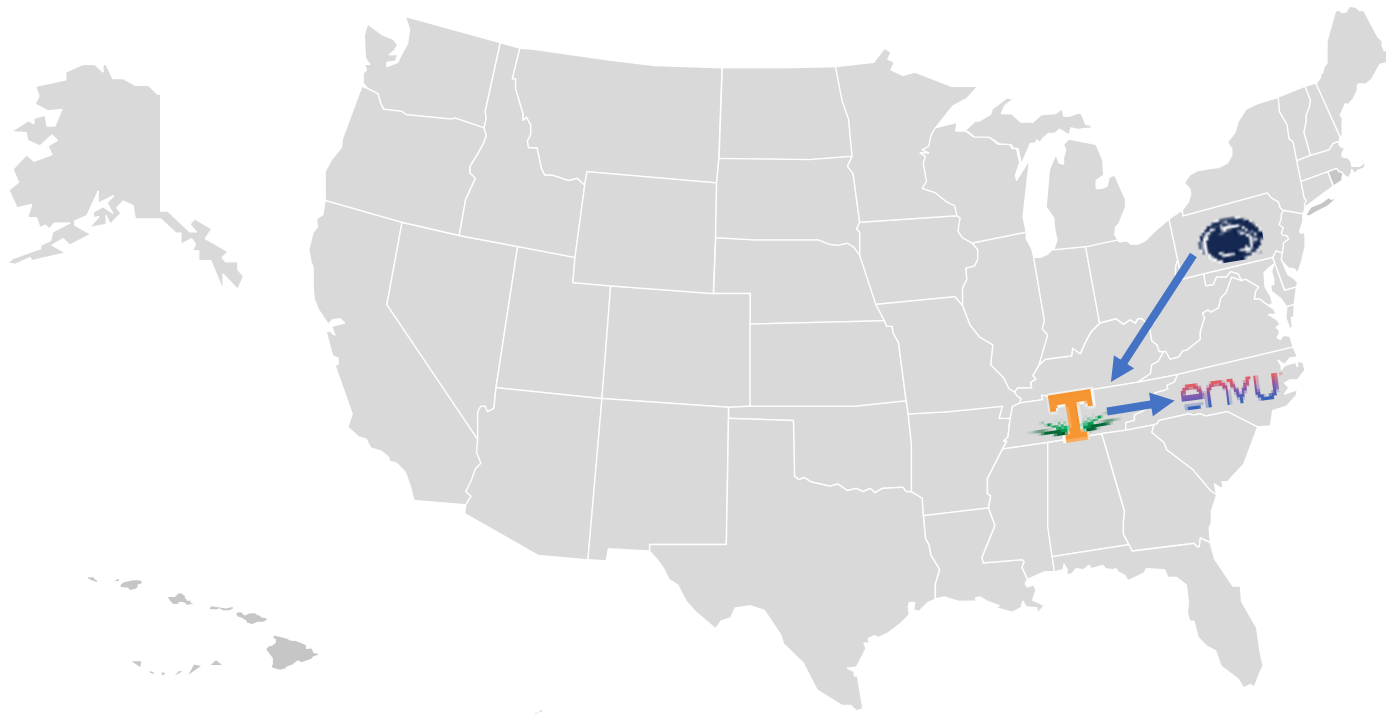




Herbicide modes of action: The building blocks to weed control

Devon Carroll, Ph.D.

Background



Key Definitions

Mode of action (MOA) = how an herbicide acts on a plant

Chemical family = group of herbicides with chemical similarities

Common name = chemical name

Trade name = marketed name

MOAs

- Defined by Herbicide Resistance Action Committee (HRAC) & Weed Science Society of America (WSSA)
- Indicated by a “group” number (used to be letters)
 - **35** defined MOAs across all crops
 - **19** used in turf
 - Not all available in Asia

Building blocks:

- How an herbicide “works” → how we use it
- RESISTANCE MANAGEMENT

Label Example


Full MOA &
Chemical Family
Not Listed

Trade Name

Common Name

MOA Group

POISON
KEEP OUT OF REACH OF CHILDREN
READ SAFETY DIRECTIONS BEFORE OPENING OR USING

 **Ronstar[®]**


TURF AND ORNAMENTAL HERBICIDE

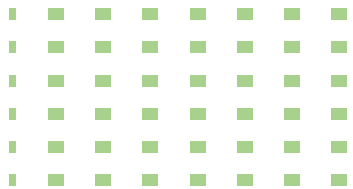
ACTIVE CONSTITUENT: 20 g/kg OXADIAZON

GROUP G HERBICIDE

15 kg NET For the control of certain weeds in Woody Ornamental Shrubs and Trees in nurseries or in Turf as specified in the Directions for Use table.

