Programming & management of troublesome turfgrass weeds

Devon Carroll, Ph.D.

Topics

- Weed management principles
- Sedges & kyllingas (*Cyperaceae* spp.)
- Crabgrass (*Digitaria* spp.)
- Goosegrass (*Eleusine indica*)
- Broadleaved weeds
- Mechanical weed control (fraise mowing)

Weed Management Basics

- **Best "herbicide"** is healthy turf
- Integrated approach required
- ≠ Control does not mean 100%
- Identification is key

ID Tools

Google app

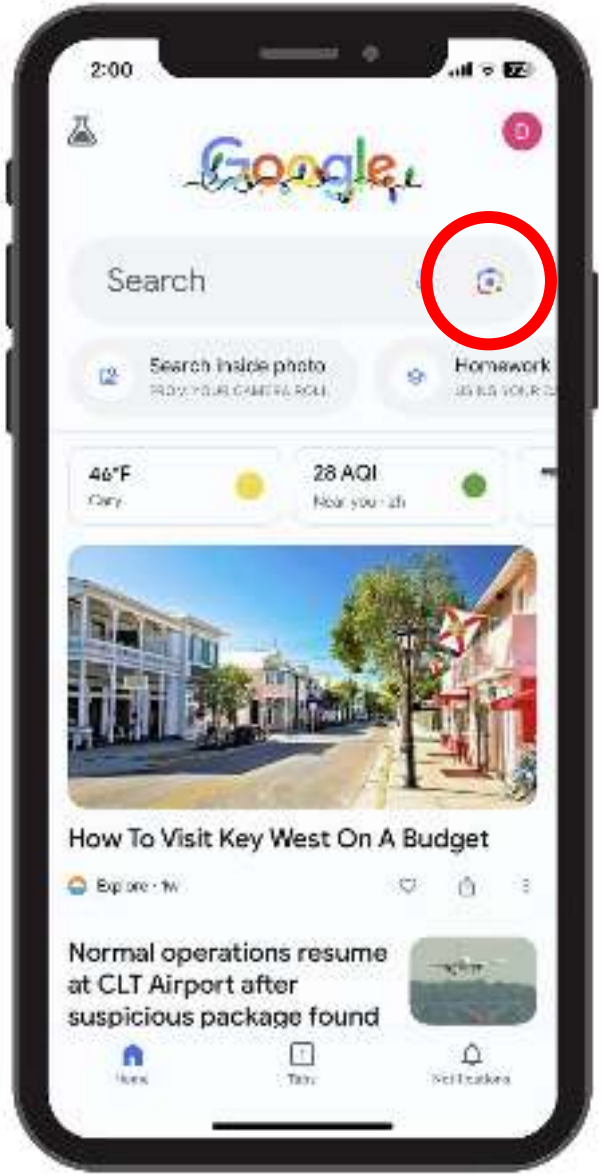
Easy as 1, 2, 3

ID Tools

Google app

Step #1

Click camera icon in search bar



ID Tools

Google app

Step #2

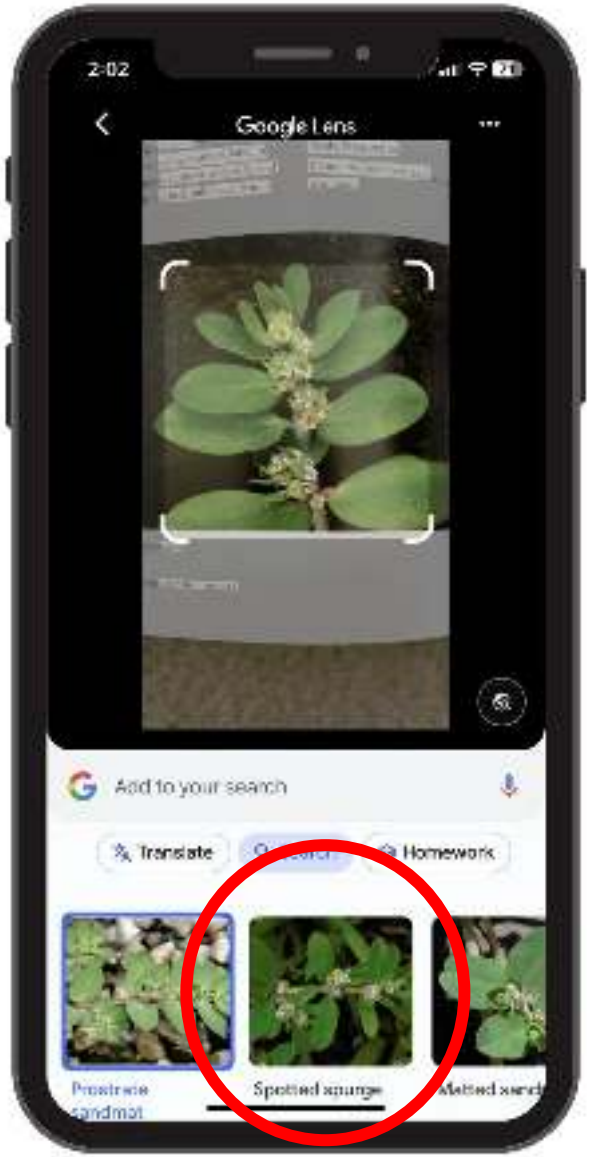
Take close-up photo of weed (or other pest!)

