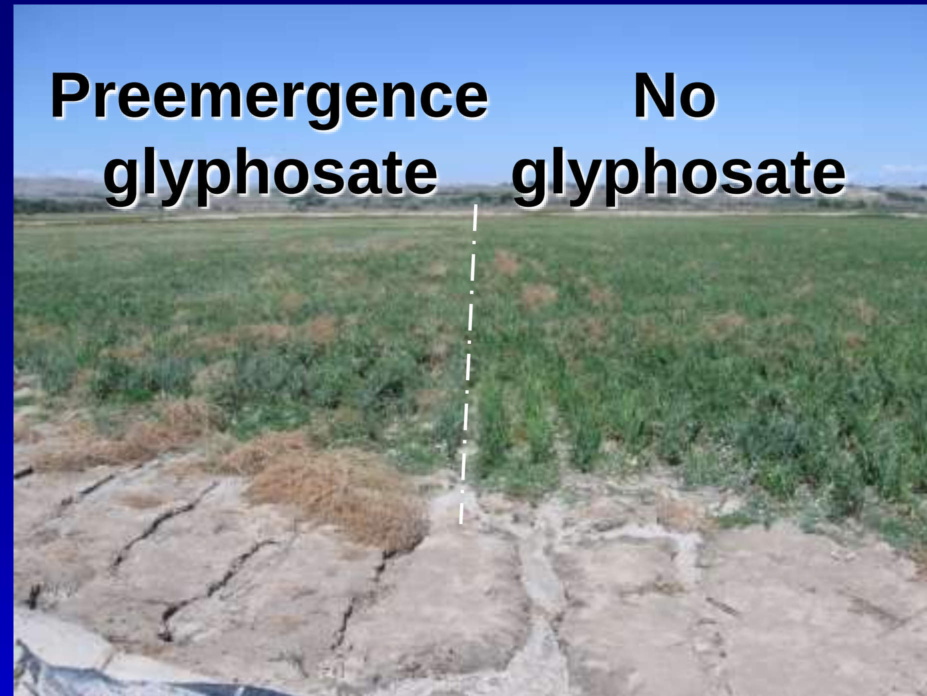
Disruption of Plant Hormones by Glyphosate*

	Hormone			
Treatment	Indole acetic acid	Gibberellic acid	Cytokinin	Abscisic acid
Untreated	100 %	100 %	100 %	100 %
Roundup®	4 %	32 %	20 %	183 %
MegaGro**	497 %	103 %	250 %	60 %
RU+MegaGro	47 %	50 %	53 %	112 %

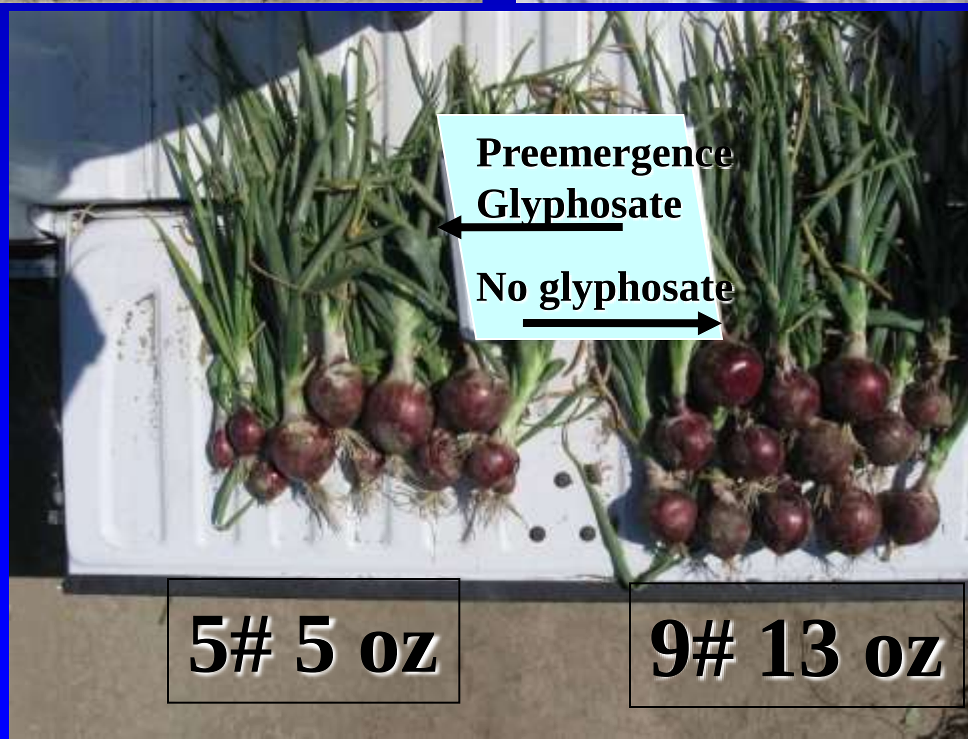
*Research by LT Biosyn., Riverwoods, IL

**Natural plant growth stimulant





Poor



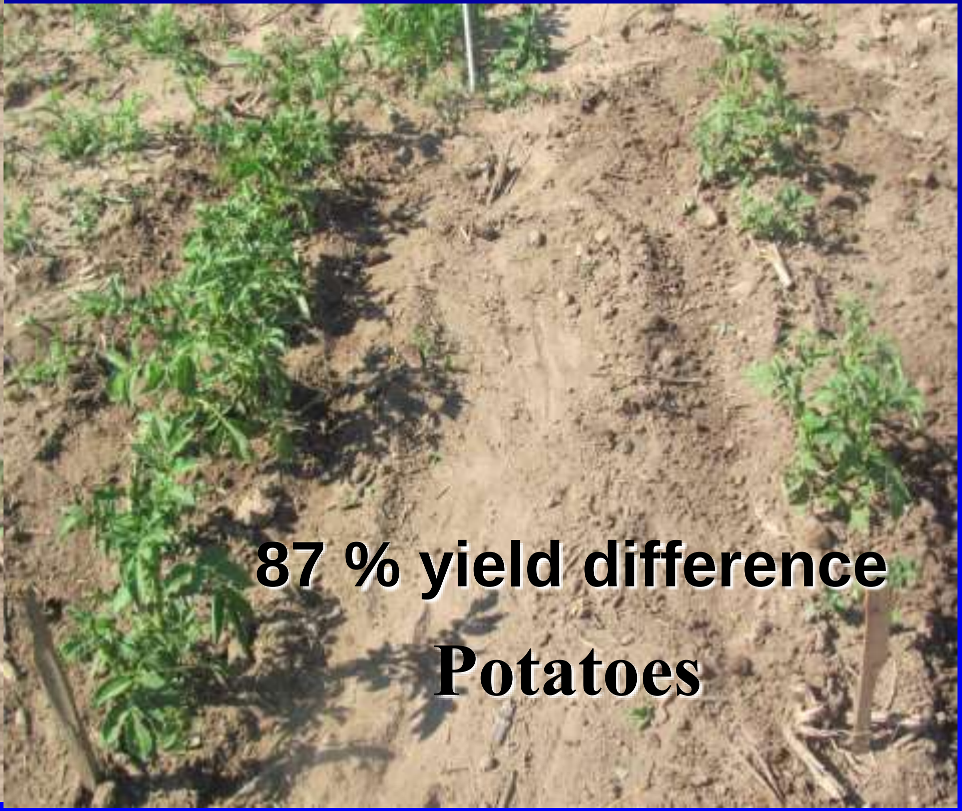
Bulking

Failure to ‘Bulk’ of Russet Potatoes

Glyphosate frequency	How applied	No. growers	% Potatoes over 10 oz
None in the previous 2 yrs	None	5	35.3
1-2 in the previous 2 yrs	Burn down	17	20.2
Preceding year	RR crop	5	5.4
	Total #:	27	Ave : 20.3

Effect of Residual Glyphosate in Soil on Plant Growth

- Soybeans and potatoes on the left side were planted after hand weeding;
- Soybeans and potatoes on the right side were planted six days after glyphosate was applied to hand weeded soil.



