

Herbicide Resistance Management in Tomato

Nathan S. Boyd
Peter Dittmar



UF | What is Herbicide Resistance?



- Tolerant
 - A plant is naturally tolerant to a herbicide dose typically used to control other plant species
- Susceptible
 - Plant population dies at doses that do not injure other plant species
- Resistant
 - The ability of a formerly susceptible plant to survive and reproduce following exposure to an herbicide dose that would normally killed susceptible plants.

UF | Why Herbicides Don't Work

- PLANT CHARACTERISTICS
- Tolerance
- Plant size
- Not actively growing
- Limited movement to underground plant parts



UF | Why Herbicides Don't Work

- APPLICATION ERRORS
- Improper calibration
- Wind or rain
- Poor coverage
- Water quality
- Tank mix of products known to inhibit one another
- Improper use of surfactants

A vertical splash of water, captured in a high-speed photograph, showing the fluid's motion and the resulting droplets and ripples. The water is white and translucent, contrasting with the solid blue background.

Water pH

- pH 3-6 adequate for short term storage
- pH 6.1 to 7 ok for immediate spraying
- pH 7 or above add a buffer or acidifier
 - Sulfonylurea (Sandea) herbicide works better in slightly basic conditions

A vertical splash of water, showing a column of water rising from a base of bubbles and splashing, set against a solid blue background.

Water pH

- Herbicides that break down quickly when pH is greater than 7
 - 2,4-D amine
 - Glyphosate (Roundup)
 - Glufosinate (Ignite)
 - Flumioxazin (Chateau)

A vertical splash of water on the left side of the slide, with water droplets and bubbles visible at the bottom.

Example:

Flumioxazin (Chateau, Broadstar)

| pH | 5 | 7 | 9 |
|-----------|------|--------|------------|
| Half Life | days | 24 hrs | 15 minutes |

Options

1. Test pH
2. Read the herbicide label
3. Limit time products are stored in tanks once mixed with water
4. Add acidifiers or buffering agents when needed

UF | Why Herbicides Don't Work

- APPLICATION ERRORS

- Improper calibration
- Wind or rain
- Poor coverage
- Water quality
- Tank mix of products known to inhibit one another
 - Sandea + Select + surfactant
- Improper use of surfactants

Prior to any Herbicide Application: *Where a weed is not abundant*



- Rates of mutation: 1 in 10^5 - 10^6 for single, nuclear gene



YEAR 1: Following a Single Herbicide Application

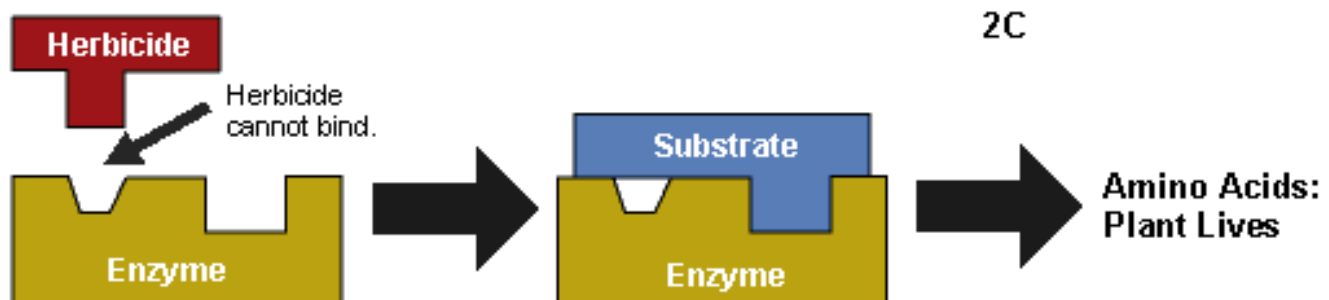
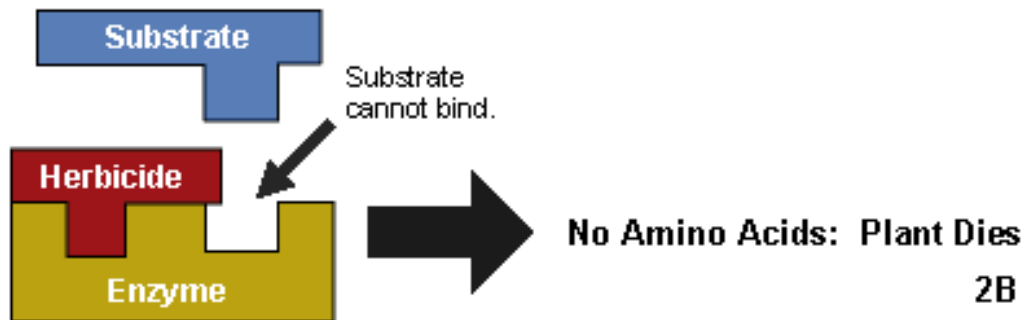