ID Tools

Google app

Step #3

Match suggested photos to the weed



Biology Matters

- Annual vs. perennial life cycle
- Growth habit
- Seed germination timing
- Seed production timing

- When to treat
- Application frequency
- Herbicide mobility

Sedges & Kyllingas
Cyperaceae spp.

Identification & Biology

- Thick, triangular stem differentiates from grass weeds
- Annual or perennial depending on species
- Reproduction by seed **and/or underground structures**

"Carex pachystachya - chamisso sedge" by Matt Lavin

Jim Brosnan, Ph.D.

Identification sedge vs. kyllinga

- Seedhead is best tool
- Difficult if not present
- Shape, color, time of year

Sedge

Bert McCarty, Ph.D.

Kyllinga

Jim Brosnan, Ph.D.

Identification sedge vs. kyllinga

- Reproductive structure
- Tuber vs. rhizome
- Single vs. network
- Single plant can produce **> 500 tubers** if undisturbed!

Kyllinga

Jim Brosnan, Ph.D.

Annual Sedge

Jim Brosnan, Ph.D.

Purple Nutsedge

Todd Lowe, Envu

Identification sedge vs. kyllinga

Kyllinga

Bert McCarty, Ph.D.

Jim Brosnan, Ph.D.

Growth Habit

- Single plants (sedge) vs. patches/clump (kyllinga)

Location

- Low mowing height (putting green) = likely kyllinga

Sedge

Bert McCarty, Ph.D.

Cultural Control

- Thrive in moist environments
  - If a re-occurring issue, consider improving drainage/altering soil type
  - Tubers can survive 3 years with moisture but only a few days dry
- Mowing
  - Sedges cannot withstand low mowing
  - Mow regularly & lower heights if possible

Fix Underlying Issues!

Jim Brosnan, Ph.D.

Chemical Control (PRE)

metolachlor (15), indaziflam (29)

- **DO NOT CONTROL TUBERS**
- Only prevent seedling emergence
- Remember, seeds are often not the main source of spread
  - Species dependent

Chemical Control (POST)

Jim Brosnan, Ph.D.

sulfentrazone (14), halosulfuron (2), flazasulfuron (2), trifoxysulfuron (2), penoxsulam (2)

- Rare situation with POST > PRE
- One application does not equal success
- Best to apply to young plants
- Re-application 6 to 8 weeks later
- Herbicide resistance!

Weed Science 2016 64:33–41

ALS–Resistant Annual Sedge (*Cyperus compressus*) Confirmed in Turfgrass

Patrick E. McCullough, Jialin Yu, J. Scott McElroy, S. Chen, H. Zhang, Timothy L. Grey, and Mark A. Czarnota*

