

Mashed Mysteries of Subterranean Shenanigans and Aerial Agents



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EXTENSION

Tuber trauma

1. Causes
2. Herbicides
3. What to do



Tuber malformations



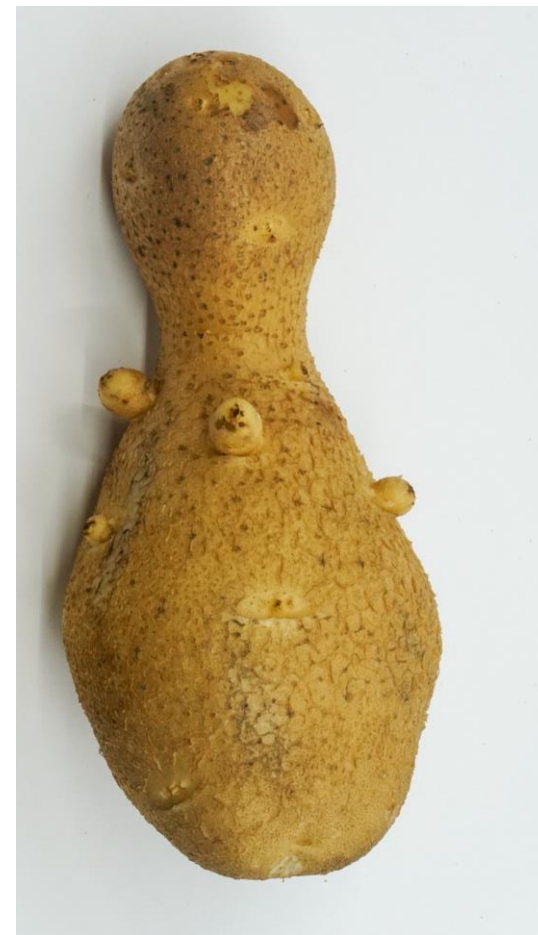
- Result of:
 - Sudden growth interruption, rapid growth following a stress
- Bottleneck, dumbbell, or pointed end appearance, this is indicative of when growth interruption occurred.
- Herbicides can interrupt growth and cause malformations.

Tuber malformations





Physiological

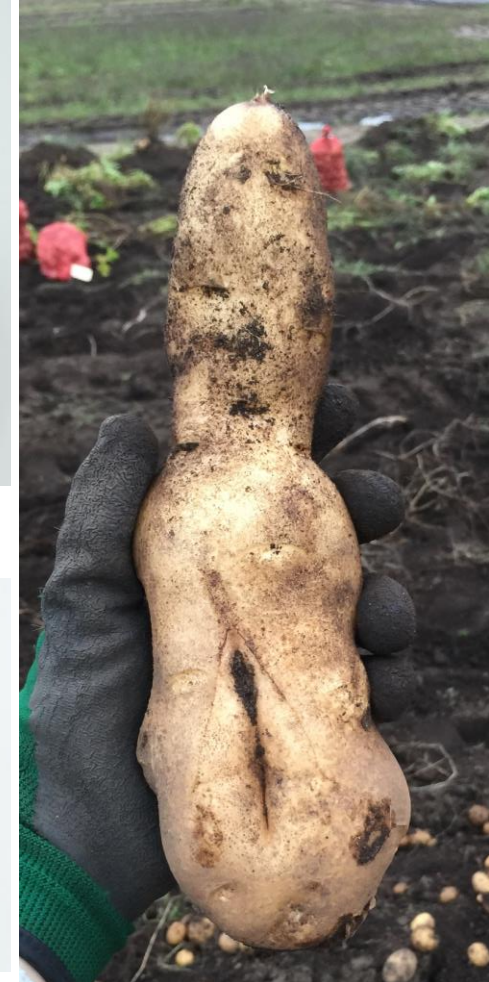


Environment



Tuber cracking causes

- Environmental stress, nutritional imbalance, disease or genetics.
- Results of high turgor pressure and rapid tuber growth
- Earlier cracking = larger cracks



Herbicides

- Herbicides can result in tuber injury.
 - Soil
 - Seed
 - Foliage contact
- Labelled herbicides misused or applied in unfavorable growing conditions can injure tubers.