YEAR 2: Prior to the Second Herbicide Application

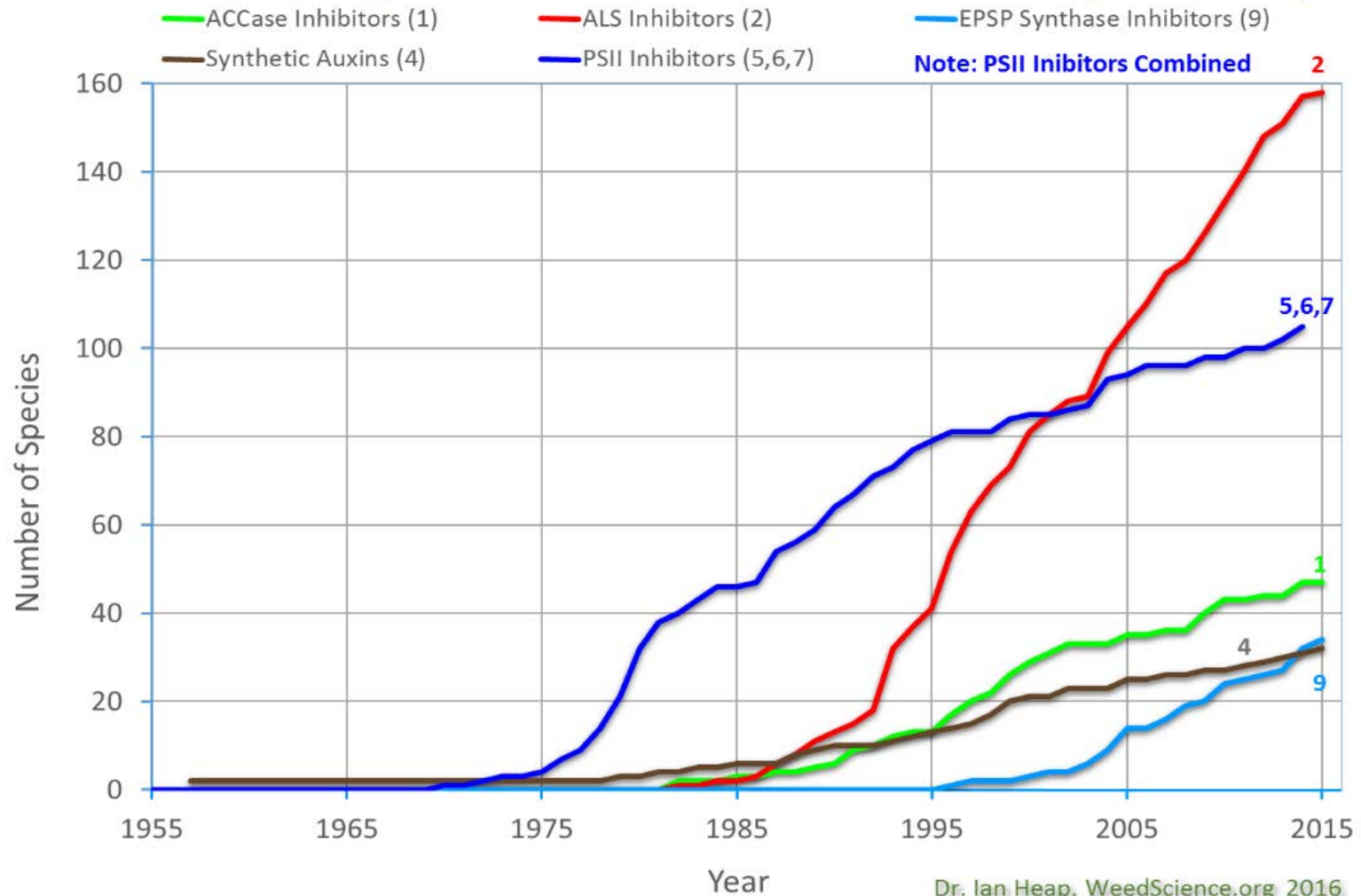


YEAR 2: Following the Second Herbicide Application