Acetolactate synthase (ALS) inhibitors are widely used for POST control of sedges in turfgrass. A suspected resistant (R) biotype of annual sedge was collected from a bermudagrass turf in Georgia with a history of exclusive use of halosulfuron. Research was conducted to evaluate the resistance level of this biotype to halosulfuron, efficacy of ALS-inhibiting herbicides and other mechanisms of action for control, and the molecular and physiological basis for resistance. In greenhouse experiments, the halosulfuron rate required to reduce shoot biomass 50% in comparison with the nontreated at 8 wk after treatment (WAT) were 8 and > 1,120 g ai ha^{-1} for the S (susceptible) and R biotypes, respectively. Imazapic, sulfosulfuron, and trifloxysulfuron reduced biomass of the S biotype greater than 60% at 8 WAT, but biomass was reduced less than 20% for the R biotype. Glufosinate, glyphosate, MSMA, and sulfentrazone reduced shoot biomass of the R biotype by 93, 86, 97, and 45%, respectively. In laboratory experiments, the halosulfuron concentration required to inhibit ALS activity by 50% in excised leaf tissues was 5.8 and > 1,000 µM for the S and R biotypes, respectively. Gene sequencing of the R biotype revealed a Pro-197-Ser substitution that confers resistance to ALS inhibitors. This is the first report of ALS-inhibitor resistance in annual sedge and herbicide resistance in a sedge species from a turfgrass system.

Nomenclature: Glufosinate; glyphosate; halosulfuron; imazapic; MSMA; sulfentrazone; sulfosulfuron; trifloxysulfuron; annual sedge, *Cyperus compressus* L.; bermudagrass, *Cynodon dactylon* L. (Pers.) × *Cynodon transvaalensis* Burtt-Davy.

Key words: Efficacy, mutation, sedge, sod, turf, sulfonylurea.

ALS inhibitors are the most widely used herbicides for POST control of sedges (*Cyperus* spp.) in turfgrass. These herbicides have low use rates, broad-

Practitioners often use halosulfuron for sedge control when multiple turfgrass species are managed in lawns, golf, or sod production.

Summary

- Difficult to control
- Best means of control is to fix underlying problem
- Chemical applications can be effective
  - Mainly POST
  - 2 apps required
- Beware of resistance!


Crabgrass
Digitaria spp.

Biology

- “Annual” life cycle
  - Perennial in tropical climates
  - This affects control!

- Generally a sign of weak turf
  - Raise mowing height
    - High HOC blocks sunlight
  - Improve fertility
  - Deep/infrequent watering

"Digitaria ischaemum - smooth crabgrass"
by Matt Lavin

Identification

- Multiple species of interest
  - Control is generally the same
- Prostrate stems
- “Starburst” like growth habit
- Rolled leaves, often with hairs
- Commonly confused with goosegrass
  - Important to differentiate for control

“Crabgrass" by The NYSIPM Image Gallery

Growth Habit

Crabgrass

"Crabgrass" by tyx88820

Goosegrass

Seed Heads

Crabgrass

"Large crabgrass" by The NYSIPM Image Gallery

Goosegrass

"Goosegrass" by The NYSIPM Image Gallery

Leaf Shape

Crabgrass

Matt Elmore, Ph.D.

Goosegrass

Matt Elmore, Ph.D.

Chemical Control (PRE)

turfdiseases.org

metolachlor (15), pendimethalin (3), oxyfluorfen (14), oxadiazon (14), indaziflam (29)

- Leverage PRE chemistry strength
- Principles of weed science: control early, don’t spend the season chasing control
- Apply ~ 2 weeks before germination anticipated

Chemical Control (POST)

Todd Lowe, Envu

quinclorac* (4), MSMA (17), metribuzin (5)

*Include MSO with quinclorac for best control

- SCOUT
- Best applied at early growth stage (**1 to 2 tillers**)
  - Or 6+
  - In general, 3-5 tiller stage extremely difficult to control


Goosegrass
Eleusine indica

Biology

- “Annual” life cycle
  - Perennial in tropical climates
  - This affects control!
- Often found in compact areas
  - Wear/traffic
  - Thin turf cover

Jim Brosnan, Ph.D.

Jim Brosnan, Ph.D.

Identification

- Prostrate stems
- White center of origin
- Folded leaves
- Seedhead like a “zipper” or “feather”

Chemical Control (PRE)

Jim Brosnan, Ph.D.

metolachlor (15), pendimethalin (3), oxyfluorfen (14), **oxadiazon (14), indaziflam (29)**

- Make multiple PRE apps
  - 1 for crabgrass, followed by different a.i. if possible for goosegrass
  - Especially important in rainy seasons
- **SCOUT** - typically germinates after crabgrass

Chemical Control (POST)

Jim Brosnan, Ph.D.

metribuzin (5), MSMA (17)

- Limited POST options = **PRE IMPORTANT**
- Best applied at early growth stage (1 to 3 tillers)
- Moisture management
  - Control drastically improves when soil is moist
  - Watering in can limit turf injury but may impact control

