Weed management recommendations for Florida citrus

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Outline of presentation

I. Impact of weeds on citrus production
II. Weed management tactics
III. Weed management programs
    a. Young citrus
    b. Older citrus
IV. Current herbicide use in citrus
    a. Preemergence herbicides
    b. Postemergence herbicides
V. Factors affecting herbicide choice
V. Factors affecting efficacy of herbicides

Impact of weeds on citrus

- Yield loss of up to 23- 33%
- Weed control is 10 to15% of production cost in citrus

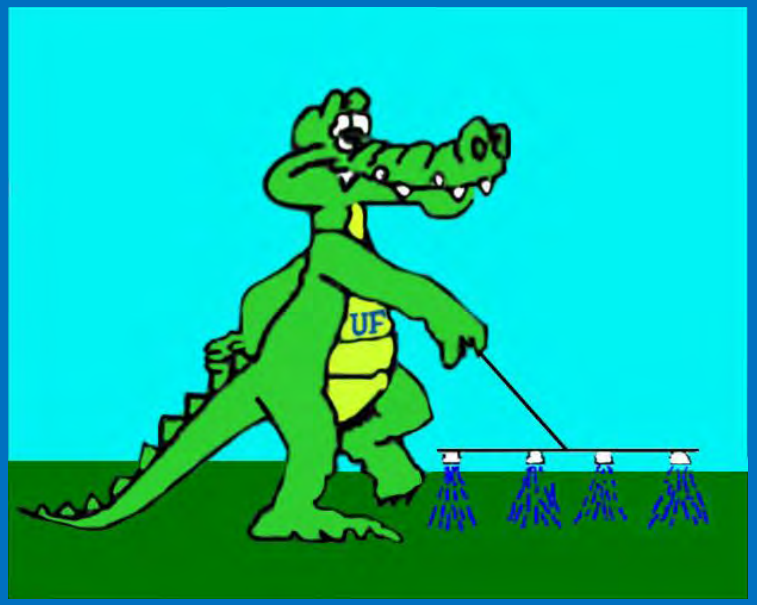
Impact of weeds on citrus

- Interfere with grove operations such as harvesting
- Serve as alternate host of other pests such as insects and disease
- Reduce soil temperatures during freezing events

Weed management goal: reduce weed population at a level that would lessen impact of competition

Weed control tactics

- Preventive
  - Spot treatment
  - Sanitation
- Mechanical
  - Tillage
  - Mowing
- Biological



- **Chemical**
  - **Herbicides**
    - **PRE vs. POST**
    - **Combinations**

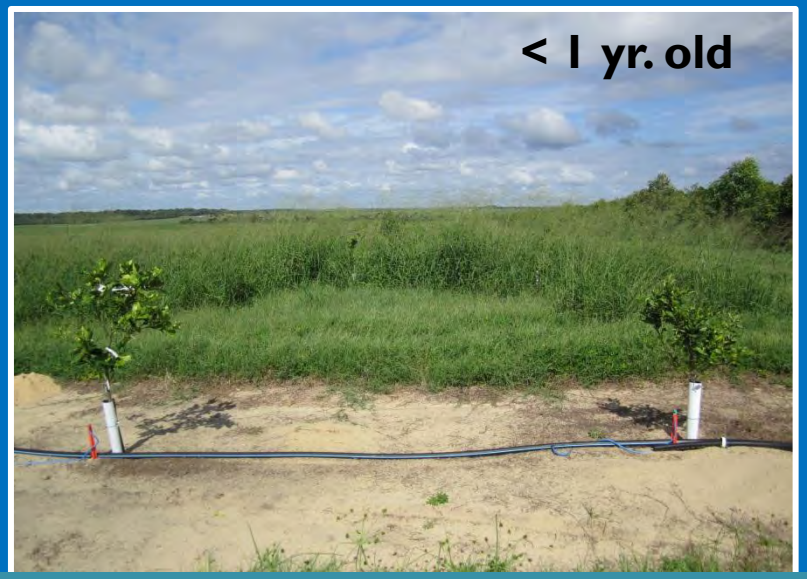
Weed management programs for young citrus

vs

- Critical during the first 3 yrs after planting

Weed management programs for young citrus

- Citrus trees less competitive
- Important resources are provided
  - Irrigation
  - Fertilizer
- More weed growth due to
  - Smaller canopy
  - FL weather conducive for weed growth



↑ in tree age = less space for weeds

Weed management programs for young citrus

- Important to give citrus a head start over weeds
- Common weed control tactics employed
  - PRE herbicides with good residual activity
  - POST herbicides as follow-up treatment
  - Restrictions on some herbicides

Weed management programs for older citrus

- Presence of weeds not too critical for productivity
  - Older trees have well developed canopy
- Maybe critical for other operations such as harvesting
  - Presence of vine weeds

Weed management programs for older citrus

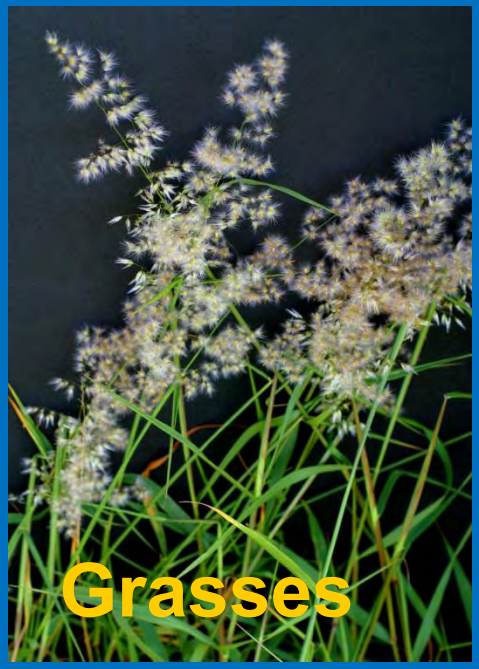
- Mowing
- Herbicides
  - Use of a PRE with long residual activity may be more beneficial
  - POST applied as need basis
  - Reduced application (frequency) due to minimal weed pressure

Factors that determine the herbicide choice

- Tree variety and age
  - Bearing vs. non-bearing
  - low vs. high rates
- Location
  - Flatwoods vs. Ridge
  - Restrictions

Effect of various rates of experimental herbicide on newly established grapefruit at Fellsmere, FL (2010 trial)