The bag must not be sold separately.
Do not destroy box while product still remains.


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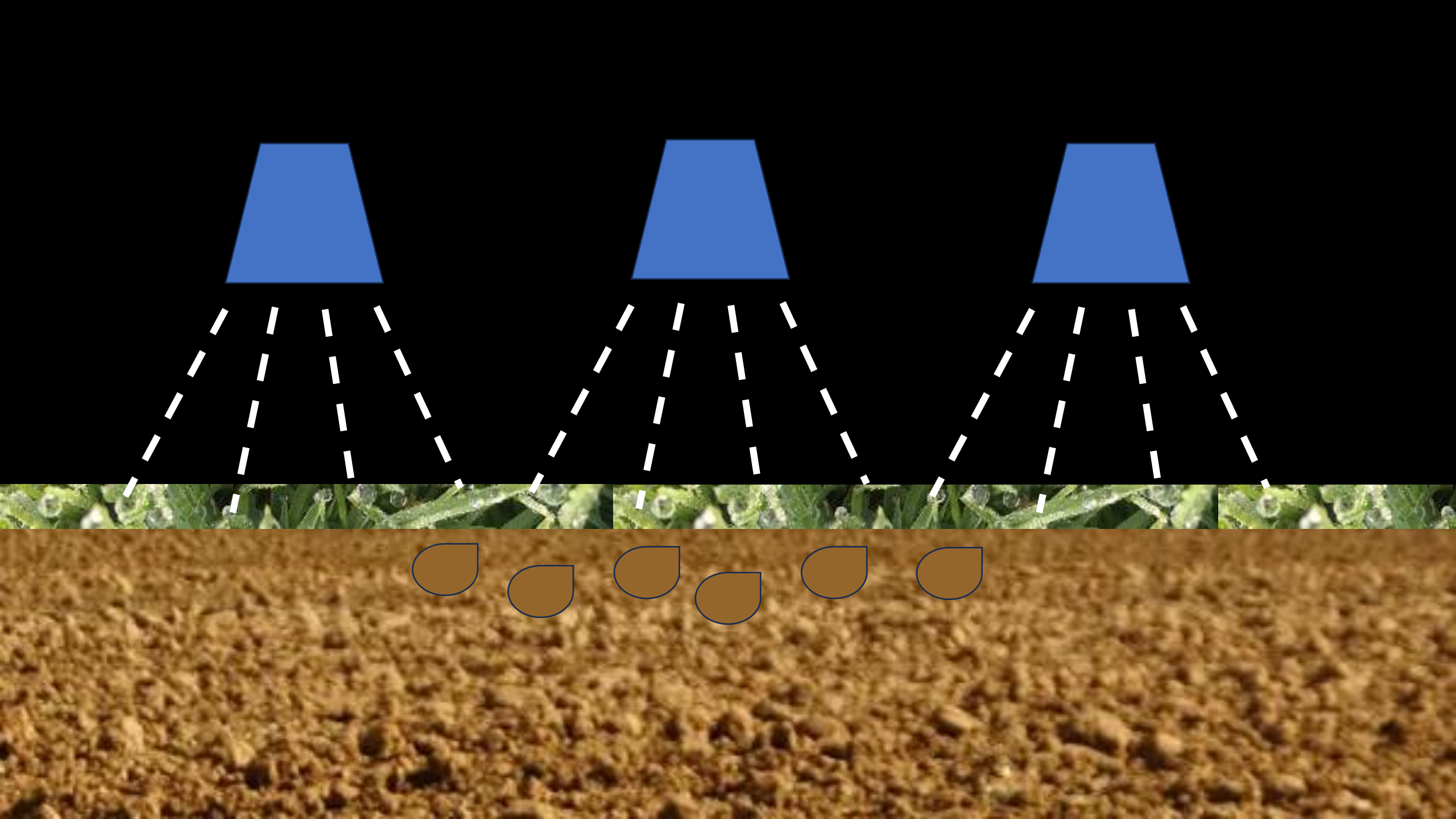