Soil Moisture

www.nature.com/scientificreports

scientific reports

Check for updates

OPEN

Environmental effects on efficacy of herbicides for postemergence goosegrass (*Eleusine indica*) control

Avat Shekoofa[1], James T. Brosnan[1], Jose J. Vargas[1], Daniel P. Tuck[2] & Matthew T. Elmore[2]

Experiments were conducted to understand environmental effects on efficacy of herbicides used to control goosegrass (*Eleusine indica* L. Gaertn.). Herbicides were applied to goosegrass maintained at soil moisture contents (VMC) of < 12%, 12 to 20%, or > 20%. Herbicides included fenoxaprop-p-ethyl (140 g ha^{-1}), topramezone (25 g ha^{-1}), foramsulfuron (44 g ha^{-1}), 2,4-D + dicamba + MCPP + carfentrazone (860 + 80 + 270 + 28 g ha^{-1}), and thiencarbazone-methyl + foramsulfuron + halosulfuron-methyl (22 + 45 + 69 g ha^{-1}). Goosegrass control increased as VMC increased. Vapor pressure deficit (VPD) and air temperature were manipulated to determine effects of evaporative demand on foramsulfuron. Effects of soil drying were also studied following foramsulfuron application. Reductions in transpiration rate (TR) and leaf area were greatest with foramsulfuron applications to goosegrass in silt-loam under high evaporative demand (3 kPa VPD, 38 °C). Foramsulfuron had no effect on goosegrass in silica-sand regardless of evaporative demand. TR dropped to 0.2 mmh^{-1} within eight days after application to goosegrass in silt-loam compared to 18 days in silica-sand. Overall, foramsulfuron efficacy on goosegrass was maximized under conditions of high soil moisture and evaporative demand, and may be reduced in sandy soils that hold less water.

Safening with Irrigation?

HortScience 54(9):1621–1624. 2019. https://doi.org/10.21273/HORTSCI14187-19

Goosegrass Control and Turfgrass Injury Following Metribuzin and Topramezone Application with Immediate Irrigation

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Additional index words. Cynodon dactylon Pers. × *Cynodon transvaalensis* Burtt-Davy, 'Tifway 419', turfgrass, weed control

round and behave more like a perennial. Also, seeds germinate year round, resulting in varying aged goosegrass plants, and inconsistent PRE and POST control efficacy.

Goosegrass control efficacy is effected, among other variables by the maturity of the plant. Previous research noted a reduction in control at the one- to two-tiller and four- to six-tiller growth stage, compared with the two- to four-leaf growth stage (Burke et al., 2005). McCarty (1991) noted differences in goosegrass control with diclofop based on goosegrass mowing height. Greatest control was achieved on goosegrass maintained at 1.3 cm, compared with higher heights or unmown. The addition of metribuzin with diclofop improved control efficacy of mature goosegrass plants.

End-user options for goosegrass control efficacy while maintaining acceptable turfgrass quality has decreased over the past decade or so, due to reduced performance for certain herbicides (e.g., foramsulfuron), specific goosegrass herbicides (e.g., diclofop-methyl) being removed from the market, and the removal and/or severe use reductions of other herbicides (e.g., monosodium methanearsonate). Current goosegrass control options (e.g., topramezone, metribuzin) also have activity on warm-season turfgrass, often

Broadleaved Weeds

Problem Weeds in Thailand

Annual

- Black Pigweed (*Trianthema portulacastrum*)
- Green Amaranth (*Amaranthus gracilis*)
- Garden Spurge (*Euphorbia hirta*)
- Sand-dune Spurge (*Euphorbia cumulicola*)
- Old World Diamond-flower (*Hedyotis corymbose*)