Weeds in the area


Grasses

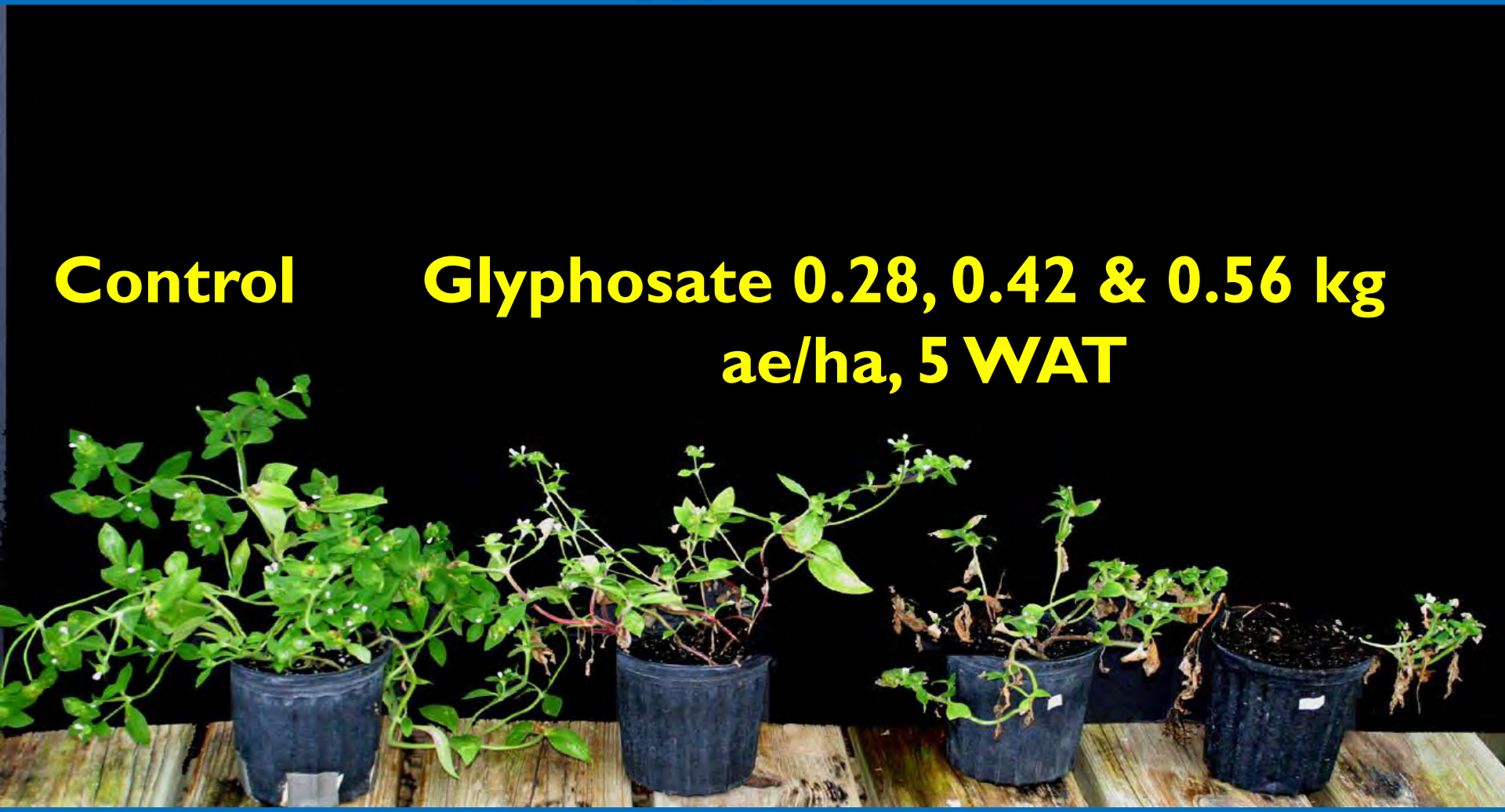

Sedges


Broadleaf

Annuals

Perennials

Not all weeds can be controlled by glyphosate!



Soil applied herbicides registered for Florida citrus

Common name	Brand name	Rates	Weeds controlled	
		product/ac	Broadleaf	Grasses
Diuron*	Direx, Karmex	2-4 lb	C(A)	C(A)
Bromacil*	Hyvar X	2-6 lb	C(A)	C(A&P)
Indaziflam[a]	Alion	5-6.5 fl oz	C	C
Pendimethalin*	Prowl H20, Pendimax(nb)	6.3-7.0pt 2-4.8 qt		C
Norflurazon*	Solicam	2.5-5 lb	PC	C
Simazine*	Princep 4L, Caliber-90	1-2.0 gal	C	C (A)
Oryzalin	Oryzalin 4AS, Surflan	0.5-1.5 gal	sC	C
Oxyflourfen (nb)	Goal	6 pt	C	
Bromacil+Diuron*	Krovar I	2-4 lb	C(A)	C(A&P)
Trifluralin	Treflan	1- 2 pts	C	C
Rimsulfuron (r)	Matrix		C	C

*commonly used; [a]- New; C-control, PC-partial control; A-annual; P-perennial; s-some
r - Restricted ; nb – non bearing

Recently registered PRE products for citrus

Alion (Indaziflam) – Bayer CropScience

- Mode of action: inhibition of cellulose biosynthesis
- Rates: 5-6.5 oz/ac; 10.3 oz/acre total annual
- Has excellent residual activity: 90-120 DAT
- Very effective against grasses and broadleaf
  - Limited activity on bermudagrass, annual sedge and purple nutsedge
  - Excellent on FL/BR pusley

Alion efficacy at 90 days after treatment

Indaziflam (5 fl oz/A)

Norflurazon + Diuron

Foliar applied (POST) herbicides registered for citrus

Common name	Brand name	Rate	Weeds controlled		
		product/ac	Broadleaf	Grasses	Sedges
Glyphosate*	many brands	22-43 oz	C	C	C
Carfentrazone	Aim EC	2 – 7.9 fl oz	C	C	C
Clethodim	Prism	6 fl. oz		C	
Glyphosate + 2,4-D	Landmaster	1-8 qt	C	C	C
Fluazifop	Fusilade DX/2E	1-1.5 pt		C	
Paraquat*(r)	Gramoxone SL/ Inteon	2.5-4 pt 20 pt max/yr	C	C	C
Sethoxydim	Poast Plus	2.25-3.75 pt		C	
Saflufenacil[a]	Treevix	1 oz	C		

*commonly used; [a] - New; C-control, PC-partial control; A-annual; Perennial; s-some nb –non bearing; r - Restricted