After Olson, 2011

Effect of Glyphosate on Roundup Ready® Corn

Colorado State University, 2007

Mike Bartolo, Sr. Res. Scientist

Treatment	% grain moisture	Yield (bu/a)	% of control
Untreated*	15.6	234 a	100
Glyphosate**	15.6	195 d	83
Glyphosate + Zn, Mn	15.6	221 b	94
Glyphosate + Mn, Zn, Fe, B	15.6	208 c	89

*Hand weeded, **1 lb a.i. + 1 pt AMS per acre

Notes: UTC = genetic potential (with RR gene)

Glyphosate reduces genetic potential 39 bu/a

Application of high Mn & Zn recovers some genetic potential, lower Mn & Zn recovers less

Response of Roundup Ready® Corn to Zn & Mn, 2007*

NDSU Carrington

Treatment	Yield (bu/a)
Glyphosate control	144
Zn seed Treatment	156
Foliar applied Zn	158
Foliar applied Zn+Mn	173
Seed + Foliar Zn	175
Soil granular Zn sulfate	167

* All treatments received glyphosate

Yield Response of Roundup Ready® Soybeans to Micronutrients

Treatment	Indiana	Michigan	Kansas	Wisconsin
	---------------Yield (bu/a)------------------			
Untreated	46	24	77	33
Glyphosate only	57	33	65	8
Glyphosate + Micronutrient	75 Mn	56 Mn	78 Mn	19 Fe

Effect of Glyphosate on Roundup Ready® Corn

Colorado State University, 2007

Mike Bartolo, Sr. Res. Scientist

Treatment	% grain moisture	Yield (bu/a)	% of control
Untreated*	15.6	234 a	100
Glyphosate**	15.6	195 d	83
Glyphosate + Zn, Mn	15.6	221 b	94
Glyphosate + Mn, Zn, Fe, B	15.6	208 c	89

*Hand weeded, **1 lb a.i. + 1 pt AMS per acre

Notes: UTC = genetic potential (with RR gene)

Glyphosate reduces genetic potential 39 bu/a

Application of high Mn & Zn recovers some genetic potential, lower Mn & Zn recovers less

Response of Roundup Ready® Corn to Zn & Mn, 2007*

NDSU Carrington

Treatment	Yield (bu/a)
Glyphosate control	144
Zn seed Treatment	156
Foliar applied Zn	158
Foliar applied Zn+Mn	173
Seed + Foliar Zn	175
Soil granular Zn sulfate	167

* All treatments received glyphosate

Glyphosate Resistant Weeds

It starts this way >>>>> and >>>>> Develops into this

Failed Promises of Touted Benefits

- ✓ Higher yields
- ✓ Fewer pesticides
- ✓ Less post-harvest loss
- ✓ Improved N-fixation
- ✓ Drought and salt tolerance
- ✓ Increased photosynthesis
- ✓ Greater root growth & function
- ✓ Disease resistance
- ✓ Lower risks (economic)
- ✓ Lower cost
- ✓ Greater safety
- ✓ Simpler management – resistant weeds & pests

BETRAYAL OF THE PUBLIC TRUST

Detoxifying Glyphosate

- **In meristematic/reproductive tissues**

  Ca, Mn, Si+Mn, Mn+Cu, Zn, Mn+Zn, Ni

- **In root exudates in soil**

  Broadcast:

  Gypsum

  In furrow (or stem drench) t

  Gypsum (CaSO4)

  Manganese

  Ca + Mn

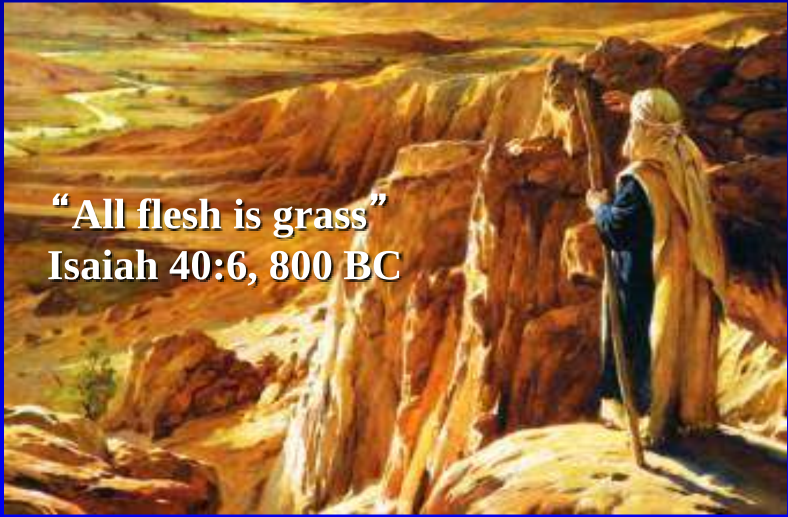
  Nickel, Zinc

Effect of in-furrow treatments on Soybean tissue Mn

Treatment	Rainfed	Irrigated
Lime	32a	29a
Gypsum	38b	36b

% Reduction in Alfalfa Nutrients by Glyphosate*

Nutrient	% reduction compared with Non-RR
Nitrogen	13 %
Phosphorus	15 %
Potassium	46 %
Calcium	17 %
Magnesium	26 %
Sulfur	52 %
Boron	18 %
Copper	20 %
Iron	49 %
Manganese	31 %
Zinc	18 %



*Third year, second cutting analysis; Glyphosate applied one time in the previous year

% Mineral Reduction in Tissue of Roundup Ready® Soybeans Treated with Glyphosate

Plant tissue	K	Ca	Mg	Fe	Mn	Zn	Cu
Young leaves	16	40	28	7	29	NS	NS
Mature leaves	4	30	34	18	48	30	27
Mature grain		26	13	49	45		

Reduced:

Yield 26%

Biomass 24%

After Cakmak et al, 2009

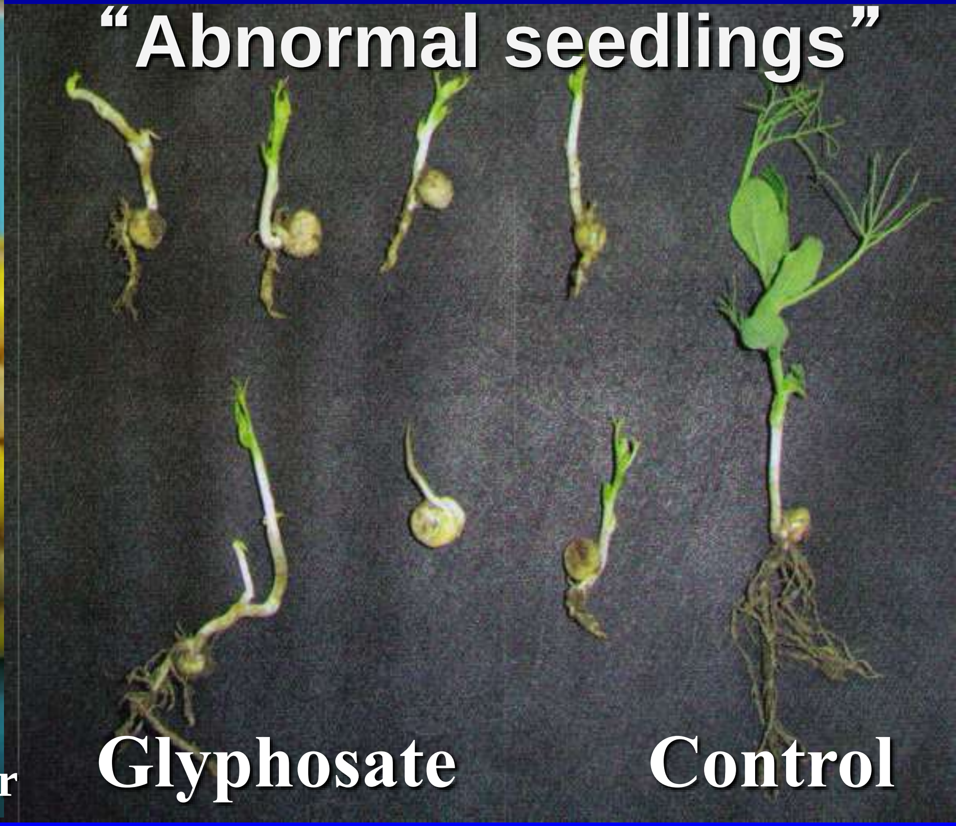
Some SYMPTOMS of Glyphosate Damage

(Sub-herbicidal depending on rate and exposure time)

- ✓ Low vigor, stunting, slow growth
- ✓ Leaf chlorosis (yellowing) - complete or between the veins
- ✓ Leaf mottling - sometimes with necrotic flecks or spots
- ✓ Leaf distortion - small, curling, strap, wrinkling, 'mouse ear'
- ✓ Abnormal stem proliferation ('witches broom')
- ✓ Bud, fruit abortion
- ✓ Retarded regrowth after cutting (alfalfa, perennial plants)
- ✓ Lower yields, lower mineral value
- ✓ Predisposition to infectious diseases - NUMEROUS!
- ✓ Predisposition to insect damage
- ✓ Induced abiotic diseases - drought, winter kill, sun scald
- ✓ Root stunting, poor growth, inefficient N-fixation and uptake
- ✓ Bark cracking