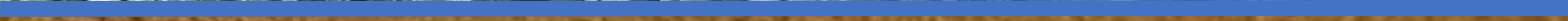
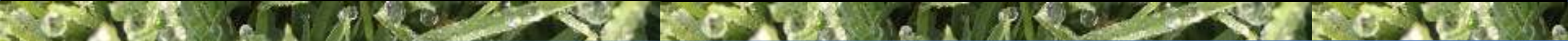
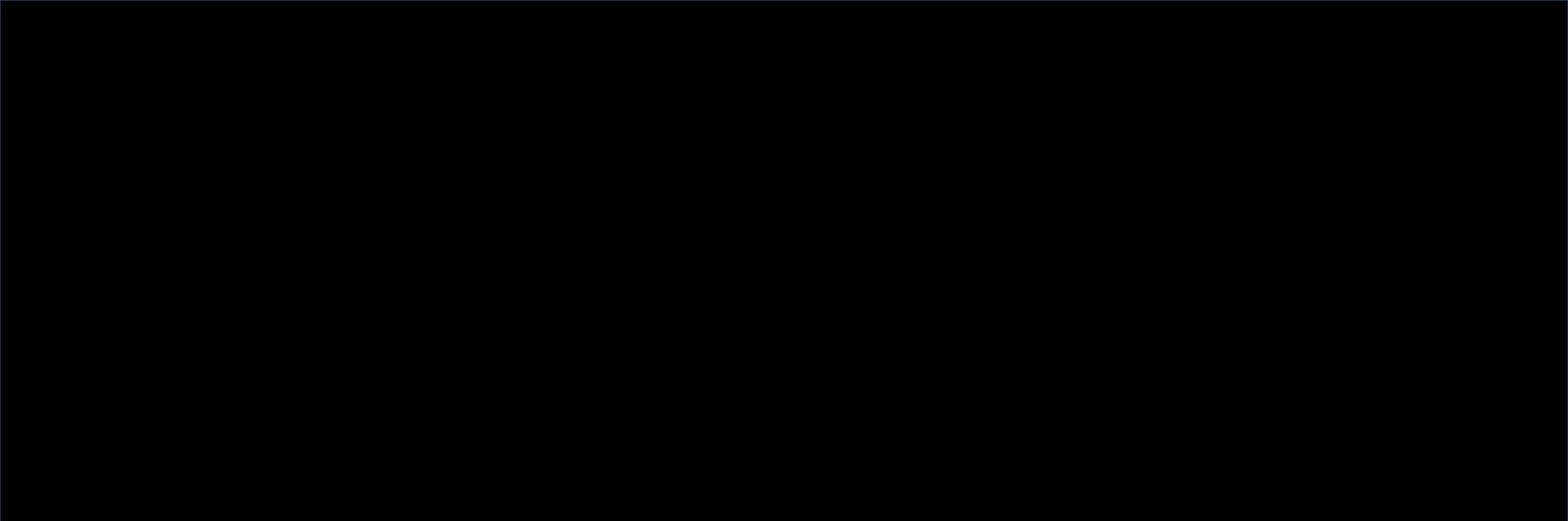
PRE – emergence