Recently registered POST herbicides for citrus

Treevix (Saflufenacil) – BASF

- Mode of action: protoporphyrinogen oxidase (PPO) inhibitor
- Rates: 1 oz/acre
- Quick and excellent burndown activity
- Very good on broadleaf but not on grass weeds
  - can be tank mixed with grass or non-selective herbicides

Treevix efficacy on citrus weeds

Untreated control

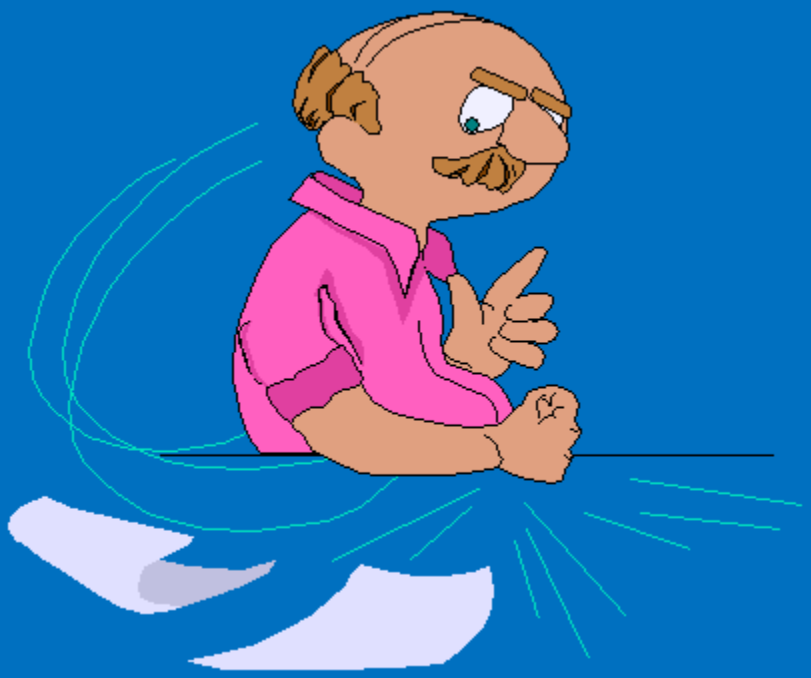
Treevix at 1 oz/ac

Treevix + Prowl H20 + Glyphosate

- effective on FL/BR pusley and Spanishneedles

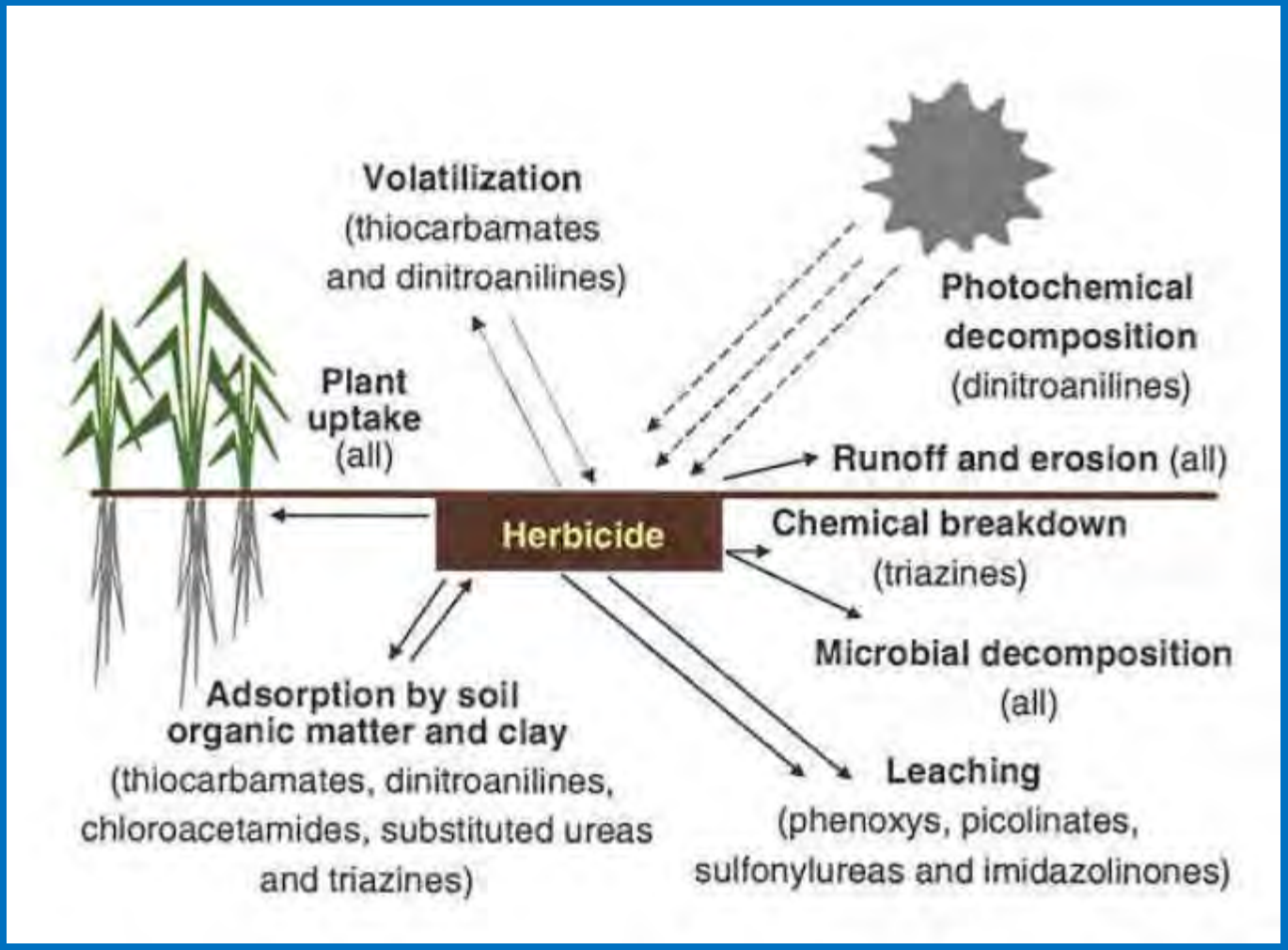
Factors affecting efficacy of herbicides

For a herbicide to work it must…..