after Univ. of Hawaii; Univ. of Connecticut, Ohio State University

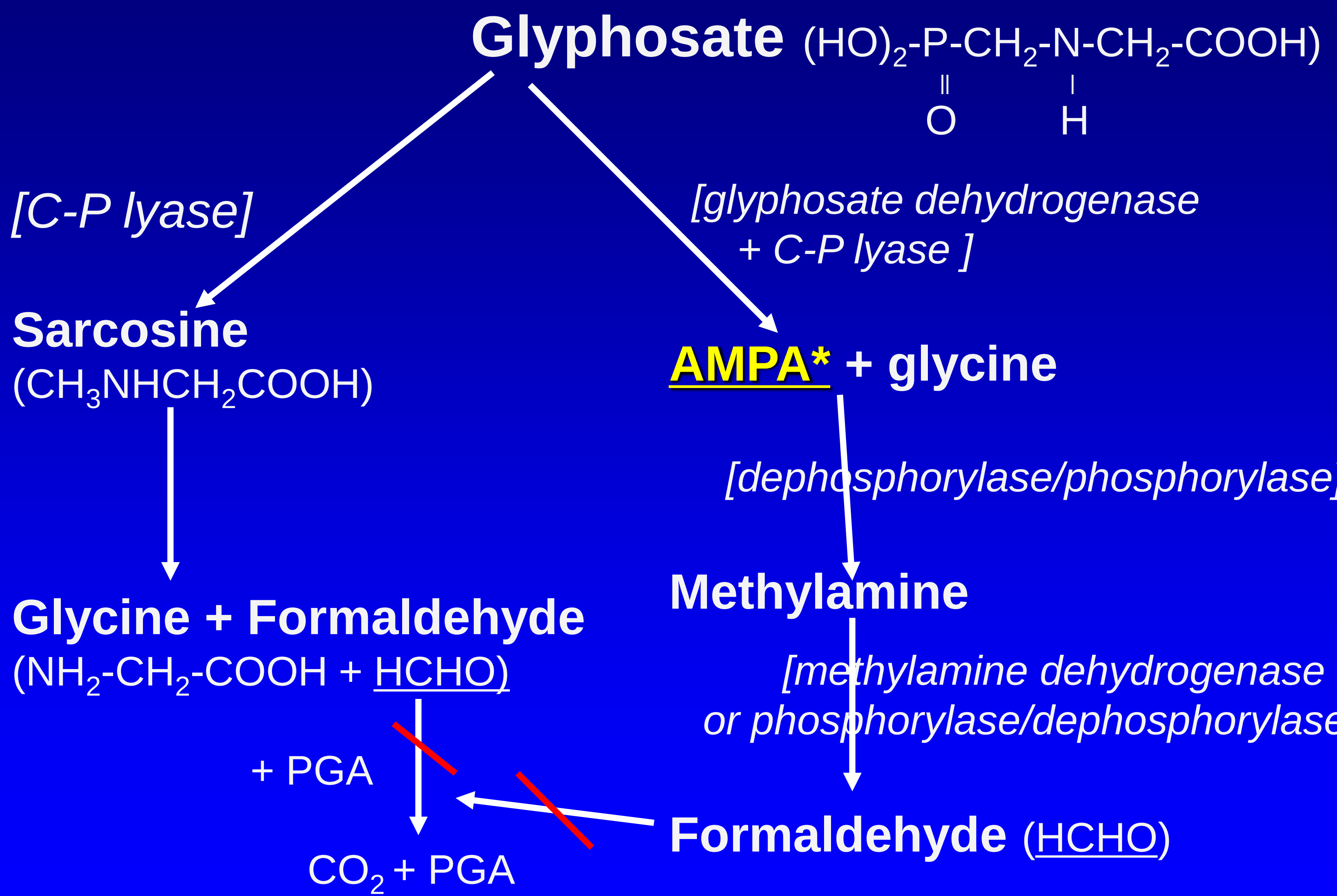
"98 Reasons Not to Use Glyphosate"
North Dakota Seed Guide, 2013



Nutrient Density of GMO & Non-GMO Corn, Iowa, 2012

Nutrient	GMO	Non-GMO	Nutrient	GMO	Non-GMO
Glyphosate	13	0	Mn	2	14
Formaldehyde	200	0	Fe	2	14
Test Wt.	57.5	61.5	Zn	2.3	14.3
N	7	46	Cu	2.6	16
P	3	44	Co	0.2	1.5
K	7	113	Mo	0.2	1.5
Ca	14	6130	B	0.2	1.5
Mg	2	113	Se	0.6	0.3
S	3	42	Cl	10	1

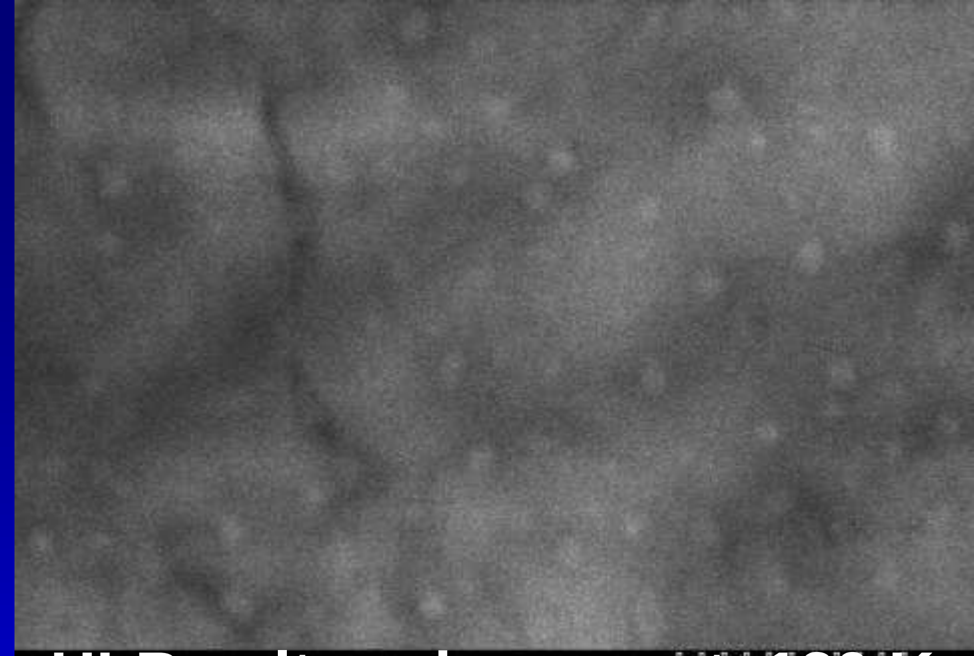
Degradation of Glyposate



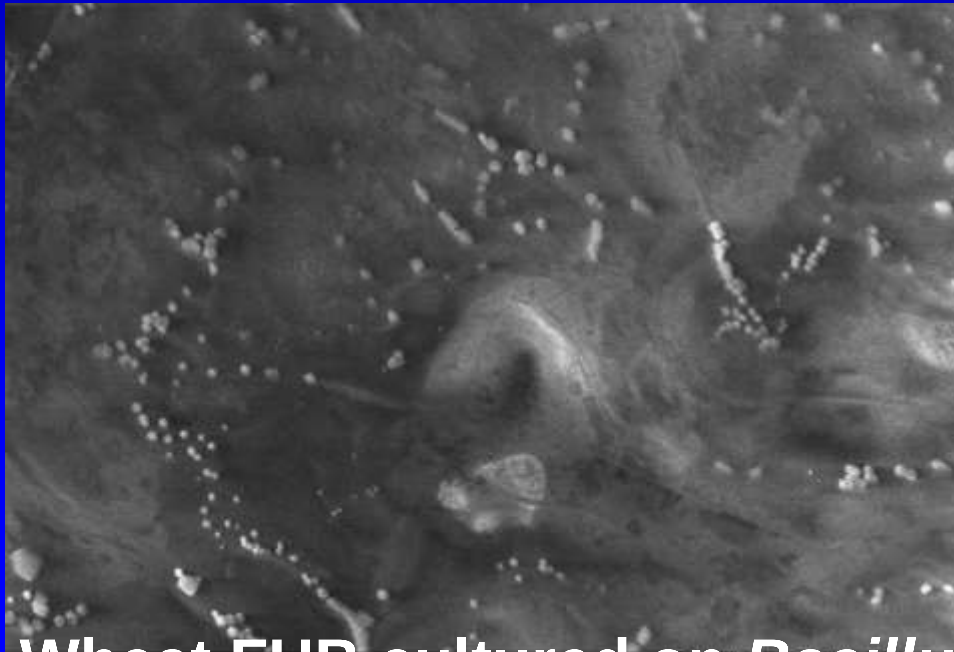
PGA = PteroylGlutamic Acid

Toxic to RR plants

Plant Disease Prion-like proteins (biomatrix)

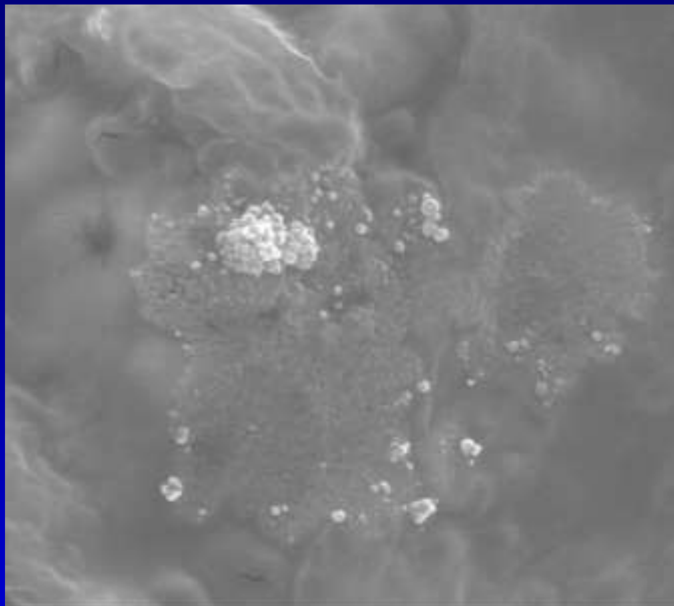


HLB cultured on yeast, 120 K

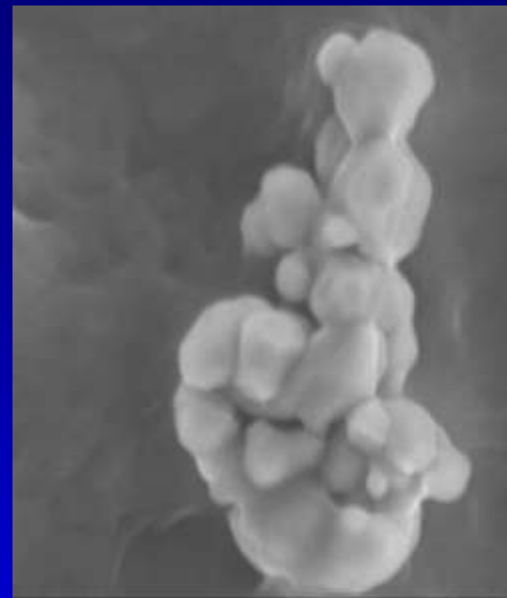


Wheat FHB cultured on *Bacillus* 6,000 X (L); 40,000 X (R)