"Green Amaranth " by Willamette Biology

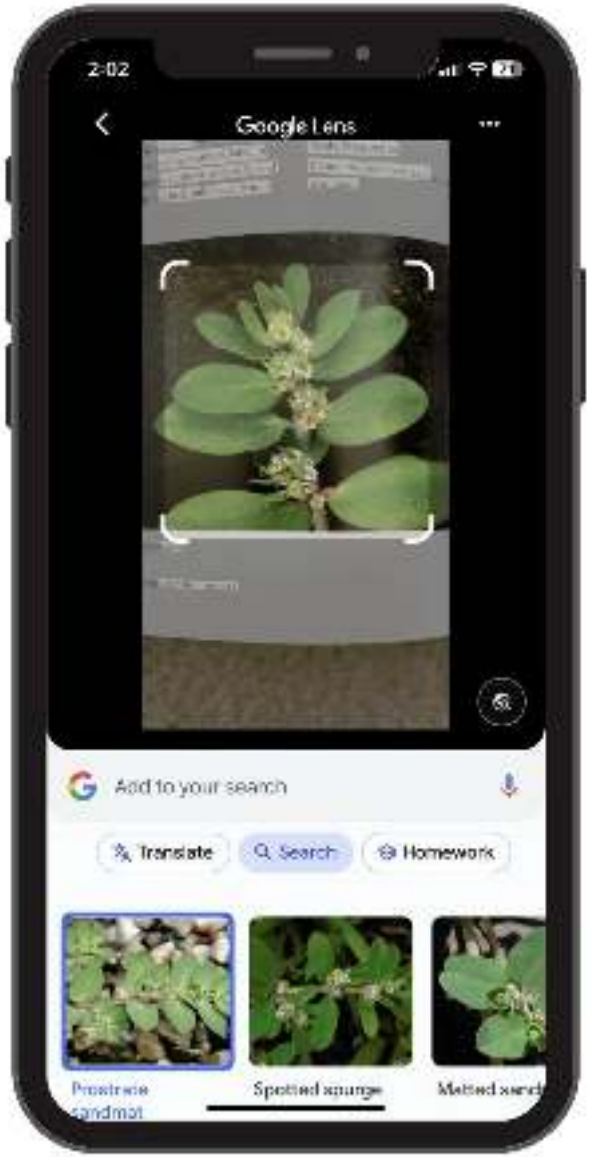
Perennial

- Wild Globe Everlasting (*Gomphrena celelosioides*)
- Sensitive Plant (*Mimosa pudica*)
- Threeflower Beggarweed (*Desmodium triflorum*)
- Alice Clover (*Alysicarpus vaginalis*)

"Mimosa pudica L. " by lalithamba

Identification

- Chemical control is **generally the same** across BLW species
- Identify individual problem weeds to choose the **BEST herbicide** and to assess cultural control options
- Germination timing important for PRE control



Chemical Control (PRE)

metolachlor (15), pendimethalin (3), oxyfluorfen (14), **oxadiazon (14), indaziflam (29)**

- Indaziflam = broadest spectrum PRE control
- Other PREs may have strength on specific weeds (e.g., oxadiazon for goosegrasss)