- come in contact with a plant surface (root, shoot, leaves)
- remain at site long enough to penetrate or be absorbed
- move to its site of action

Fate of Herbicides in the Environment



Factors affecting efficacy of herbicides

- soil
  * organic matter, texture, CEC, pH

- climatic
  * temperature, moisture, humidity, light intensity

- Proper application
  * Age of weeds, timing, rates, spray equipment

Soil Factors: Organic Matter (OM) and Texture

- most important for soil applied herbicides
- *Indirectly influences all processes that affect herbicides!!*

↑ OM and clay content = ↑ adsorption of herbicides

Soil Factors: Texture

- Soil texture is used to determine application rates of soil-applied herbicides.

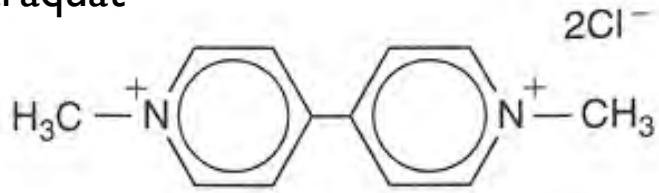
Table 1: Maximum Solicam DF Rates (Lbs. of Product per Treated Acre per Year) by Soil Texture

Crop	Coarse		Medium	Fine	Months after Planting to First Allowed Application (West/East of the Mississippi River)	Months after Application to Planting of Replacement Crop (West/East of the Mississippi River)	Special Use Directions & Exceptions (see list below)	Pre-Harvest Interval (PHI) (Days)
	Sand, Loamy Sand	Sandy Loam	Loam, Silt Loam, Silt, Sandy Clay Loam	Sandy Clay, Clay Loam, Silty Clay Loam, Silty Clay, Clay				
Citrus	2.5 - 5.0	2.5 - 5.0	3.75 - 5.0	5.0	0/0	0/0	2	30
Irrigated Citrus (FL and TX only)	2.5 - 10.0	2.5 - 10.0	3.75 - 10.0	5.0 - 10.0	0/0	0/0	1, 2	30
Apples	2.5 - 5.0	2.5 - 5.0	5.0	5.0	0/0	0/0	3	60

Soil Factors: Cation Exchange Capacity (CEC)

- soils ability to adsorb positively charged compounds
- fine-textured, high-organic matter soils have larger CEC's than coarse, low-organic matter soils
- influence rate of application

paraquat



Soil Factors: pH

- influences water solubility, adsorption, and persistence of herbicides

- more persistent in high pH soil
  - triazines - Simazine
  - sulfonylureas - Matrix

Important Soil Parameters Of Two Citrus Soil Types (0-12")

Parameters	"Ridge"	"Flatwoods"
Soil type	Candler Sand	Myakka Sand
Sand (%)	96.5	93.2
Silt (%)	2.0	4.4
Clay (%)	1.5	2.4
Org. matter (%)	0.4	0.8
pH (H_20)	5.6	5.8
CEC (meg/100g)	1.3	3.3
Bulk density (g/cc)	1.3	1.5

Climatic Effects: Temperature

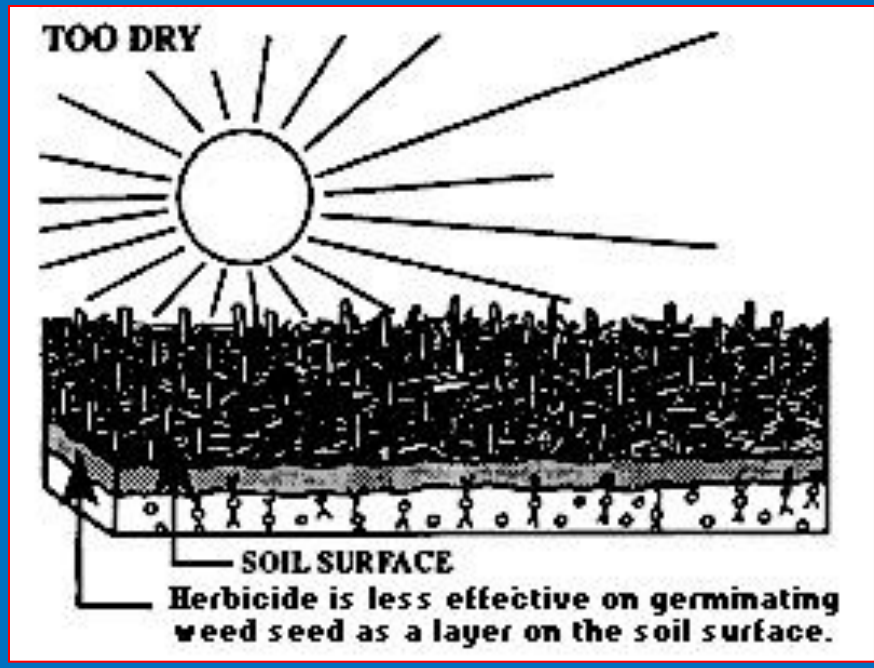
- In johnsongrass, Roundup absorption doubled as temperature was increased from 75^0 to 95^0 (McWhorter et al. 1980)

Climatic Effects: Moisture - PPI/PRE

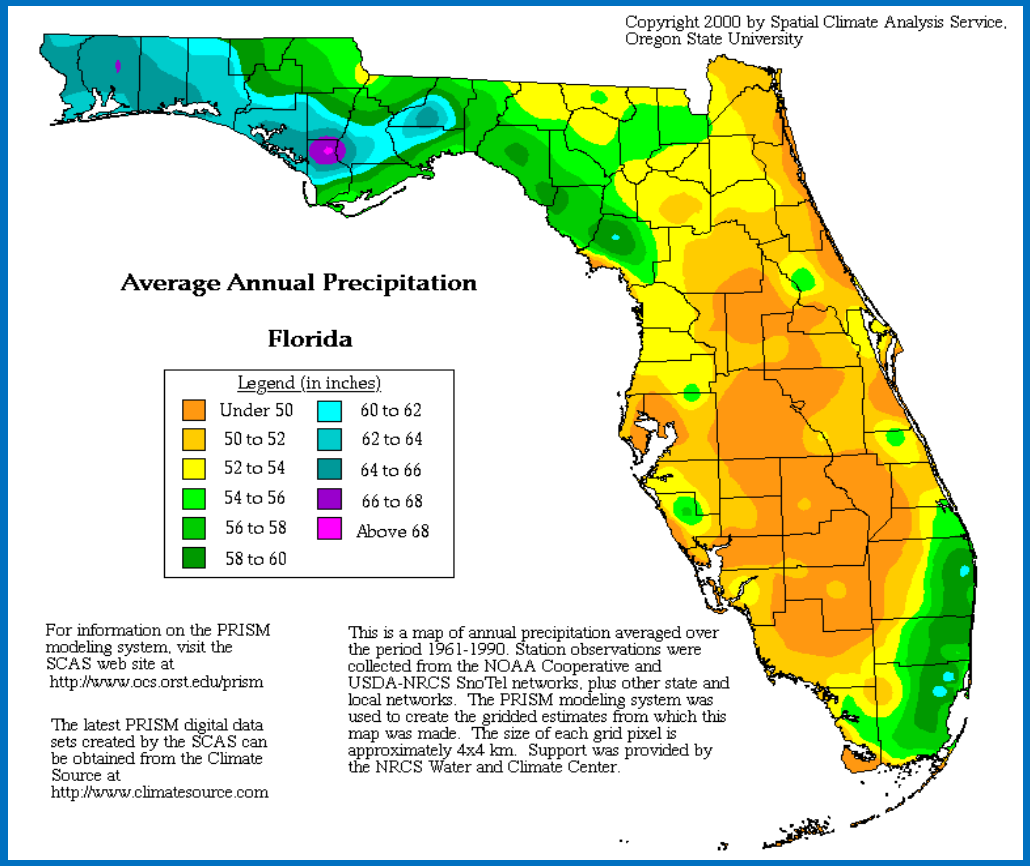
- activation
  * *movement to 0.5" within 7-10 d*