Abortigenic Agent From Miscarried Faetal tissue

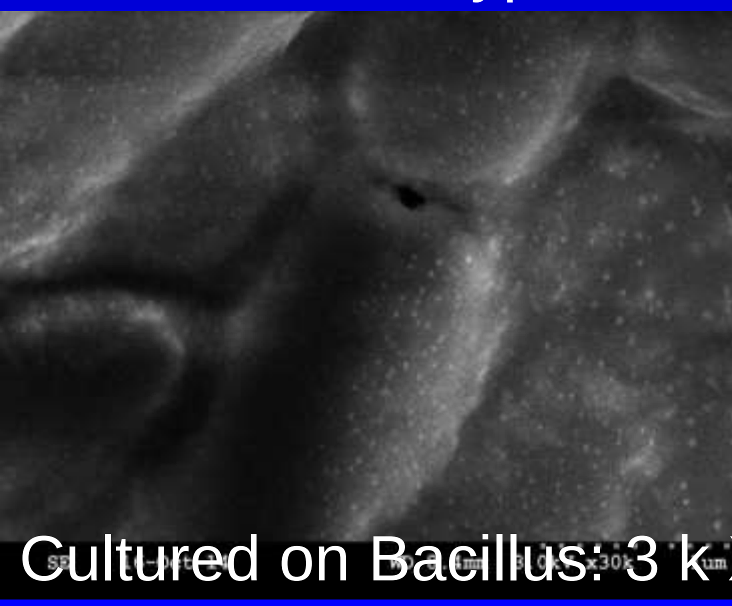


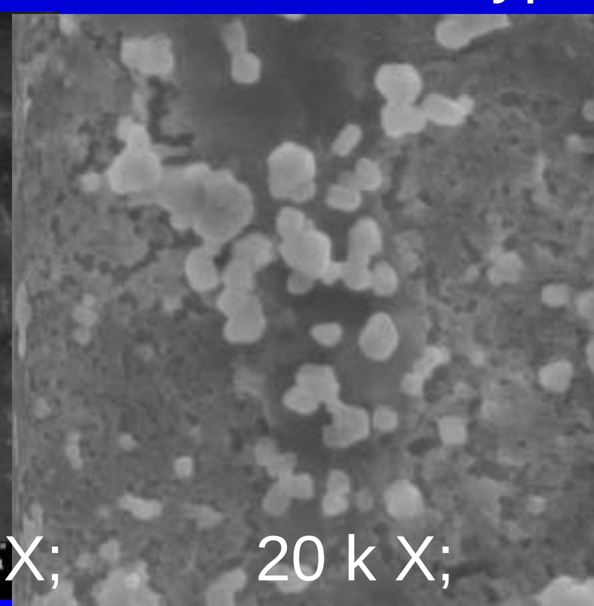
15 k X on hypha

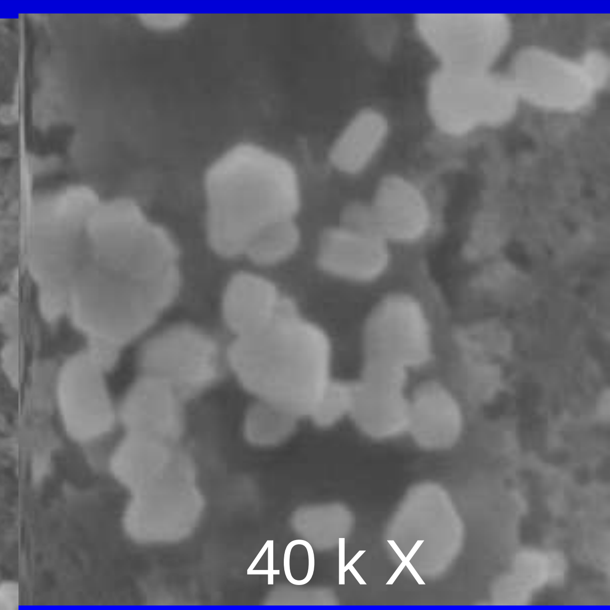


45 k X on hypha

70 k X







Cultured on Bacillus: 3 k X; 20 k X; 40 k X

"Male fertility under threat as average sperm counts drop"*

- Study of 26,600 men in France found sperm concentration had decreased by 32% since the 1990s.
- Numbers steadily dropped by 2% per year from 1989 to 2005.
- Proportion of normally formed sperm also declined by about 1/3.

* M. Rolland et al., Hum Reprod. 2013 Feb;28(2):462-70.

Fertility in the US dropped 30 % in the last five years. USA Today, 2014

Occurrence

- Verified in IA, IL, KY, MI, NE, ND, SD, WI
- Sources: **'Environmental'** **Animal tissue**

'Environmental'	Animal tissue
Soybean meal	Placental tissue
Silage - fermented products	Amniotic fluid
Corn grain	Semen
SDS Soybean plants	Stomach contents
Manure	Eggs
Soil	Milk

Fusarium solani fsp *glycines* mycelium

Potential Interactions of ‘new entity’ with Glyphosate

- **Glyphosate affects plants (predisposes):**
  - Inhibits plant defenses
  - Reduces nutrient content and efficiency [chemical and RR gene(s)]
  - Increases root colonization
  - Increases membrane permeability
  - Surfactant affect for penetration of natural openings and wounds
- **Glyphosate affects animals (predisposes):**
  - Inhibits aramatose system – endocrine hormone system
  - Toxic to liver, placental, testicular, and kidney cells
  - Reduced defense - liver function [from lower Mn, etc. in feed]
- **Glyphosate affects pathogens:**
  - Stimulates growth and virulence (direct/indirect)
  - Favors synergism, infection (as a carrier)
  - Increases movement into plant tissues (water film for plant infection)
- **Glyphosate affects the environment:**
  - Toxic to soil microbes that constrain plant pathogens
  - Nutrient availability reduced

What is Known About the 'New' Entity

- **Characteristics**
  - Very small (EM visible at 38,000 X)-(size of a virus, prion, 'nanobacteria')
  - Filterable - passes through a bacterial filter
  - Culturable - self replicating
  - Common in nature (- in soil)? -FL, IA, IL, IN,KY, MI, NE, ND, WI, others!
  - 'High' temperature, formaldehyde, etc. tolerance
- **Synergist with bacteria and other microbes**
- **Affect in animals (horses, cattle, sheep, pigs, poultry, humans)**
  - Causes infertility - male and female
  - Causes spontaneous abortions (miscarriage)
  - Death of chicken embryos
  - In milk from cows fed highly contaminated feed
- **Affect in plants**
  - High population in 'scorch' type diseases
  - 'Extends' symptoms of Goss' wilt, HLB, Fus. Head blight & SDS (soybean)
  - Seed-and feed-borne (?) - in soybean seed and feed/food products

Biomatrix (Nanobacter)

- Self replicating, proteinaceous mineral
- Don’t contain DNA or RNA
- Culturable with bacteria or fungi
- Resistant to proteases
- Resistant to autoclaving
- Serologically distinct
- Nano crystals growing in a biological system
- Associated with diseases
  - Alzheimers
  - Arthrosclerosis
  - Arthritus
- Protein altered by chelaters

Bt **cotton**

Hundreds of laborers in India reported allergic reactions to Bt cotton

Itching all over the body, eruptions, wounds, discoloration

“Morgellan’s Disease”