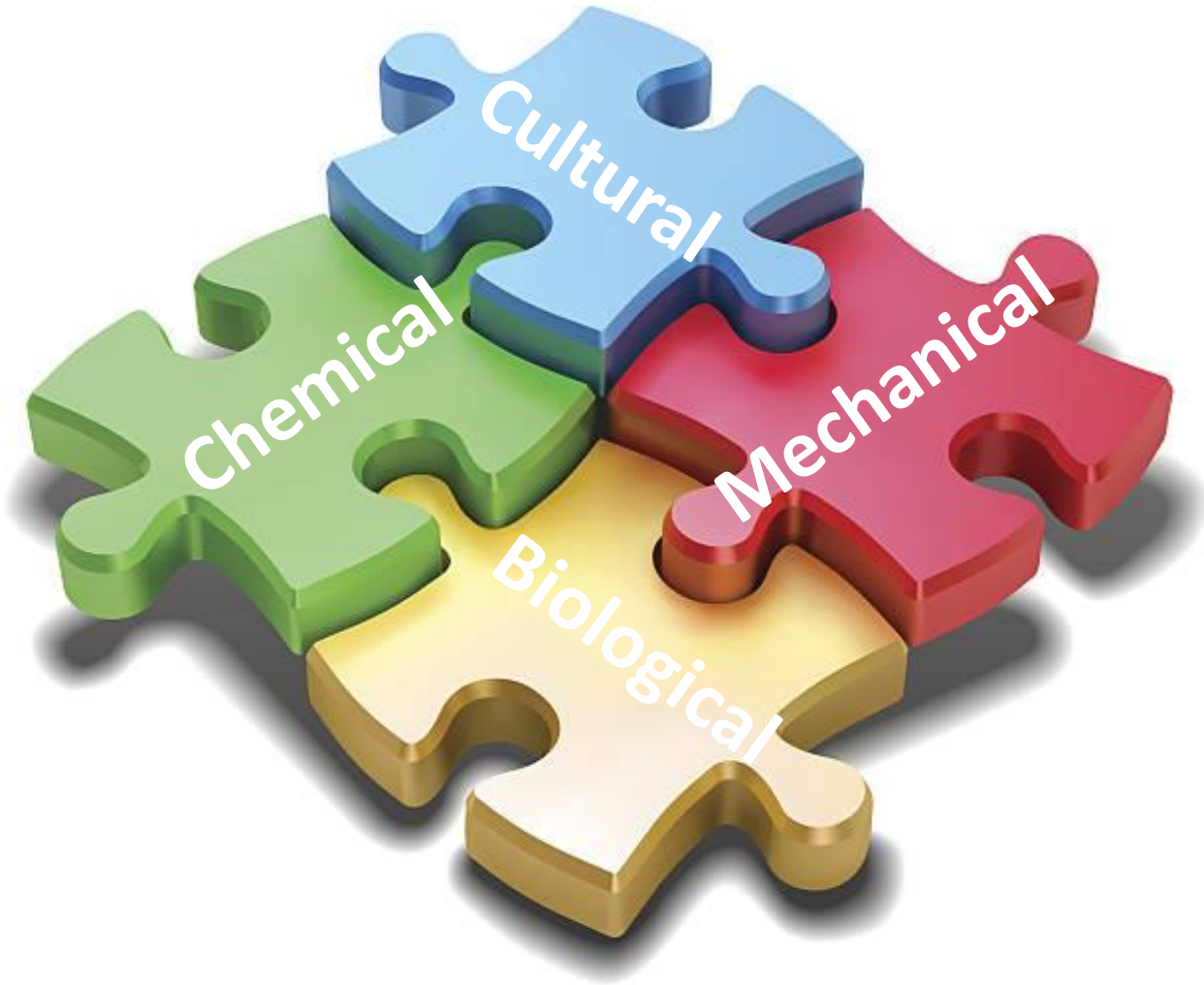
Chemical Control (POST)

- Broad germination times = control focus tends to be POST
- Group 4 is most typical, followed by group 2
  - Group 4 VERY safe to turfgrass (strong selectivity)
- Mixtures are best approach
  - 2,4-D + MCPA common
- Perennial weeds are harder to control
  - High rates
  - Repeat applications

MANY

Integrated Pest Management (IPM)

- Chemical control only **1 piece of the puzzle**
- Focus on cultural **1st**
- Biological solutions often have limited efficacy
- Few mechanical options (no fallow period)



Fraise mowing:
A mechanical solution

Fraise mowing:
A mechanical solution

Poa annua control by Fraise Mowing

% *Poa annua*									
	Tennessee					Florida			
Treatment	Jan	Feb	Mar	Apr		Jan	Feb	Mar	Apr
Non-treated (0 cm)	33 a	38 a	56 a	62 a		64 a	57 a	26 a	0 a
Fraise mow (1.5 cm)	0 b	1 b	2 b	2 b		10 b	22 a	6 ab	0 a
Fraise mow (3 cm)	1 b	2 b	4 b	2 b		9 b	17 a	5 b	0 a