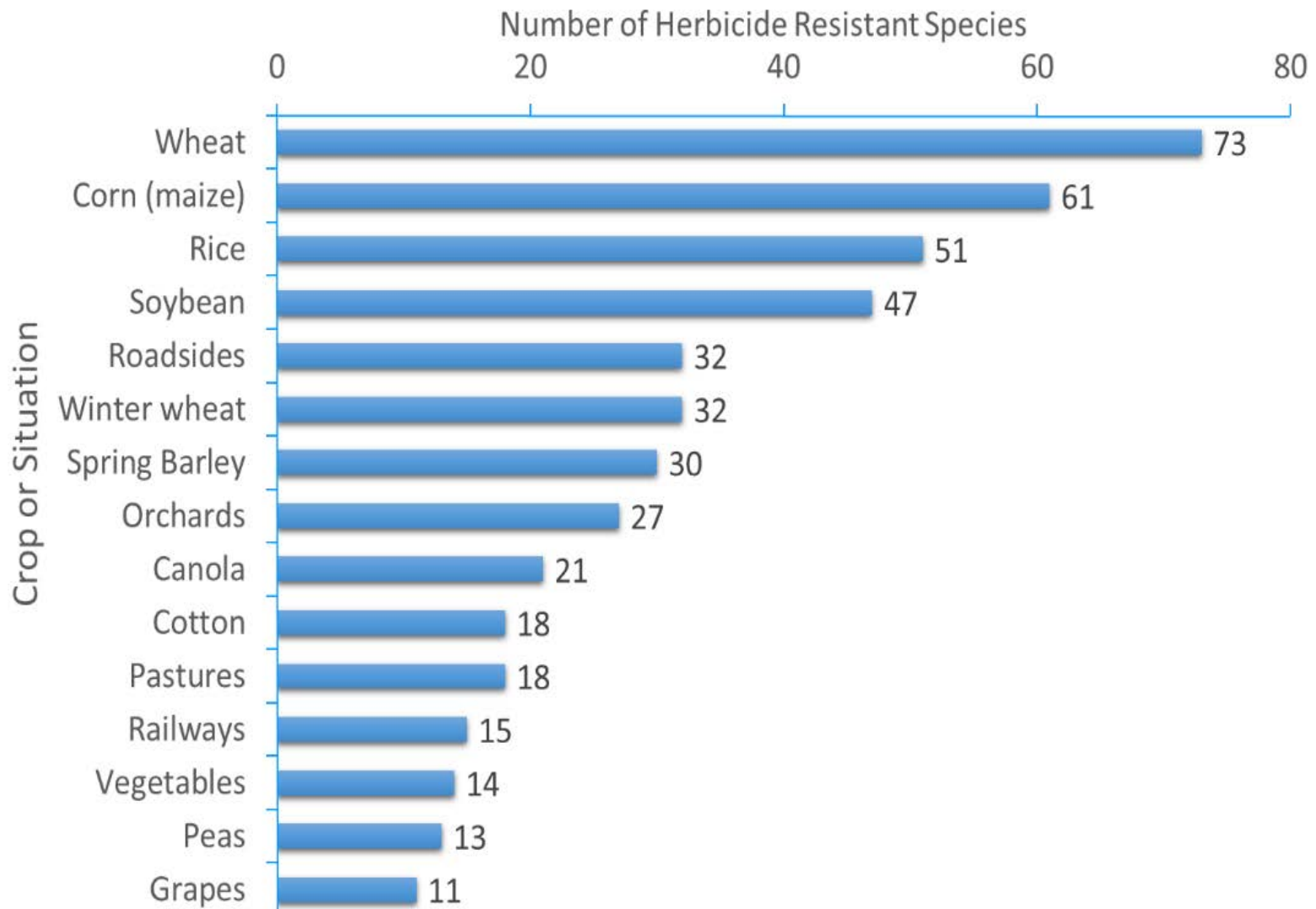




UF | Resistance by MOA



UF | Resistance by Crop Category



UF