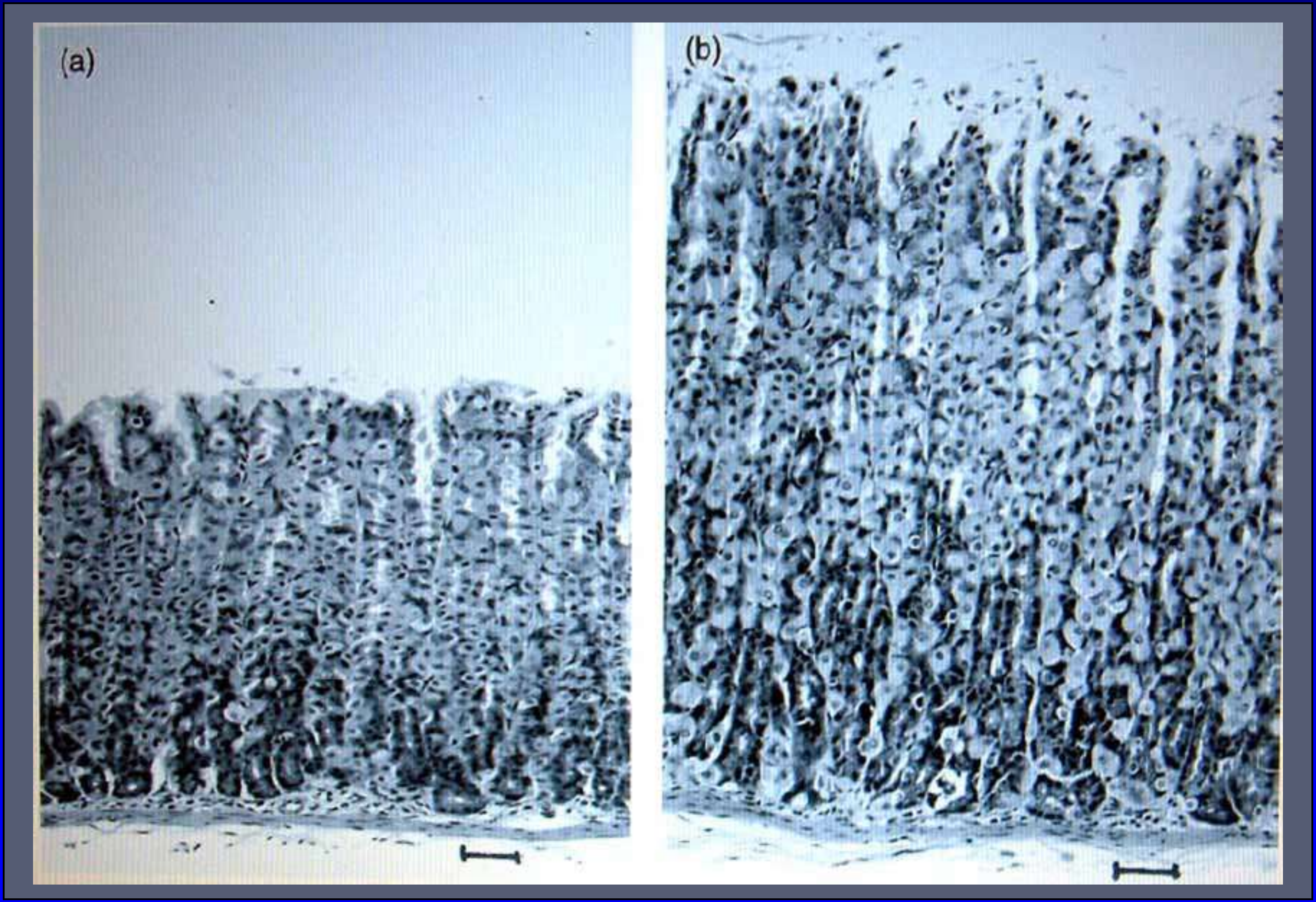
Bt cotton

Thousands of sheep died after grazing on Bt cotton plants

Buffalo (Warangal)

- Grazed on Bt cotton plants (1 day)
- Sick and unconscious for 2-3 days
- 13 deaths

Stomach lining



Non-GM GM

Summary of Findings

- *Clostridium botulinum* is a ubiquitous soil organism
- Chronic toxic infection depends on predisposition by:
  Glyphosate in the feed
  Spore count in the feed
- Glyphosate inhibits microbial antagonists of *C. botulinum*
- Glyphosate from feed can cause microbial imbalance and chronic botulism
- Glyphosate increases toxic fungi such as *Fusarium* spp.
- *C. botulinum* and *C. perfringens* are very tolerant of glyphosate

Are Bees (and Other Invertebrates) the Canaries in Our Coal mine?

Ecology for the Honeybee

Internal
GI system

External
Physical
Chemical
Biological

Hive
Protection
Resources
Continuity

Storm clouds in the near future

Importance of the Honeybee

- Pollinator for plant reproduction
  - One-third of agricultural production
  - Ecologically important

- Honey
  - Nutrient source
    - 'Sugars'
    - Minerals
  - Probiotic source (10^8/gm honey)
    - *Lactobacillus* spp.
    - *Bifidobacteria* spp.

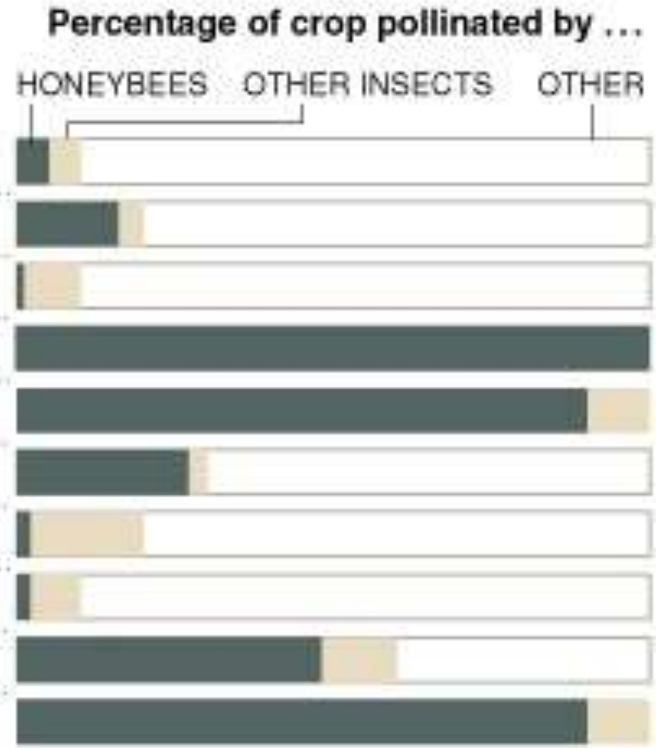
Staphlococcus aureus (MRSA)
Pseudomonas aeruginosa
Enterococcus (VRE)

Some Crops Honeybees, etc. Pollinate

Relying on Bees

Some of the most valuable fruits, vegetables, nuts and field crops depend on insect pollinators, particularly honeybees.

	Crop value *in billions 2006*	Percentage pollinated by honeybees
Soybeans	$19.7	5%
Cotton	5.2	16
Grapes	3.2	1
Almonds	2.2	100
Apples	2.1	90
Oranges	1.8	27
Strawberries	1.5	2
Peanuts	0.6	2
Peaches	0.5	48
Blueberries *cultivated*	0.5	90



Besides insects, other means of pollination include birds, wind and rainwater.

Sources: United States Department of Agriculture; Roger A. Morse and Nicholas W. Calderone, Cornell University

The New York Times

Interactions with Pesticides

- Direct toxicity
  - Endocrine hormone disruption
  - Enzyme inhibition, mortality
- Indirect impact
  - Antibiotic effect
  - Mineral nutrient availability
  - Pollen, nectar, etc. availability

Most Common Pesticide Interactions

- Neonicotinoid insecticides
  - Endocrine hormone disrupters
    - Foraging activity
    - Queen activity
    - Brood development
- Gyphosate herbicides/antibiotics
  - Endocrine hormone disrupters
  - Mineral chelators
  - Antibiotic activity against beneficials
- GMO crops (RR and Bt)
  - Intestinal disruption
- Phenoxy herbicides - Future impact
  - Endocrine hormone disrupters

Neonicotinoid Insecticides
(enhanced with pyrethroids)

- Use:
  - Systemic seed treatments
  - General insecticides


A bee enjoying the first spoils of spring. File photo: AP

- Effect on bees:
  - Endocrine disruption
  - Flight of the returning forager, navigation
  - Foraging 'learning' skills

- Banned in some European countries

Genetically Engineered 2,4-D Resistance

- An older herbicide (‘phenoxy’ group)
  - Systemic in plants
- Strong endocrine hormone disrupting chemical
- Newly approved geneticaly engineered crops
  - Applied directly to crop grown to harvest - repeatedly
  - Already have 2,4-D resistant weeds
  - Toxic exposure to honeybees

Glyphosate

- Indiscriminate use (330 million pounds/yr):
  - Systemic broad-spectrum general use herbicide
  - Herbicide of choice for 85+% of GE plants
- Effect on bees
  - Potent endocrine hormone disrupter
  - Potent antibiotic to *Lactobacillus, Bifidobacterium*, etc. - essential microbes for nutrition and pest resistance (immunity)
  - Strong mineral chelater in the bee, plants, & environment

***"Glyphosate, Three Rivers, and Anencephaly"*, Yakima Harold Republic**

Market Impact of GE on Honey

(Other products: wax, protein, etc.)