  but not too much (leaching!)

- adsorption
  * *availability*

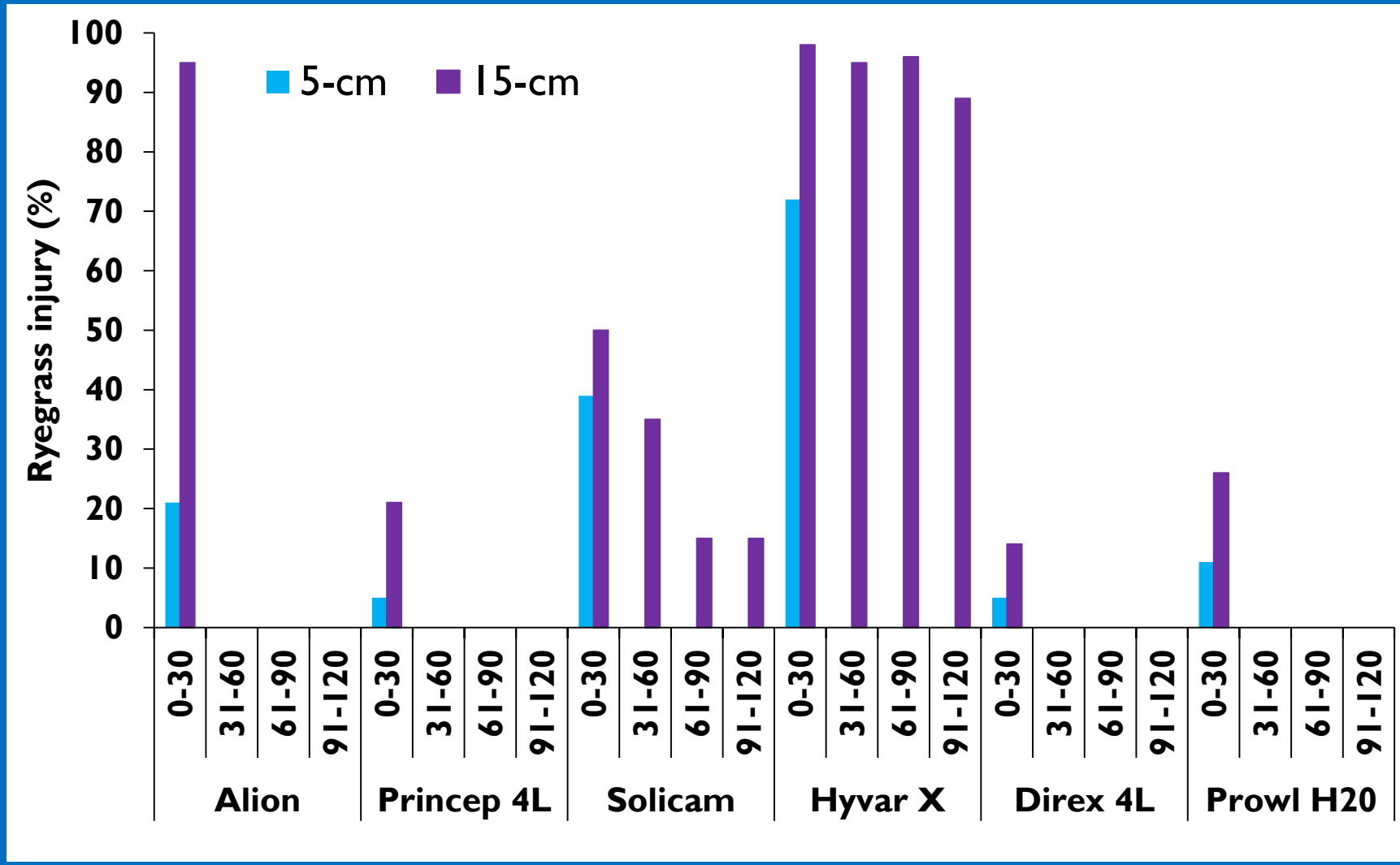


Climatic Effects: Moisture - PPI/PRE



- Some regions within the state are prone to leaching due to high amount of rainfall and inherent soil type

Leaching of commonly used PRE herbicides in citrus under two amounts of rainfall



Climatic Effects: Moisture - POST

Dry weather causes…..

- plants to develop thicker cuticles
- reductions in absorption, retention, and translocation
- POST herbicides i.e. glyphosate: better control if applied in Fall than in Spring