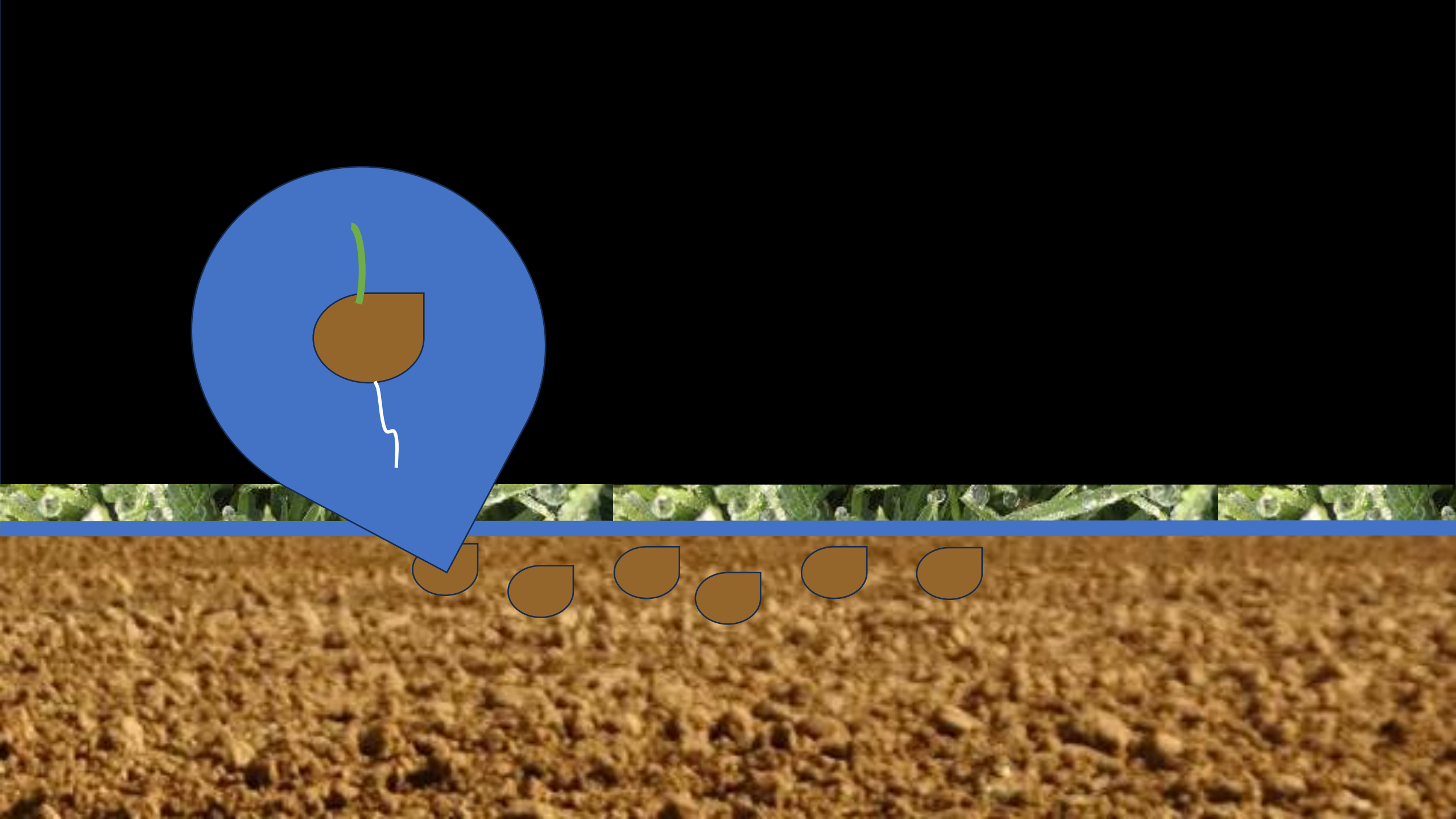


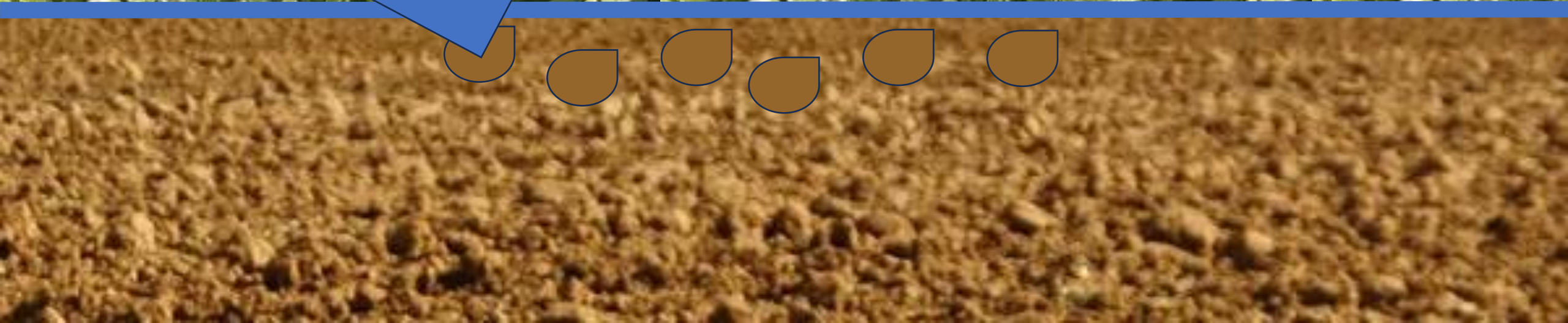
- Efficacy only against **ANNUAL** weeds
- **Control emergence** by stopping maturation
- Do **NOT** prevent seeds from germinating
- Mainly root inhibited
- Water in after application