- Containing:
  - GE pollen (genetics)
  - Glyphosate (or other pesticide)
  - Mycotoxins - pathogens
- Domestic market
  - Conventional (depends on labeling)
  - Organic - contamination
- Export market
  - Rejection
  - Unknown factor

Some Common Honeybee Concerns

- **Colony Collapse Disorder**
  - **Micronutrient deficient bees**
  - **Starving with food available**
  - **Disoriented foraging**
  - **Pest susceptible**

- **European Foul Brood**
- **Varroa mites**
- **Amoeba and Nosema diseases**
- **Viruses**

Antibiotic Activity of Glyphosate

Honey Crop Microbiome

- ✓Species:
  - Lactobacillus spp.
  - Bifidobacterium spp.
- ✓Function:
  - Nutrition
    - Digestion
    - Mineral availability
    - Nutrient production (vitamins, growth factors, etc.)
  - Immunity/protection

THE LETHAL IMPACT OF ROUNDUP ON AQUATIC AND TERRESTRIAL AMPHIBIANS

Rick A. Relyea[1]

Department of Biological Sciences, University of Pittsburgh, Pittsburgh, Pennsylvania 15260 USA

Abstract. The global decline in amphibian diversity has become an international environmental problem with a multitude of possible causes. There is evidence that pesticides may play a role, yet few pesticides have been tested on amphibians. For example, Roundup is a globally common herbicide that is conventionally thought to be nonlethal to amphibians. However, Roundup has been tested on few amphibian species, with existing tests conducted mostly under laboratory conditions and on larval amphibians. Recent laboratory studies have indicated that Roundup may be highly lethal to North American tadpoles, but we need to determine whether this effect occurs under more natural conditions and in post-metamorphic amphibians. I assembled communities of three species of North American tadpoles in outdoor pond mesocosms that contained different types of soil (which can absorb the pesticide) and applied Roundup as a direct overspray. After three weeks, Roundup killed 96–100% of larval amphibians (regardless of soil presence). I then exposed three species of juvenile (post-metamorphic) anurans to a direct overspray of Roundup in laboratory containers. After one day, Roundup killed 68–86% of juvenile amphibians. These results suggest that Roundup, a compound designed to kill plants, can cause extremely high rates of mortality to amphibians that could lead to population declines.

Glyphosate in food, especially GM (genetically manipulated) foods)

Glyphosate allowances in US foods[253]—examples		US EPA "Crop Group 15": Cereal Grains
Food	**Parts per million**	Barley (*Hordeum* spp.)
Barley, bran	30	Buckwheat (*Fagopyrum esculentum*)
Beet, sugar, roots	10	Corn (*Zea mays*)
Canola, seed	20	Millet, pearl (*Pennisetum glaucum*)
Flax, meal	8.0	Millet, proso (*Panicum milliaceum*)
Grain, cereal, group 15 *except field corn, popcorn, rice, sweet corn, wild rice*	30	Oats (*Avena* spp.)
		Popcorn (*Zea mays* var. everta)
Peppermint, tops	200	Rice (*Oryza sativa*)
Spearmint, tops	200	Rye (*Secale cereale*)
Sugarcane, cane	2.0	Sorghum (milo) (*Sorghum* spp.)
Sugarcane, molasses	30	Triticale (*Triticum-Secale* hybrids)
Sunflower, seed	85	**Wheat (*Triticum* spp.)**
Tea, instant	7.0	Wild rice (*Zizania aquatica*)

Americans Eat Their Weight In Genetically Engineered Food

By: Renée Sharp, Director of Research

MONDAY, OCTOBER 15, 2012 Americans are eating their weight and more in genetically engineered food every year, a new Environmental Working Group analysis shows. On average, people eat an estimated 193 pounds of genetically engineered food in a 12-month period. The typical American adult weighs 179 pounds.

These figures raise a question: If you were planning on eating your body weight of *anything* in a year, wouldn't you want tomake sure it was safe to eat?

Shockingly, virtually no long-term health studies have been done on consumption of genetically engineered food.

ewg.org/agmag/2012/10/americans-eat-their-weight-genetically-engineered-

Maternal and fetal exposure to pesticides associated to genetically modified foods in Eastern Townships of Quebec, Canada.

Reprod Toxicol. 2011 May;31(4):528-33. Epub 2011 Feb 18.

Aris A, Leblanc S.

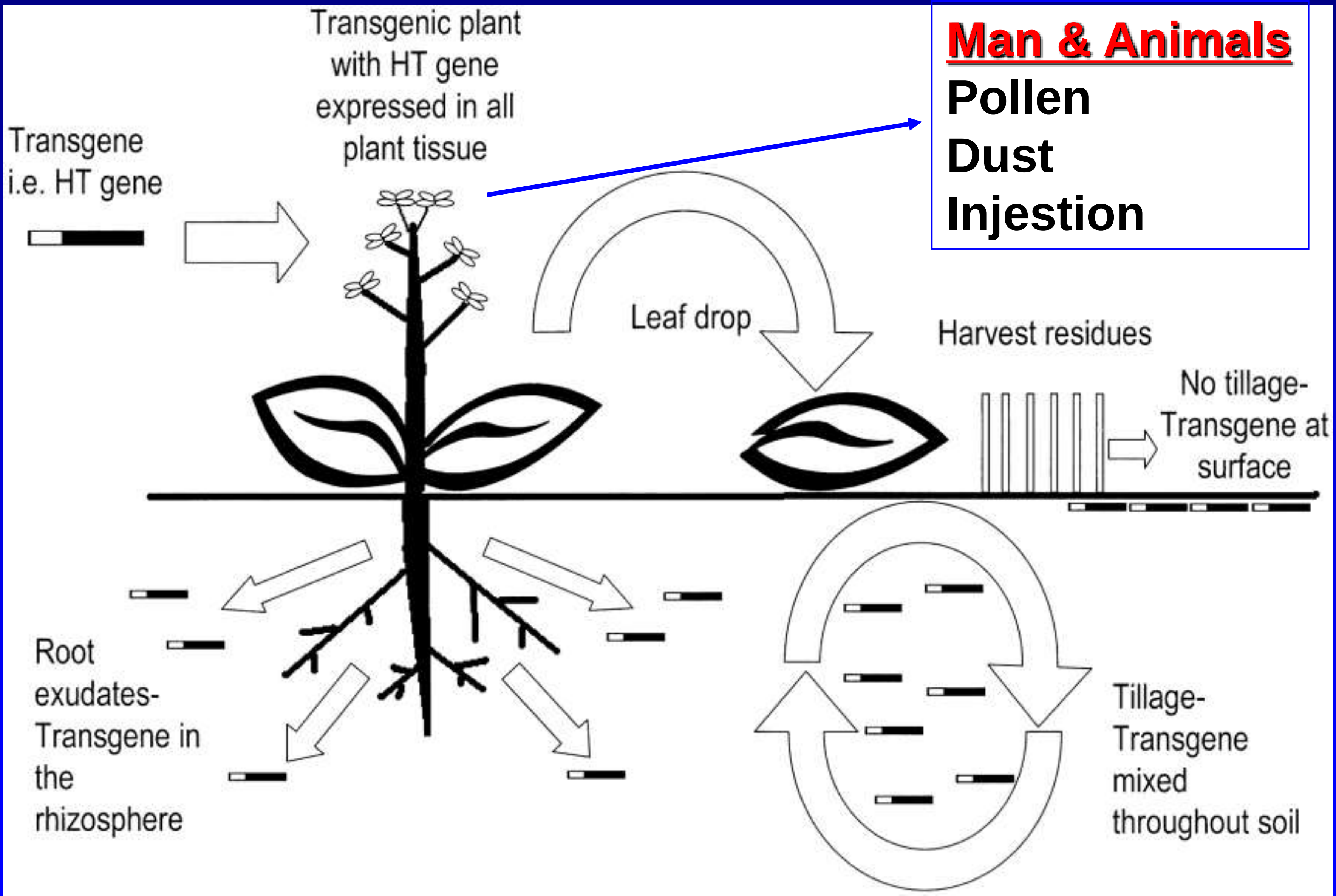
Department of Obstetrics and Gynecology, University of Sherbrooke Hospital Centre, Sherbrooke, Quebec, Canada. aziz.aris@usherbrooke.ca

Abstract

Pesticides associated to genetically modified foods (PAGMF), are engineered to tolerate herbicides such as glyphosate (GLYP) and gluphosinate (GLUF) or insecticides such as the bacterial toxin bacillus thuringiensis (Bt). The aim of this study was to evaluate the correlation between maternal and fetal exposure, and to determine exposure levels of GLYP and its metabolite aminomethyl phosphoric acid (AMPA), GLUF and its metabolite 3-methylphosphinicopropionic acid (3-MPPA) and Cry1Ab protein (a Bt toxin) in Eastern Townships of Quebec, Canada. Blood of thirty pregnant women (PW) and thirty-nine nonpregnant women (NPW) were studied. Serum GLYP and GLUF were detected in NPW and not detected in PW. Serum 3-MPPA and CryAb1 toxin were detected in PW, their fetuses and NPW. This is the first study to reveal the presence of circulating PAGMF in women with and without pregnancy, paving the way for a new field in reproductive toxicology including nutrition and utero-placental toxicities.