Why fewer cases of resistance in vegetables

- Tillage





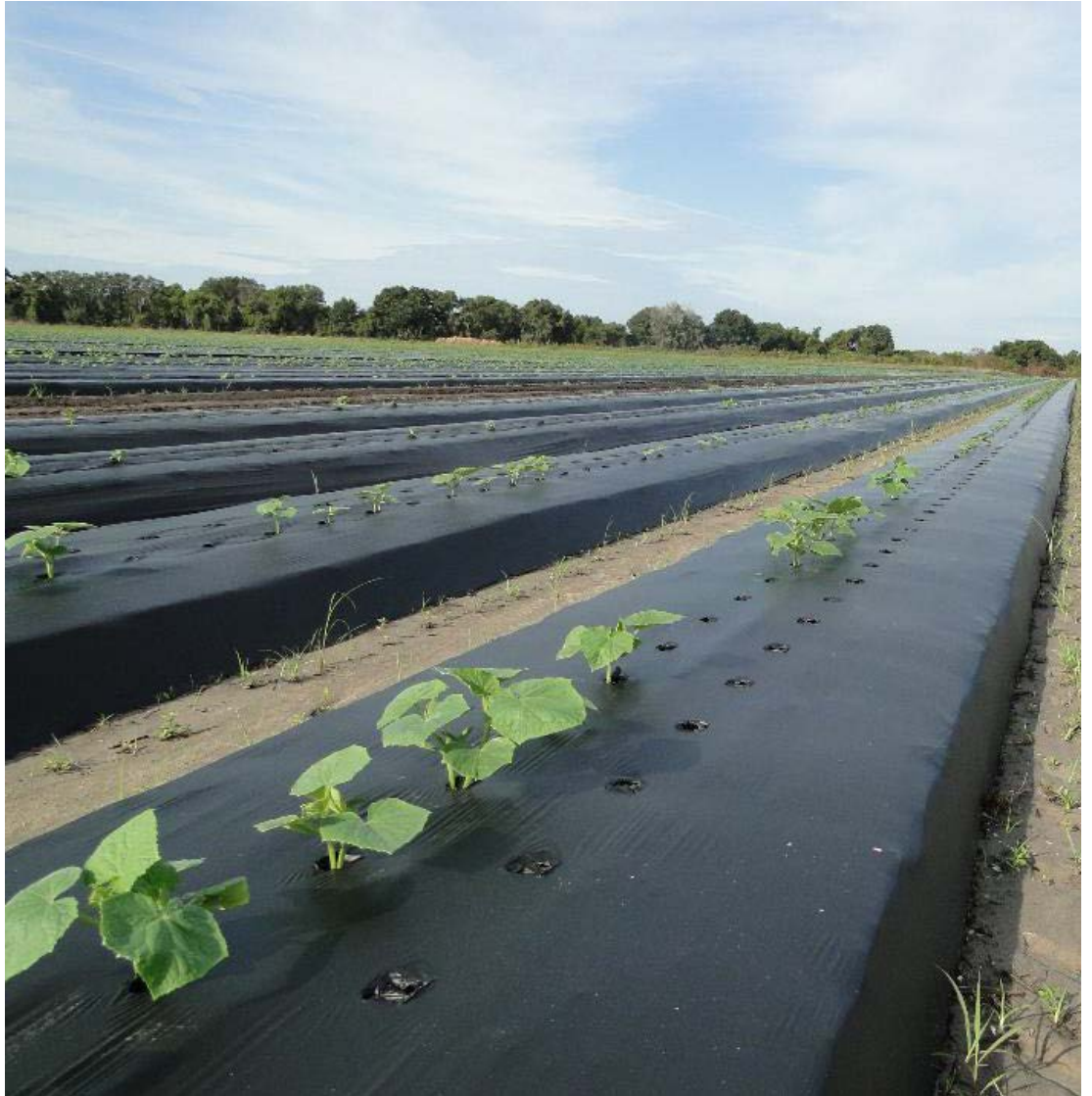
Why fewer cases of resistance in vegetables