Poa annua control by Fraise Mowing

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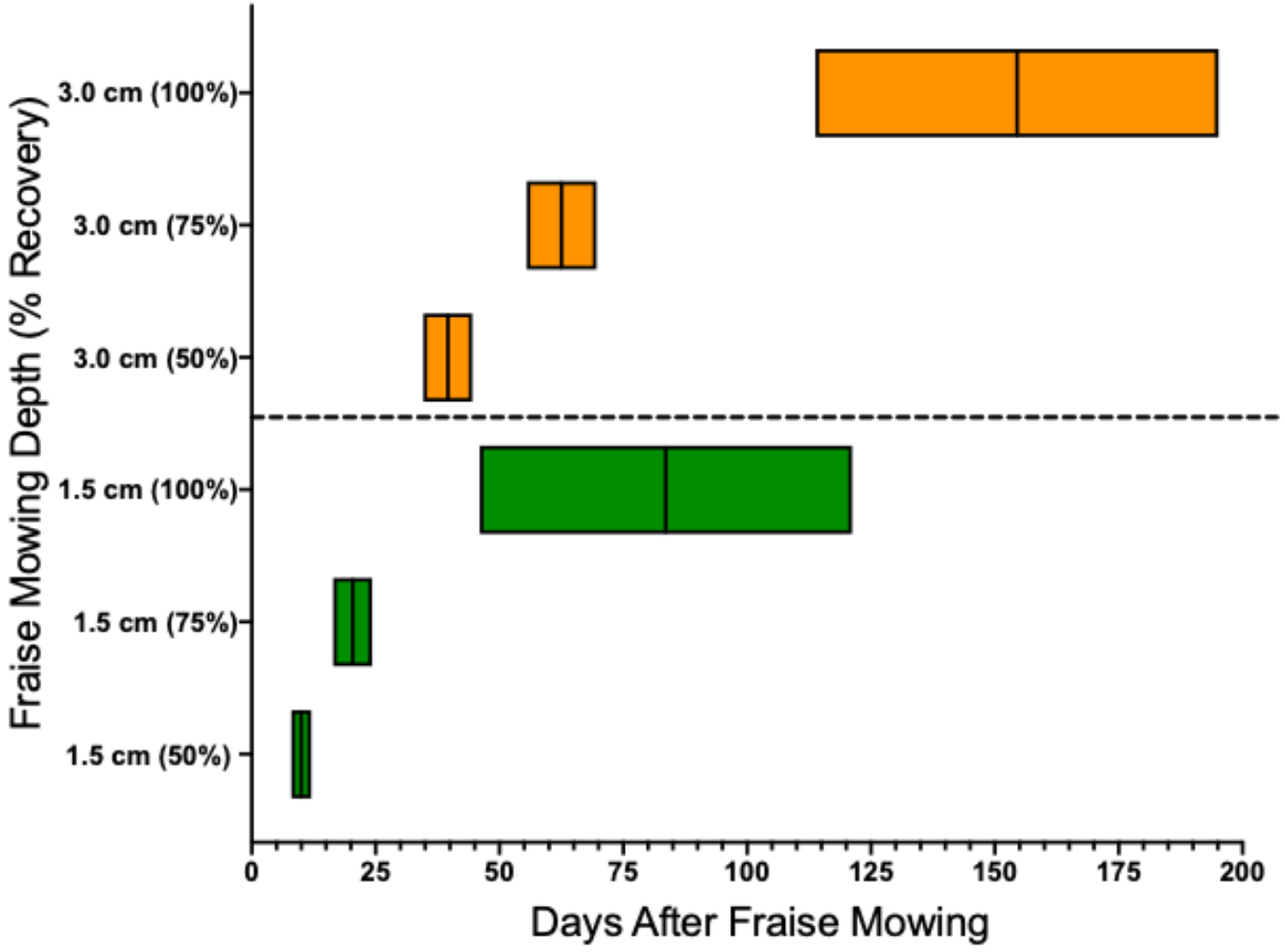
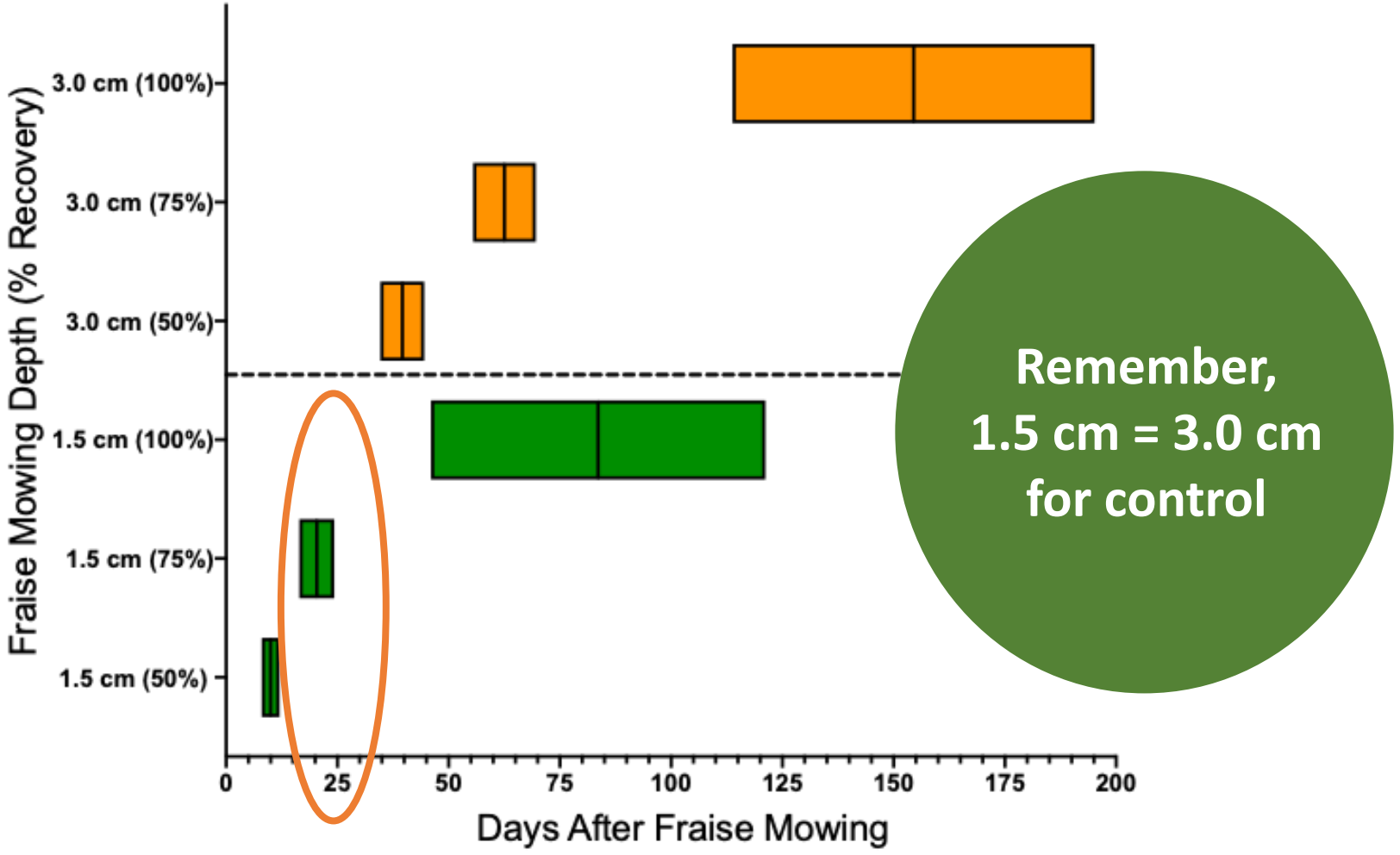
Bermudagrass Recovery (FL)