Agent Orange Deformities

Potential Interacting Sites of Transgenes and Soil Microbes (after Dunfield and Germida, 2004)



Glyphosate in Human Urine (Urbanites) & Dairy Cows

City	No.	Male	Female
1	44	10.3*	6.1
2	22	16.0	2.7
3	19	60.1	8.3
4	22	23.5	13.8

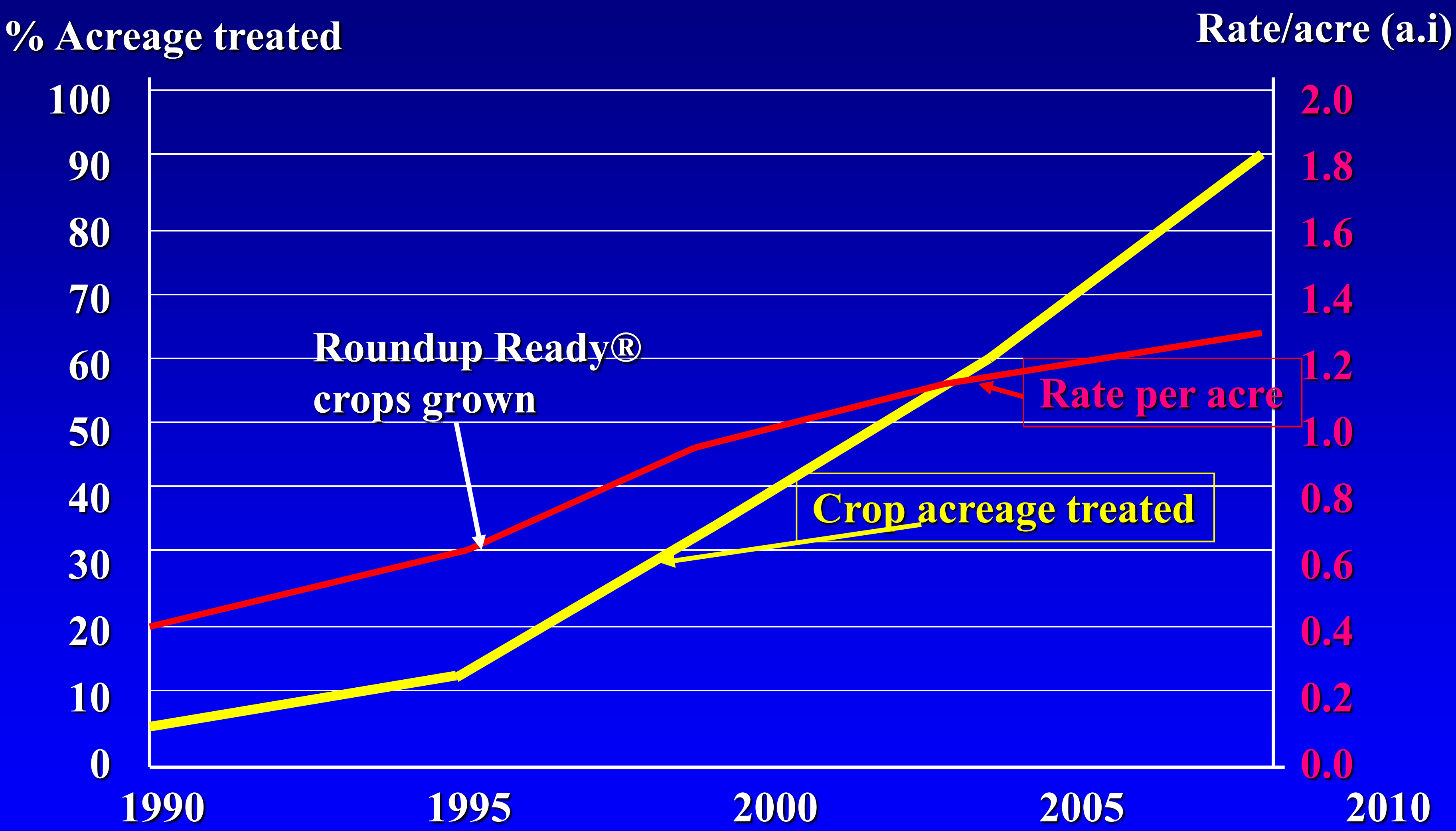
*ppb glyphosate

Dairy	Glyp*.	Dairy	Glyp.
A	9	E	37
B	21	F	38
C	22	G	46
D	25	H	102

*ppm

Permitted in cereals, soybean, corn = 20 ppm
Permitted in alfalfa = 400 ppm Corn silage = 100 ppm
Permitted in oils = 20-40 ppm
Long-term toxicity to liver, kidney, etc. tissues = 0.1 ppbillion
Long-term carcinogenicity = 0.1 ppb
Antibiotic to beneficial enteric (GI) bacteria = 0.1 ppm

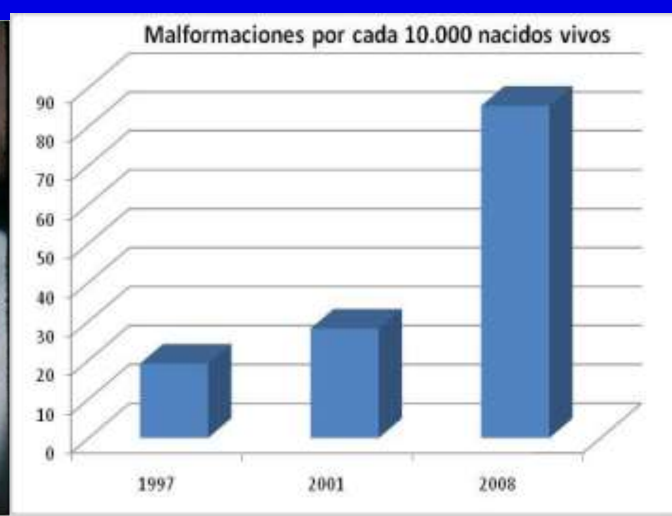
Crop Acreage Treated with Glyphosate & Rate / Acre*

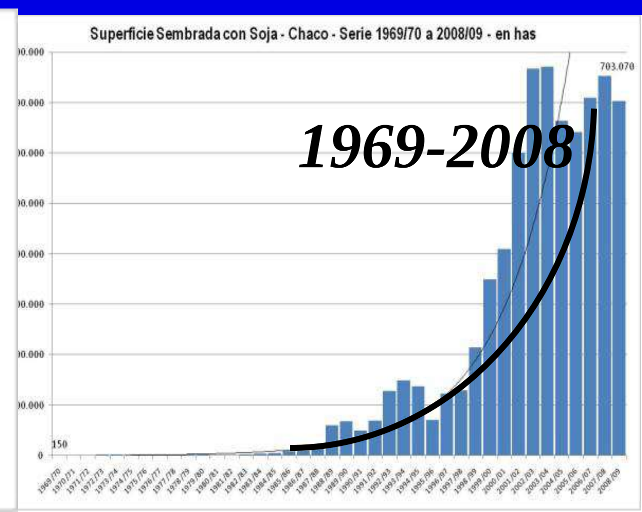


*Does not include the millions of acres of non-crop use

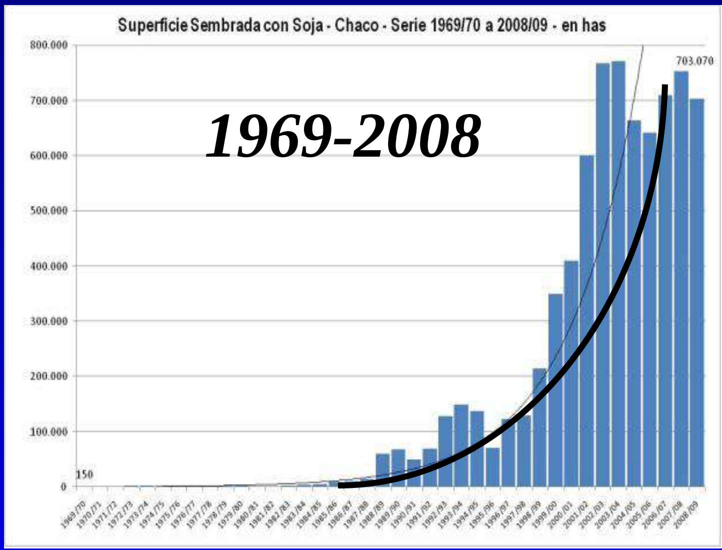
Birth Defects Based on RR Soybean Acreage & Glyphosate drift -*Cordoba, Argentina area*

- **447 % increase in birth defects - (1998-2008)**
  - **- Heart - Anaphlactoid purpura**
  - **- Musculoskeletal - Thyroid**
- **Increased miscarriages & other reproductive failures**
- **Cancers in children- and adults,Liver diseases increased**
- **Neurological disorders increased - esp. in children**
- **Acute allergies increased**



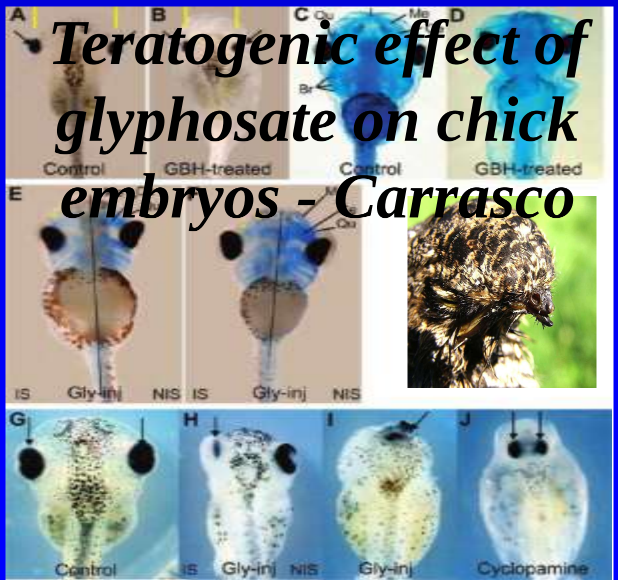


Birth Defects Based on RR Soybean Acreage & Glyphosate drift -*Cordoba, Argentina area*



Ruptured purpura

Cleft pallet



Teratogenic effect of glyphosate on chick embryos - Carrasco

Birth Defects from Endochrine Hormone Disruption in Mammals

"Underbite and cleft palate are epidemic in human newborns. These malformations on human newborns are similar and comparable to underbites and cleft palate on other mammal young and to short upper bill and holes in the upper bills of hatchling birds. These malformations are definitive symptoms of disruption of the thyroid hormones during development in the womb or egg." (Hoy, 2011)

Some Conditions Associated with Autism

- Disrupted gut bacteria
- Depleted serotonin supply
- Deficiency in sulfur metabolites

Is there a toxic substance that is currently on the rise in our environment that could account for these comorbidities?