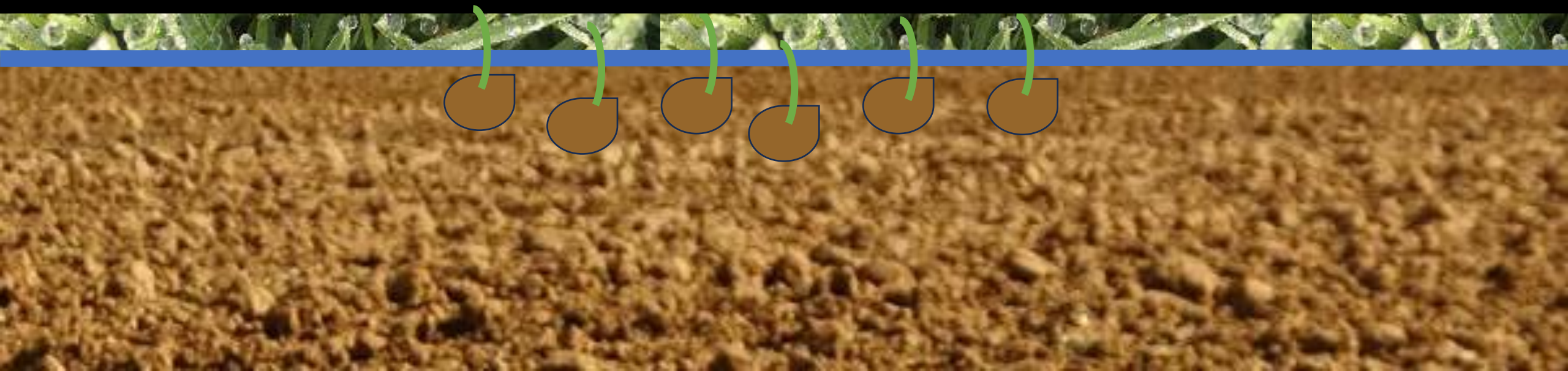






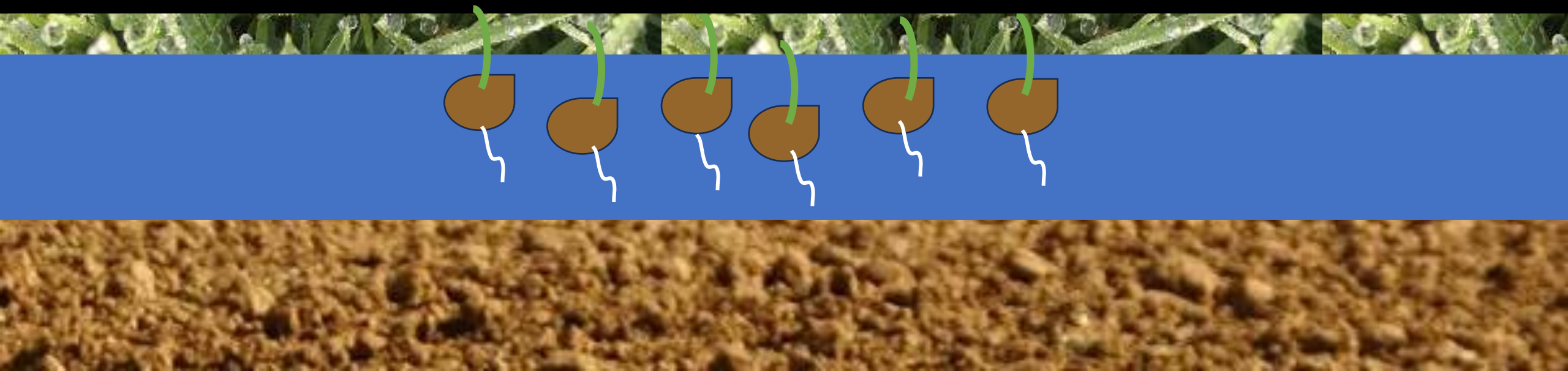














Group 3

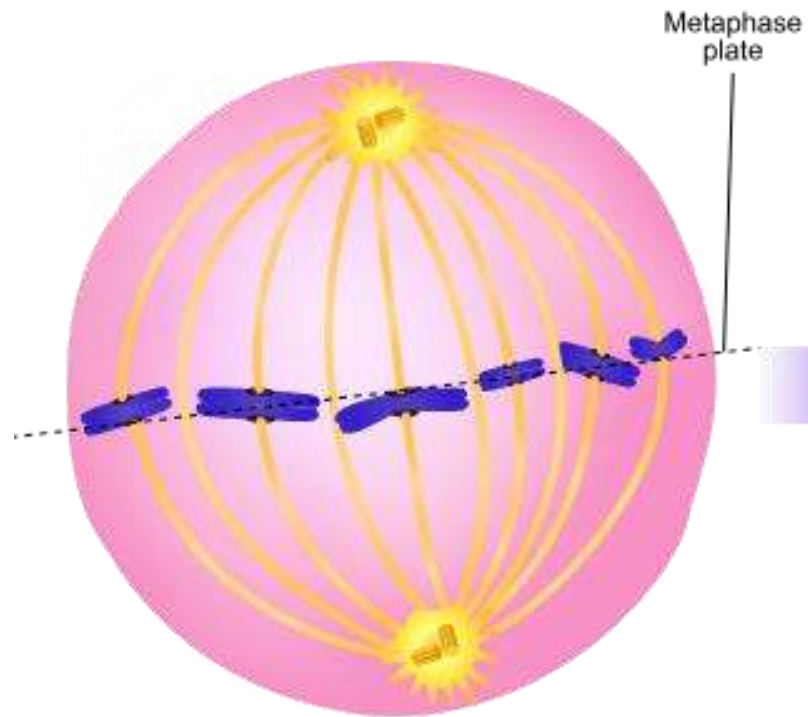
MOA: Mitosis inhibition

Example active ingredients: pendimethalin

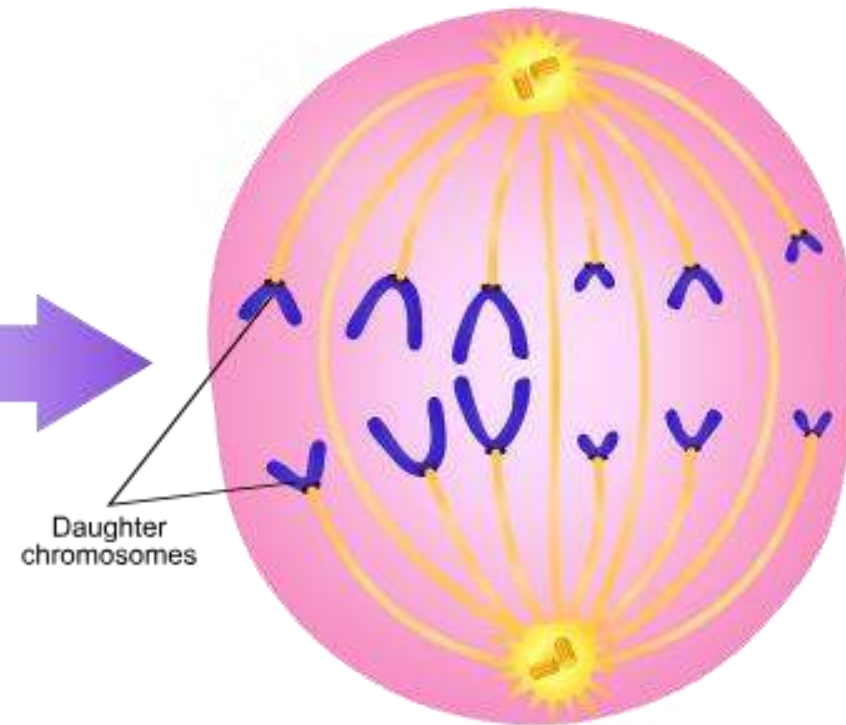
Application:

- Root absorbed
- Strength on grass weeds
- Long window for turf establishment
- Root clubbing is a typical symptom
- Can cause equipment yellowing/staining

Metaphase



Anaphase



Group 3

MOA: Mitosis inhibition

Example active ingredients: pendimethalin

Application:

- Root absorbed
- Strength on grass weeds
- Long window for turf establishment
- Root clubbing is a typical symptom
- Can cause equipment yellowing/staining



Group 15 (VLCFA)

MOA: Very long-chain fatty acid synthesis inhibition

Example active ingredients: metolachlor

Application:

- Shoot absorbed in grasses
- Root absorbed in BLW
- Some EPOST activity
- Not readily translocated = specific to seedlings
- Relatively short residual

Group 29 (CBI)

MOA: Cellulose biosynthesis inhibition

Example active ingredients: indaziflam

Application:

- Root absorbed
- Long residual
- Impacts on seeding/establishment
- Can see injury on stressed turf or in sandy soils with low OM%

Group 14 (PPO)

MOA: Protoporphyrinogen oxidase inhibition

Example active ingredients: oxyfluorfen (PRE), oxadiazon (PRE), sulfentrazone (POST), carfentrazone (POST)

Application:

- PRE (grasses) & POST (sedges/moss)
- Root & foliar absorption (depending on a.i.)
- Light activated
- Can injure actively growing turf
- Oxadiazon = safe for seeding/sprigging



POST – emergence



- Best applied on young, actively growing weeds
- Mainly shoot inhibited
- High degree of variability in application
 - Droplet coverage (speed, spray volume, pressure)
 - Environmental conditions (wind, temperature, rainfall)
 - Adjuvants

Group 2 (ALS)

MOA: Acetolactate synthase inhibition

*Largest herbicide group

(SU = sulfonylureas; IMIs = imidazolinones)

Example active ingredients: halosulfuron, metsulfuron, flazasulfuron, trifloxysulfuron, imazapic, penoxsulam, bispyribac-sodium

Application:

- Efficacy against grasses, BLWs, & sedges
- Can be influenced by environment (air temp, soil moisture, pH, OM)
- Foliar & root absorption
- Slow acting, symptoms visible in new growth
- **Very low** use rates

Group 4 (Auxin)

MOA: Auxin mimic

Example active ingredients: 2,4-D, MCPA, quinclorac, triclopyr

Application:

- Strength on BLWs
- Strong safety profile in turf, sensitivity to ornamental/landscape plants
- Often combined in mixtures for broad spectrum
- Foliar & root absorption
- Readily translocated
- Twisting/curling (epinasty) symptom



Groups 5&6 (PSII)

MOA: Photosystem II Inhibition

- Differences in amino acid binding

Example active ingredients: metribuzin (5), atrazine (5), amicarbazone (5), bentazon (6)

Application:

- Controls grasses & BLWs
- Absorbed through roots
- Readily translocated
- Widespread resistance problems

Group 17

MOA: Nucleic acid inhibition

Example active ingredients: MSMA

Application:

- Only a.i. in this class
- Primary use against goosegrass
- Little known about MOA

Other Common MOAs in Turf

Group 1 (ACCase)

- Fluazifop, fenoxaprop, sethoxydim, pinoxaden, etc.
- Classes = FOPs, DIMs, DENs
- POST; Graminicides = grass control

Group 9 (EPSPS)

- Glyphosate
- POST
- Non-selective

Group 10

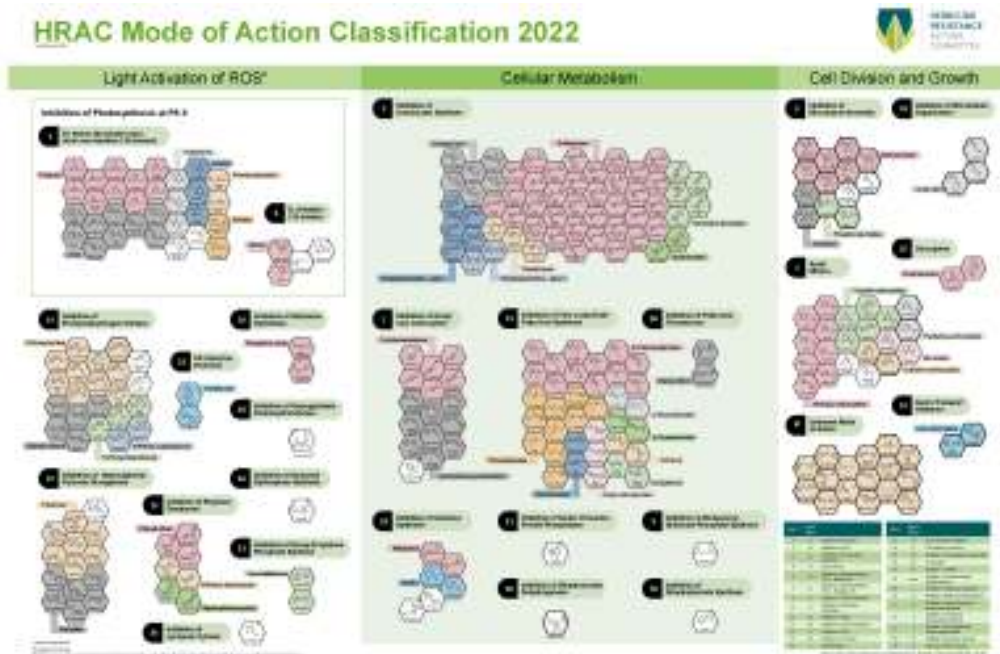
- Glufosinate
- POST
- Non-selective

Group 27 (HPPD)