- Tillage
- Fumigation



Why fewer cases of resistance in vegetables

- Tillage
- Fumigation
- Plastic mulches
- Hand weeding

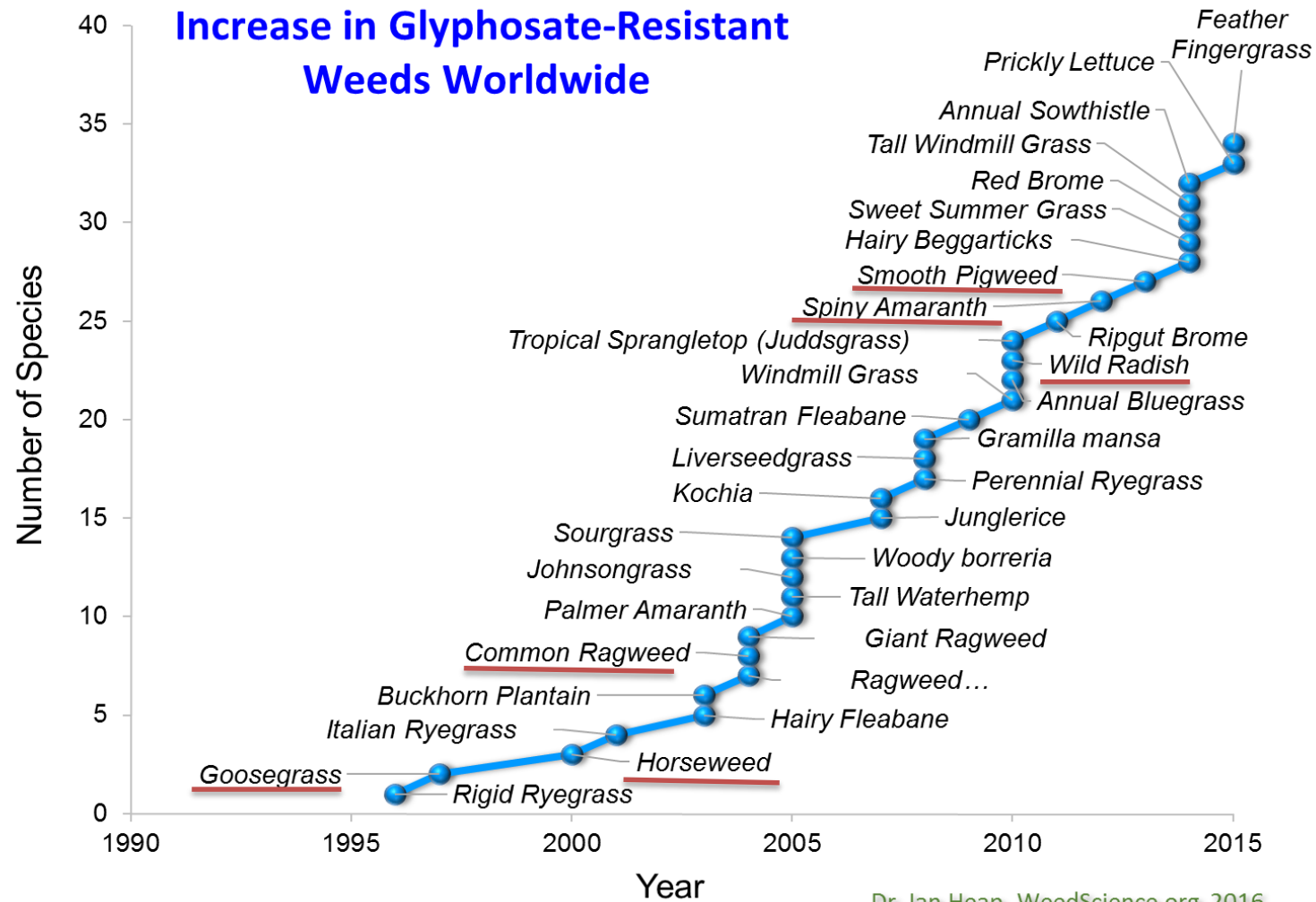


Resistance Could be a Serious Problem in Vegetables

- Few registered modes of action
- Rarely achieve a competitive canopy
- Vegetables tend to be very susceptible to competition
- Common weeds of vegetables have developed resistance in other crops