Herbicide mysteries



Ugly herbicide shenanigans



Amino Acid Synthesis Inhibitors 2, 9

Halosulfuron	Imazamox	Imazapyr	Flumetsulam	Glyphosate

Growth Regulators 4

Picloram	Dicamba	2, 4-D	Clopyralid

Cell Membrane Disrupters 14

Saflufenacil	Flumioxazin	Fomesafen	Fomesafen

Photo System II Inhibitors 5, 6, 7

Bromoxynil	Linuron	Metribuzin

Long Chain Fatty Acid Inhibitor 15

Sonalan	Metolachlor

Pigment Inhibitors 13, 27

Clomazone	Mesotrione

Nitrogen Metabolism 10

Glufosinate

Foliar stresses and symptoms



Heat crinkle

- Sprouts suddenly encounter high temperature and stress plant.
- Can increase stem number.
- More common in sandy soils.
- Russet Burbank is susceptible.



Heat crinkle



Phosphoric acid burn



Nutrient deficiencies, PVY, and others



Aerial agents - herbicides



Glyphosate













Potato exposure to herbicides

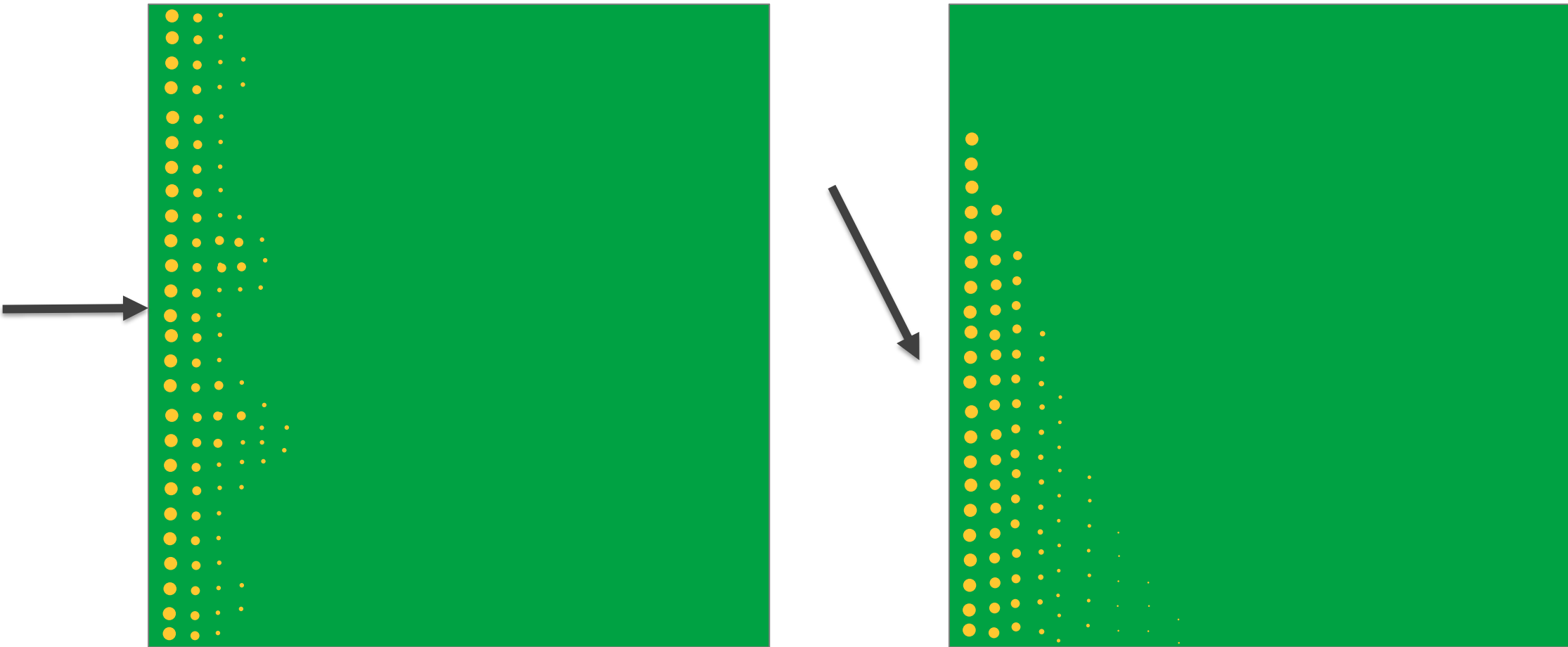
- Soil carryover
- Particle drift and inversions
- Contamination
- Volatilization
- Misapplication
- Seed carryover
- And many more...