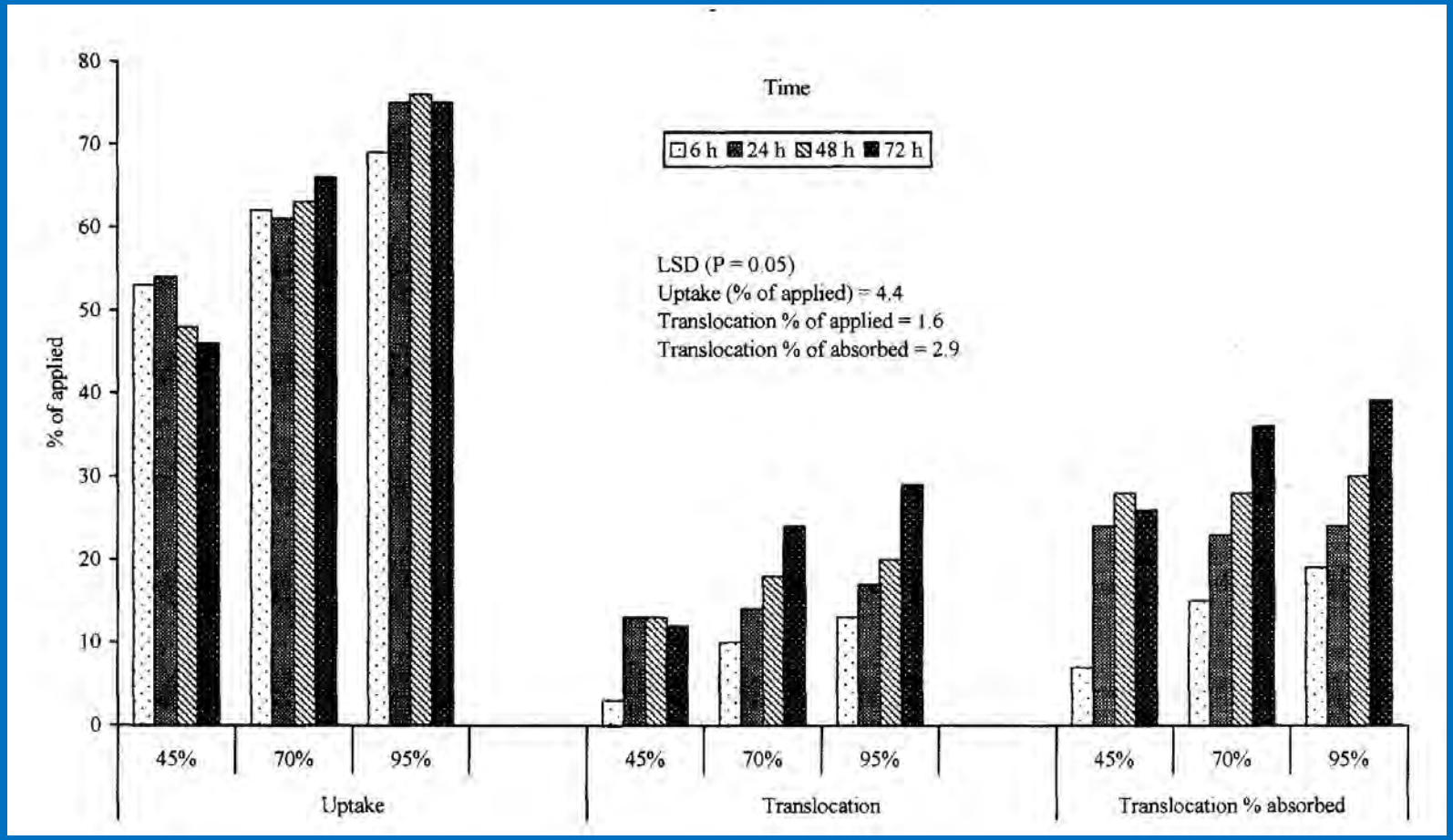
Climatic Effects: Relative Humidity

- A higher relative humidity level …..

* extends drying period of herbicide droplets.

* hydrates plant cuticles.

Effect of relative humidity on uptake and translocation of ^{14}C-glyphosate in Florida beggarweed



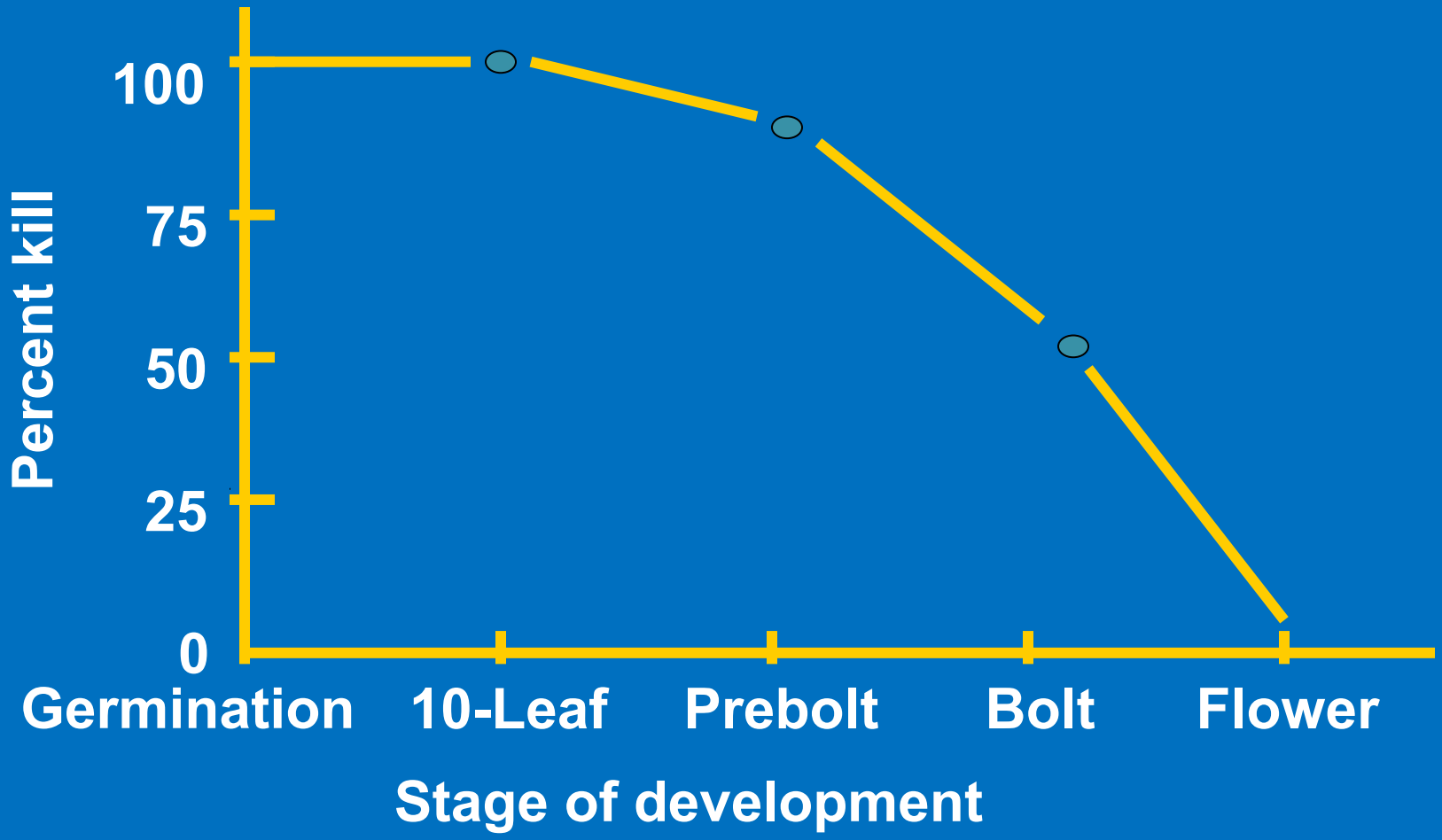
Climatic Effects: Light Intensity

- influences photosynthesis, cuticle development, stomatal openings, and photodecomposition