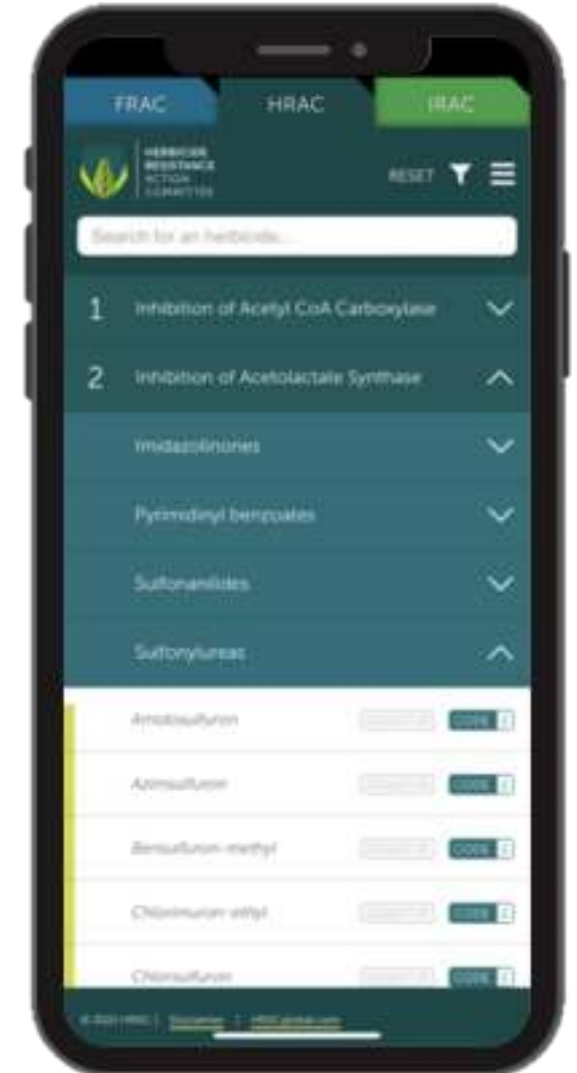
- Mesotrione, topramezone
- POST; strength on grasses
- “Bleachers”

Resources

HRACglobal.com



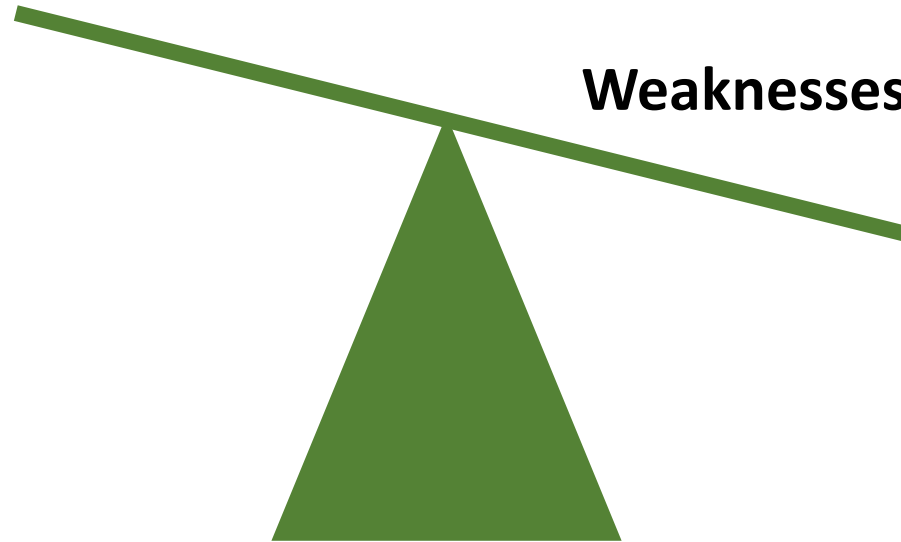
Global resistance management app



MOAs
=
Resistance
Management

Strengths

Weaknesses



Takeaways



There are differences in herbicide MOAs



Know where to find the Group number for the products you use



Strategize for resistance management & program strength

Questions?

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