Drift



Field pattern



Drift



Boom contamination



Soil carryover





Symptoms, signs, and indicators



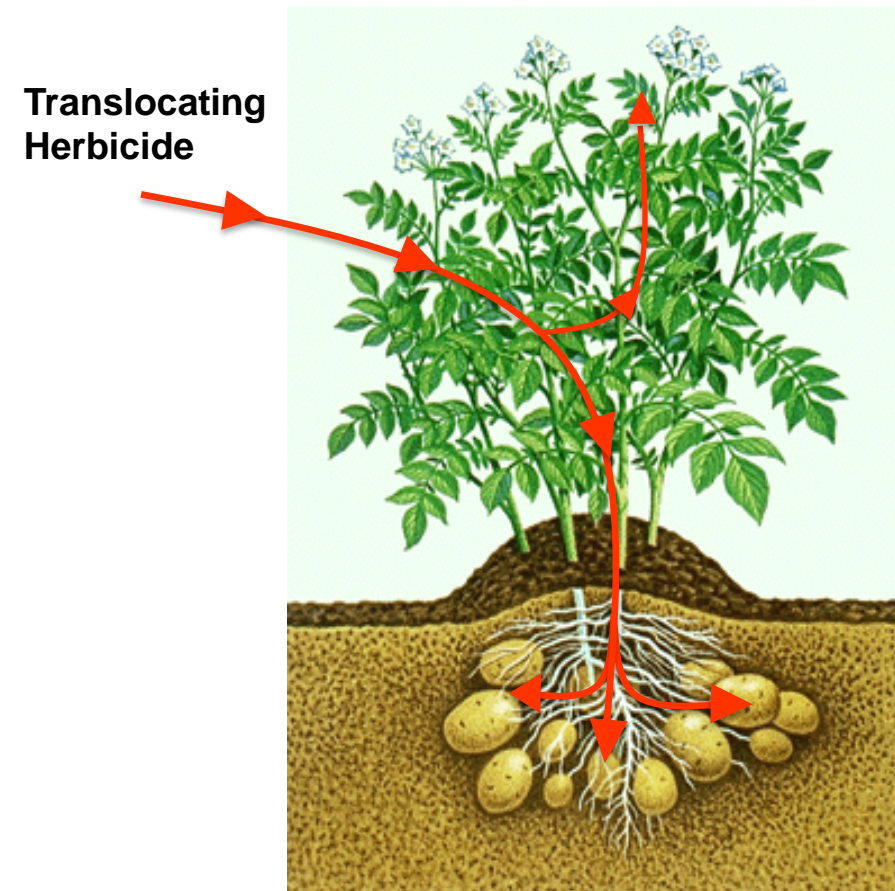
Exposure by foliage: Where to look

- Leaves and tubers
 - Translocating herbicides affect new growth (leaves/tubers)
 - Contact herbicides injure what it contacts (new & old leaves)



Herbicide movement from foliar contact

- Go to strongest sink
- ALS inhibitors (Group 2)
- Growth regulators (Group 4)
- EPSP synthase inhibitor (Group 9)



Symptoms of exposure

- Injury appears in days to weeks.
- Herbicide mode of action matters!
 - PGR are quick
 - Glyphosate is slow
 - ALS-inhibitors are slow



Foliar injury: Translocating



Foliar injury: Translocating



Foliar injury: Translocating



Foliar injury: Contact



Exposure by foliage: Tubers

- Stress from herbicide exposure can cause tuber cracking, malformations, and disrupt seed tuber growth.