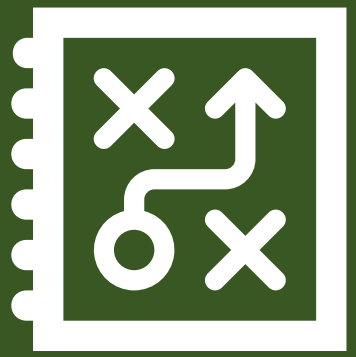
Bermudagrass Recovery (FL)



Remember, 1.5 cm = 3.0 cm for control

Bermudagrass Recovery (TN)

Bermudagrass Recovery (TN)



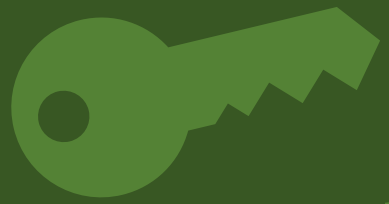
Strategize

Build a Program

Step 1

- Identify **3 biggest** weed problems throughout the year
- List a few other challenges (“nice to have” if possible)
- Common pitfall is trying to control “everything” = weak choices on most problematic weeds

Build a Program



Step 2

- Build program around top 3
- Choose strongest chemistry/control measures for THESE weeds
- Look for overlaps
- Use PRE chemistry where possible
- Mix/rotate chemistries!
- Don’t rely on chemical control alone

Build a Program

Step 3

- Based on remaining budget/product availability, plug in control for “nice to have” weed control
- Create a timeline for when control measures need to be implemented

Build a Program

Step 4

- **SCOUT & RECORD**
- Where are problem areas?
- What did you spray?
- Was it effective?
- Can learn over time where you need to treat
  - Maybe more expensive chemistry, but on smaller area
- Make changes with time

Questions?

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