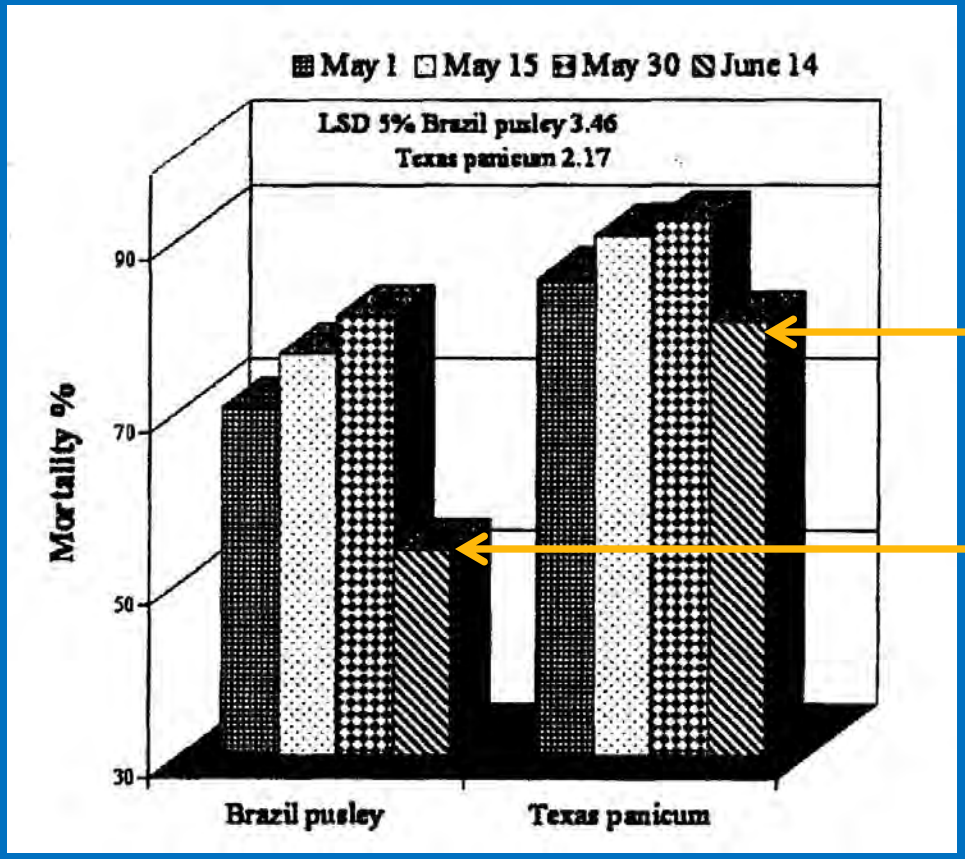
- Some herbicides are incorporated to prevent photodecomposition

Time of Application

- Pre-emergence : Before weed emergence
- Post-emergence Foliage applied



Effect of application time of glyphosate on mortality of Brazil pusley and Texas panicum