Cracking & elephant hide



Malformed tubers



Superficial problems

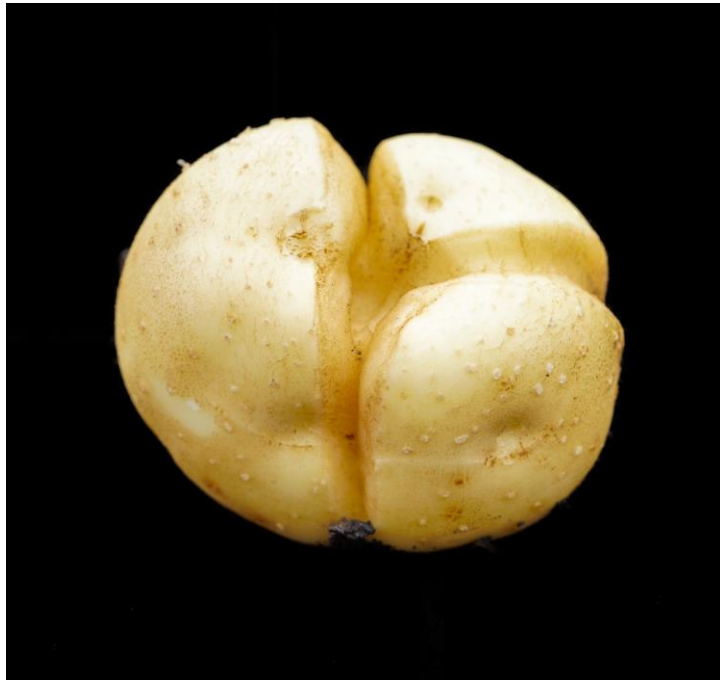


No symptoms



Visual observation of seed tubers

- Can indicate herbicides, but not always accurate



Glyphosate - tubers

- Smaller tubers
- Irregularly shaped tubers that have folds, cracks, knobs and elephant hide
- No symptoms



Glyphosate - seed

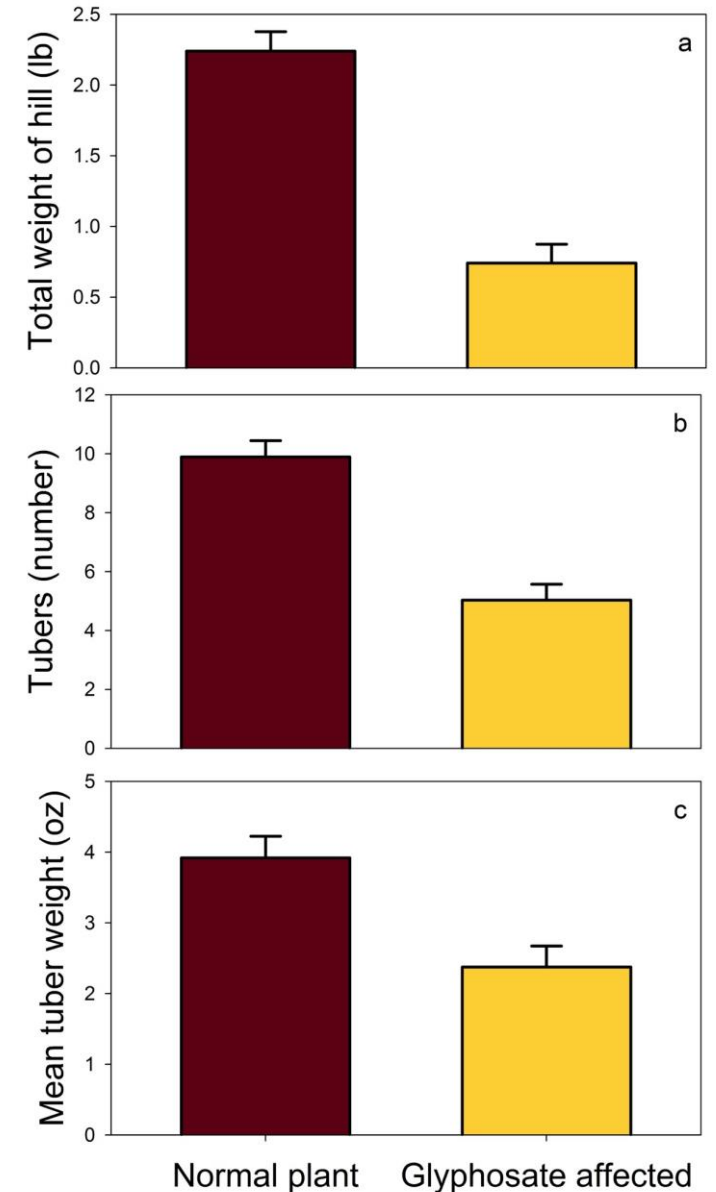
- Erratic and slow emergence pattern
- Bending, twisting, and yellowing of leaves
- Multiple stems from an eye
- ‘Cauliflower’ or ‘candelabra’ formation of stems
- Enlarged stems



Glyphosate residues

Seed pieces with glyphosate:

- 67% reduction in total yield (from 2.25 to 0.75 lb/hill)
- 50% reduction in tuber number (10 to 5 tubers/hill)
- 38% reduction in mean tuber weight (3.9 to 2.4 oz/tuber)