Glyphosate Resistant Weeds



American Black Nightshade

- Paraquat



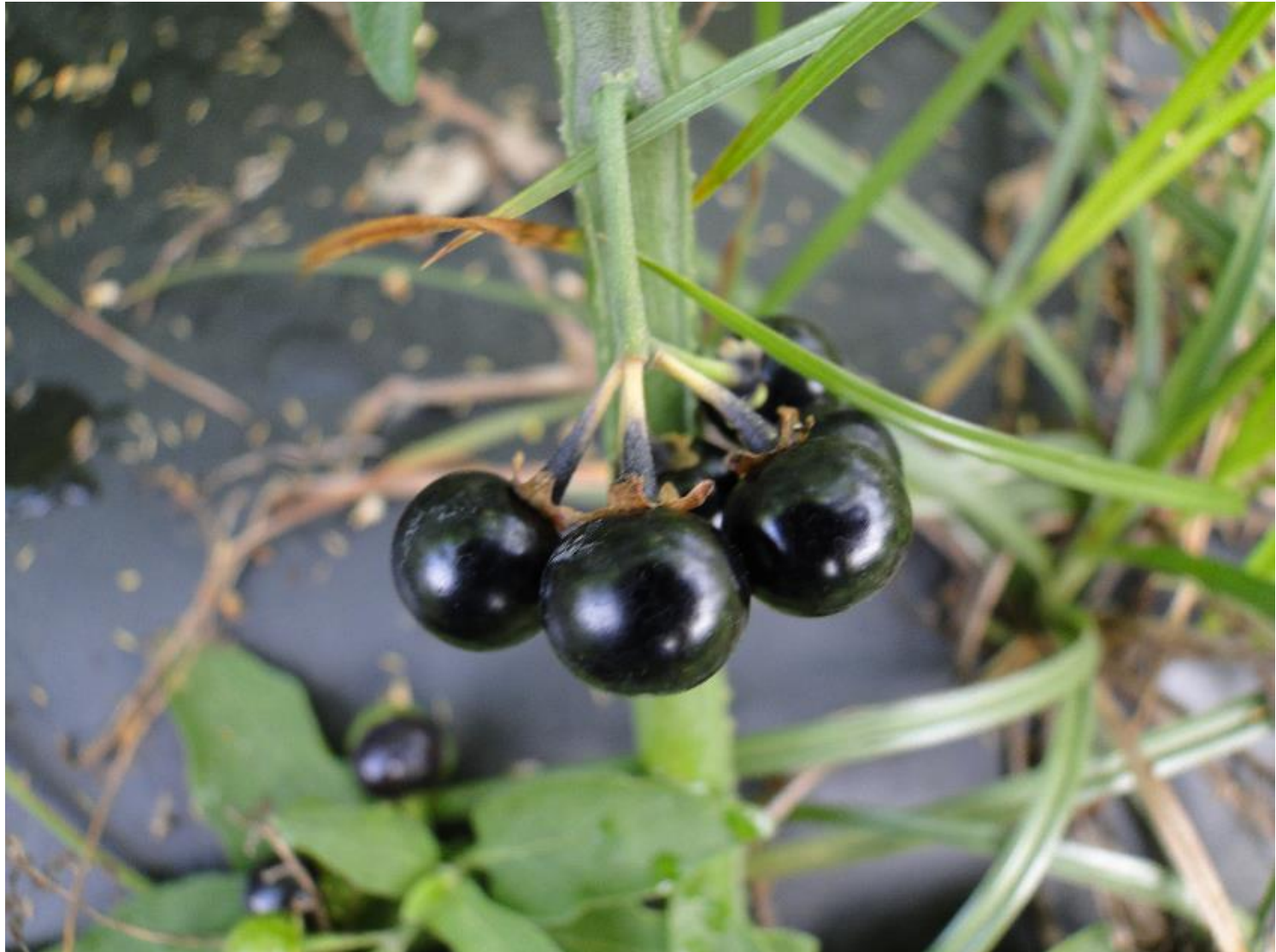
American Black Nightshade

- Paraquat



American Black Nightshade

- Paraquat



Goosegrass - Paraquat



Goosegrass

- Paraquat



Goosegrass

- Paraquat



Ragweed Parthenium

- glyphosate



Ragweed Parthenium

- glyphosate



UF | Detection of Resistance

- Good weed control except in localized areas
- Only one species is not controlled
- A previously susceptible species is no longer controlled by a given herbicide and the number of weeds of that species increases over time
- Uncontrolled species occurs in patches
- Dead plants of the same species are inter-mixed with plants that survived the herbicide application

How to Delay the Development of Herbicide Resistance

- Chemical
 - Rotate modes of action

A photograph of a tomato field with rows of green plants. Overlaid on the image are six green rectangular boxes with white text, each representing a different chemical application method. The background shows a blue sky with scattered white clouds.

Fallow - glyphosate

Row Middle
-flumioxazin

Fumigation

Post-Transplant
-halosulfuron

Under the Plastic
-S-metolachlor

Crop termination
- paraquat

How to Delay the Development of Herbicide Resistance

- Chemical

- Rotate modes of action
- Tank mix multiple modes of action
 - Flumioxazin + pendimethalin in row middles
- Retreat suspected resistant plants with a different mode of action

How to Delay the Development of Herbicide Resistance

- Cultural and Physical

- Crop rotation (cover crops)
- Remove resistant individuals
- Prevent spread of resistant biotypes
- Alternate physical/cultural methods with herbicides



Steps to take if you suspect resistance



1. Call your Extension Agent to investigate.
2. Preserve a few plant specimens for further testing.
3. Eradicate all surviving plants.
 - Tillage, herbicides, or hand removal
4. Do not let survivors produce seed!
5. Prepare a weed control program for next year that will address this problem.