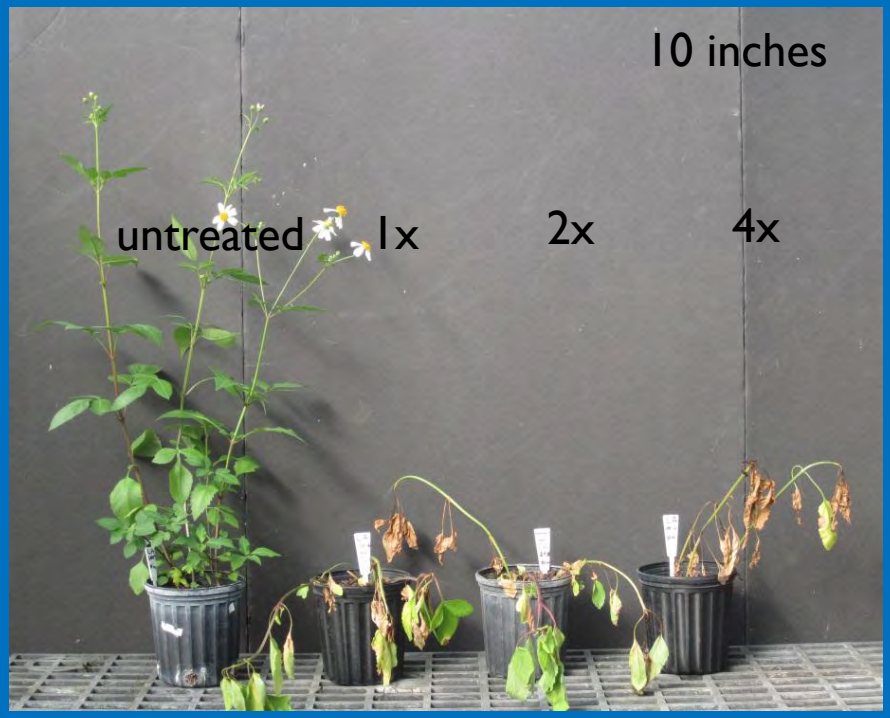


May 1: BR pusley – 0.2 m
Texas panicum – 0.3 m

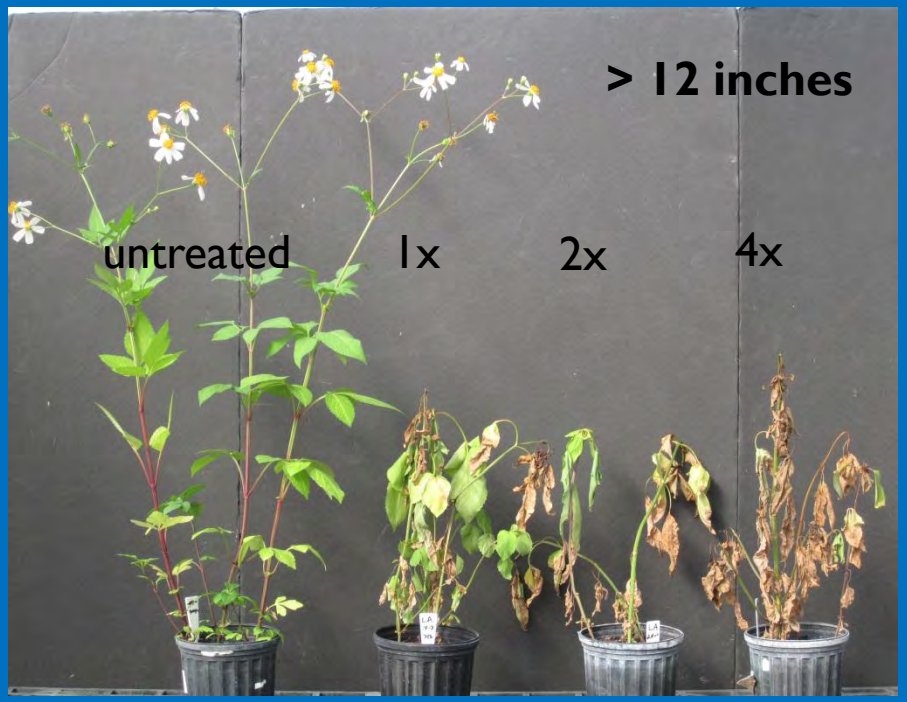
Reduced control since weeds were older

Singh et al. 2005

Growth stage and glyphosate rate effects on herbicide efficacy



Growth stage and glyphosate rate effects on herbicide efficacy



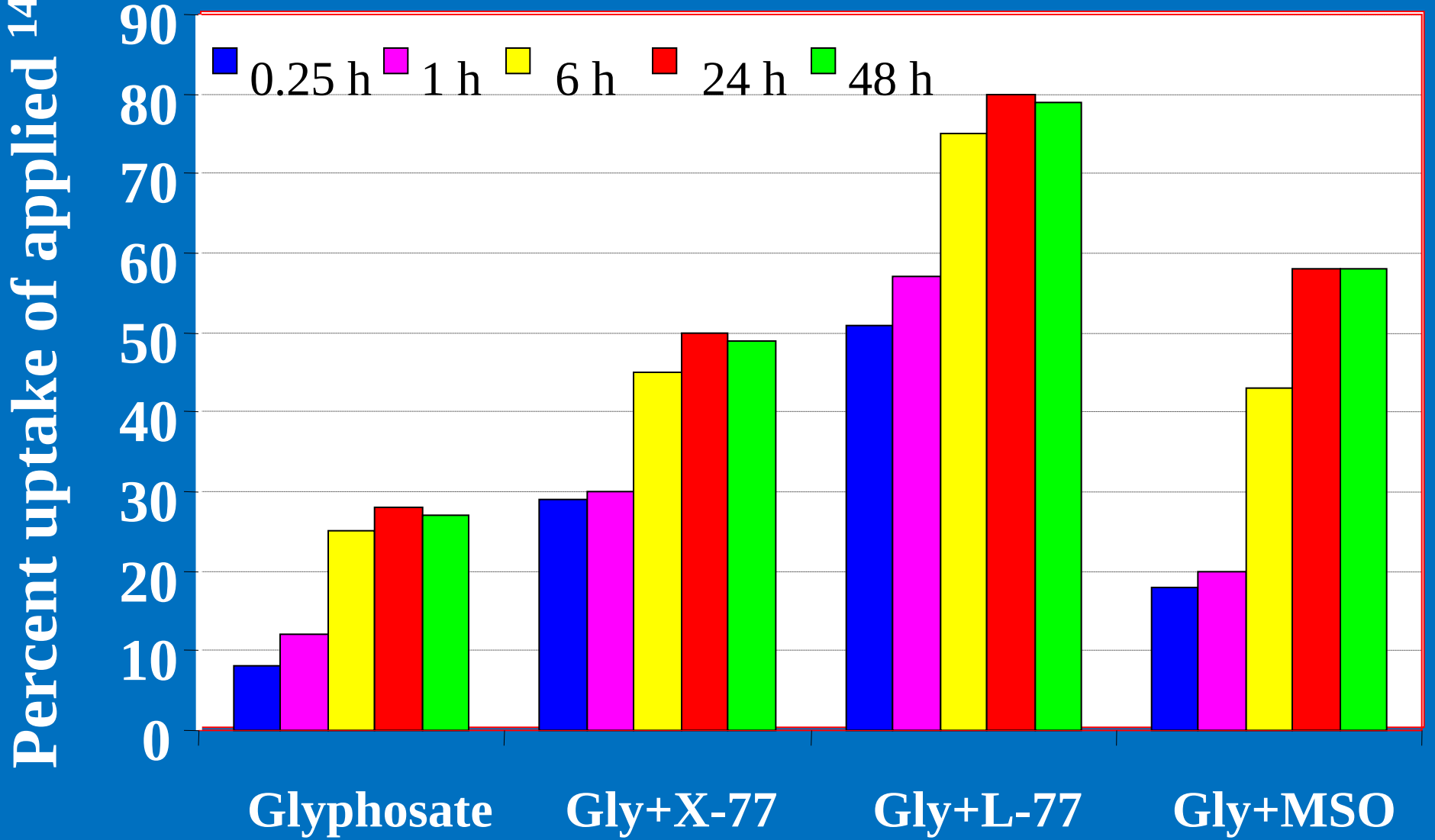
Older weeds = higher rate of herbicides

Use of adjuvants

- POST herbicides benefit most from the use of appropriate surfactants
  - glyphosate + NIS + AMS
  - Paraquat + COC
  - Treevix + MSO

- Adjuvants increase absorption and translocation of herbicides within the plants

Enhanced uptake of herbicide by surfactants in *Bidens pilosa*



Calibration of spray equipment

Spray volume is affected by:

- Speed
- Nozzle size
- Pressure

Calibrate equipment to check for correct spray output delivery

Increase in nozzle flow after 40 hrs of use

Material	Increase (%)
Brass	11.4
Delavan	7.5
Stainless steel	6.1
Lurmark	2.1
Hardened S. S.	1.2
Thermoplastic	0.4

Source: Kris Firth, Farm Chem. June 1989, P. 36

To maximize herbicide efficacy:

- Know your weeds
  Scout groves periodically
- Know what is available
- Read herbicide labels

To maximize herbicide efficacy:

- Follow herbicide label recommendations
  - Rate of application
  - Time of application
  - Weed growth stage
  - Use appropriate type and rate of adjuvant

Thank you…

Citron melon at Conserve II