Sampling to identify cause



Sampling procedure

1. Document
2. Sample
3. Chain of custody
4. Clean sample
5. Ship to a laboratory

z.umn.edu/injury

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EXTENDING KNOWLEDGE >> CHANGING LIVES



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Sampling for Herbicide Injury in Potatoes

Andy Robinson, Extension Potato Agronomist and Associate Professor
North Dakota State University / University of Minnesota

Supplies

- Pen or marker
- Disposable gloves
- New gallon size zip-top bags with holes poked through in several places to provide aeration (ventilated bag) or paper bags
- Cooler with ice
- Submission form for laboratory of choice



Dicamba injury on upper leaves of potato plant (A. Robinson, NDSU/UofM)

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Quick Steps

1. Take photographs of the injury symptoms and record GPS location. Write down the date you first noticed symptoms, what the symptoms are, and where in the field you observed it. Keep this information in your records.
2. Use a new pair of disposable gloves for each sample bag you collect.
3. Pull off leaves from the most symptomatic areas (about five to 10 plants) and place them in a ventilated zip-top or paper bag. Gather about a pound of leaves, which will fill up the bag. Dig up one to two tubers from each plant sampled and place in a separate bag. Repeat this process for any other areas in the field you would like to sample.
4. Gather leaves and tubers from an unaffected area and place them in separate bags.
5. If you are concerned about residue in seed tubers, dig up 10 to 12 mother seed pieces and place them in a separate ventilated or paper bag.
6. Label each of the bags with date, time and what it is (sample ID).
7. Place samples on ice in a cooler.
8. Out of the field, gently clean any debris or soil off the tubers and place in a new ventilated zip-top or paper bag.
9. Store the samples in a refrigerator until you can ship them.
10. Fill out the sample submission form for the laboratory of choice, being sure to include the requested herbicide test to be completed. Keep a copy of this form for your records.
11. Pack the sample in an insulated box with ice and use next-day shipping to the laboratory of choice.

Mitigation

- Dedicated sprayer
- Proper tank cleanout
- Talk to neighbors
- Public map
- Signage
- Scout fields regularly

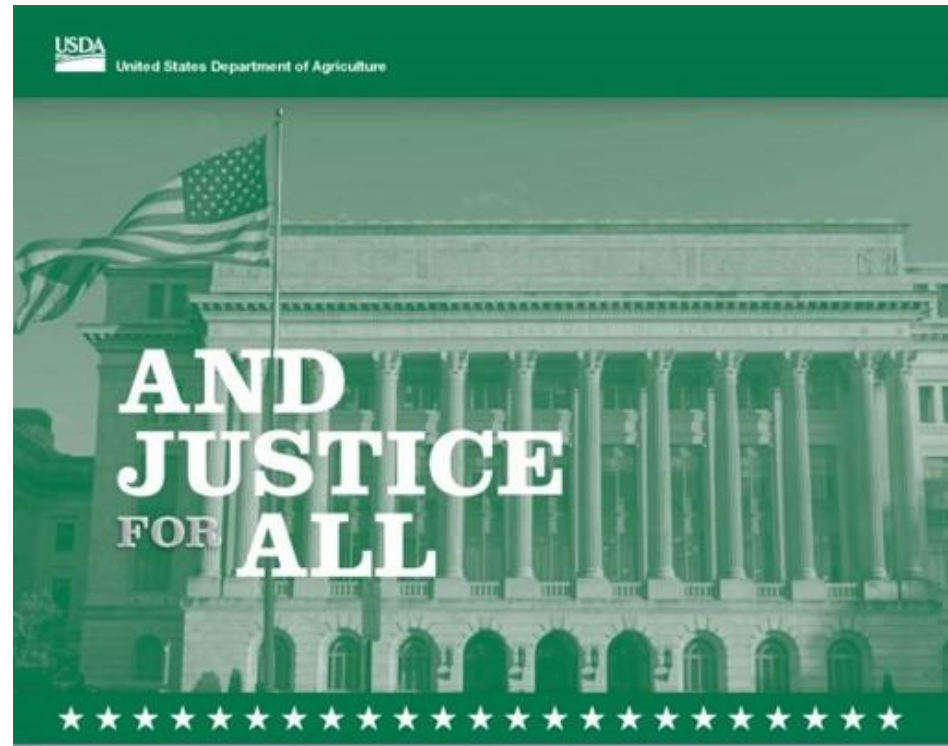


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U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410; or

fax:
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