Glyphosate: Some Biological Effects*

- Depletes aromatic amino acids and methionine
- Disrupts gut bacteria
  - Studies with chickens, cows and pigs show overgrowth of pathogens in gut
- Disrupts cytochrome P450 (CYP) enzymes which are involved in many biological functions
- Depletes important minerals
  - Calcium, manganese, zinc, cobalt, iron, ….
- Likely impairs sulfate synthesis and sulfate transport

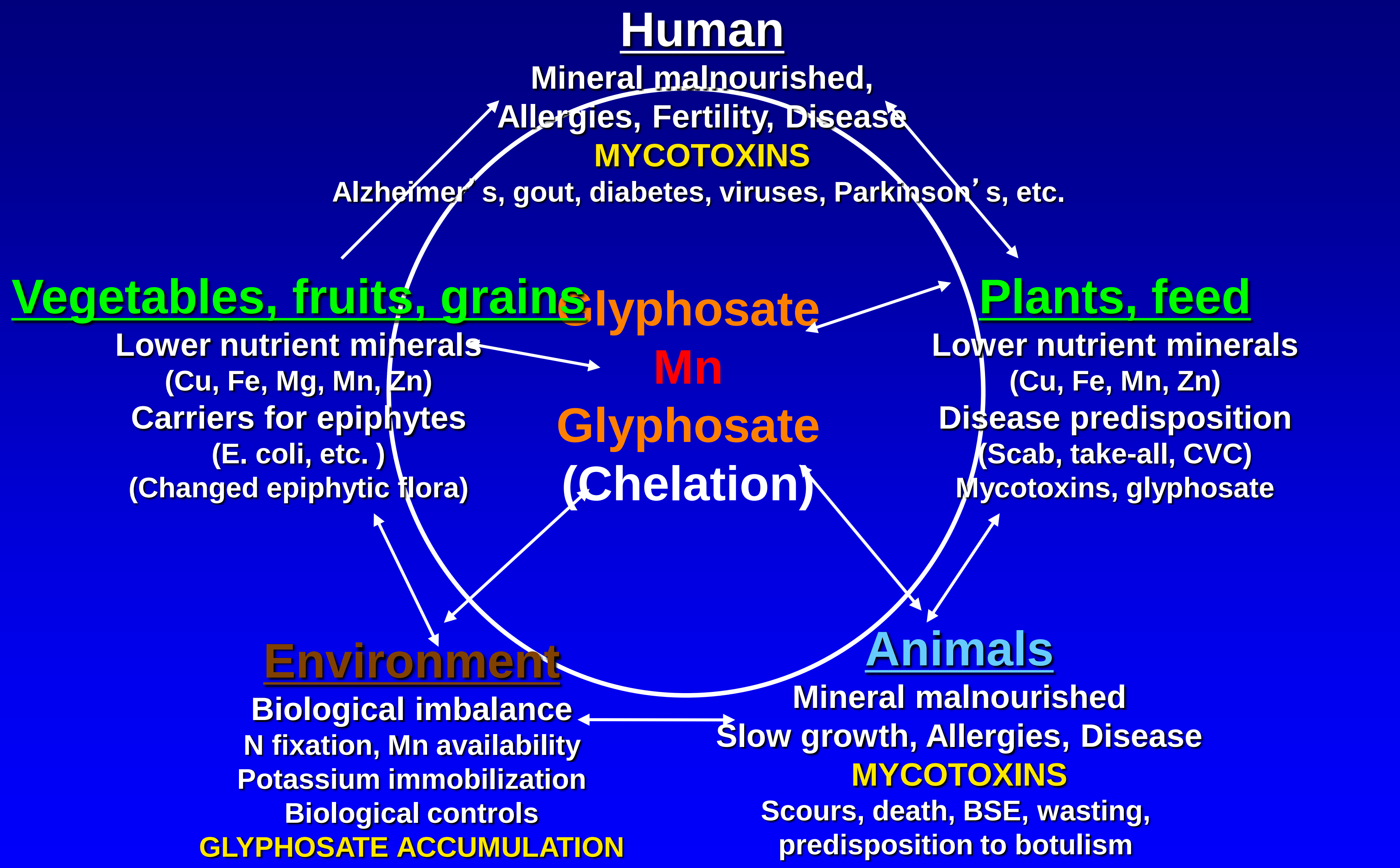
* A. Samsel and S. Seneff, Entropy 2013, 15, 1416-1463

Genetically Engineered for Insect Toxicity (and/or herbicide tolerance - not resistance!)

- Plants produce a chemical insecticide
- Insects develop resistance to the insecticide*
- Higher concentrations of plant produced insecticide
- Natural biological controls are killed by herbicide
- Insecticide remains in food/feed
    - Resistant to digestion & degradation
    - Toxic to man and animals
- Man produces insecticide

[*Similar with development of resistant weeds!]

Potential Far-Reaching Impact of Glyphosate



Effect of Surfactants on Goss' & Stewart's Wilt*

Bacterial wilt of Alfalfa - *Clavibacter insidiosum*

What has Changed?

- **Change:**

Increased disease
New diseases
Low mineral nutrition
Resistant weeds and insects

- **Precedent:**

Victoria blight (oats)
H. carbonum disease (toxin)
Texas male-sterile gene (corn leaf blight epidemic)
Glyphosate-resistance gene?????
Glyphosate nullifies genetic resistance in sugar beets, corn, soybean, etc.

- **Why (vulnerability)?**

Predisposition
Direct toxicity
Gene flow
No ecological relief - single source approach

No, Kevin, there is no consensus on the safey of GMOs. Quite the contrary: http://gmofreeusa.org/gmos-are-top/there-is-no-scientific-consensus-on-the-safety-of-gmos/

http://gmofreeusa.org/gmos-are-top/gmo-science-studies/

GMO Free USA

Flawed Safety Evaluations

Internal EPA Memos

1983 EPA Scientist :"Our viewpoint is one of protecting the public health when we see suspicious data." Unfortunately, EPA has not taken that conservative viewpoint in its assessment of glyphosate's cancer causing potential."

"There are no studies available to NCAP evaluating the carcinogenicity of Roundup or other glyphosate-containing products. Without such tests, the carcinogenicity of glyphosate-containing products is unknown."

"Tests done on glyphosate to meet registration requirements have been associated with fraudulent practices."

"Countless deaths of rats & mice are not reported."

"Data tables have been fabricated"

"There is a routine falsification of data"

"It is also somewhat difficult not to doubt the scientific integrity of a study when the IBT stated it took specimens from the uteri of male rabbits for examination."

Wikipedia, 2012

Bt Egg Plant Toxicology Evaluation

Gallagher, 2011

Summary:

* The study failed to meet international standards for evaluation (OECD 1998; Codex Alimentarious, 2003 c-c)

* There were serious departures from normal scientific standards

* Studies submitted are 'woefully inadequate to determine safety'

* Consists of substandard and extremely misleading interpretation of the results presented

* Independent study can not uphold the government report of approval

Failed to Meet International Standards

* Insufficient time for evaluation – 14 and 90 day
* Ignored toxic end-points
* Evaluated only one dose rate for 78 of the 90 days
* Dose level used was lower than anticipated exposure
* Major health problems in animals found were ignored

Organ and system damage – ovaries at half weight, enlarged spleens, White blood cells 35-40% higher, liver damage (elevated bilirubin & plasma acetylcholinesterase) immune function changes (elevated eosinophils)

* Failed to evaluate:

Neurological function
Behavioral effects
Reproductive performance
Biological resilience
Concentration of insecticide protein Cry1A(c) not measured

Failure to Honor

*** Scientific Precautionary Principle**

1. Margin of safety to prevent damage
2. Anticipation of unknowns
3. Initiate as a "pilot project"

*** Not "Substantially Equivalent"- Significant deviation in:**

1. Expression of 'end products' (new/tissues in)
2. More like virus infection than sexual transfer
3. Functional and regulatory controls absent
4. Greatly extended exposure
5. Production, quality, safety & toxicity differ

After Brown, 2000

Scientifically Irresponsible

* Untested end products (toxicology) – New proteins, Bt toxin
* Irreversible consequences
  1. Gene contamination
  2. Health damage
* Basic infrastructure attacked – food production
* Unintended consequences ignored – increased disease
* Increased toxic chemical exposure – food, environment
* Decreased production efficiency – food/feed
* Unknown end points – unregulated gene flow

In Agriculture We Are Asked to Do Impossible Things