

Pushing Back Preemergence Applications for Better Late Season Control

Roch Gaussoin, Extension Turfgrass Specialist, University of Nebraska

2023 Michigan Turfgrass Conference-January 10th- 12th
Soaring Eagle Casino & Resort

MTF EXTENSION

1

Grassy Weeds

- **Crabgrass***
- **Foxtail***
- **Goosegrass(*)**
- **Grassy sandbur***
- **Barnyardgrass***
- Quackgrass
- Bromegrass
- Nimblewill

Preemergence control possible; *preferred method

2

Broadleaf Weeds

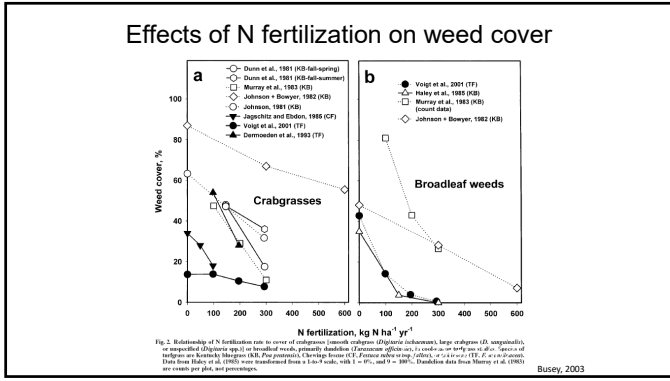
- **Prostrate spurge***
- **Henbit***
- **Prostrate Knotweed***
- Dandelion
- Plantain
- Ground Ivy

Preemergence control possible; *preferred method

3

Management First

4



5

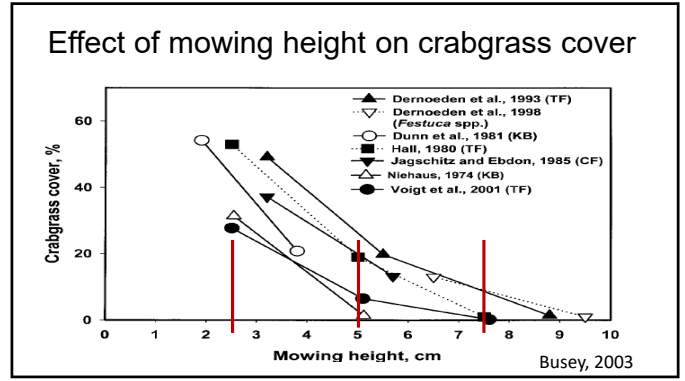
Mowing Height and Rooting Depth

- Shorter mowing heights result in:
 - Decreased rooting
 - Greater management
 - Increased pest problems

6



7

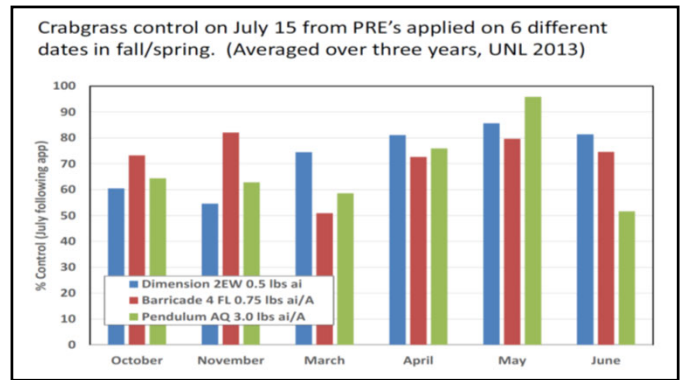


8

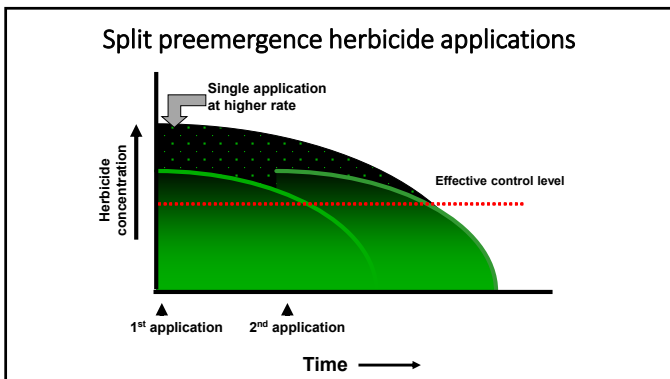
When to apply preemergence herbicides

- Soil temperatures exceed 50° F
- Occurs first:
 - In landscape beds
 - Thinned turfgrass
 - Near sidewalks
- Better to apply early than late

9



10

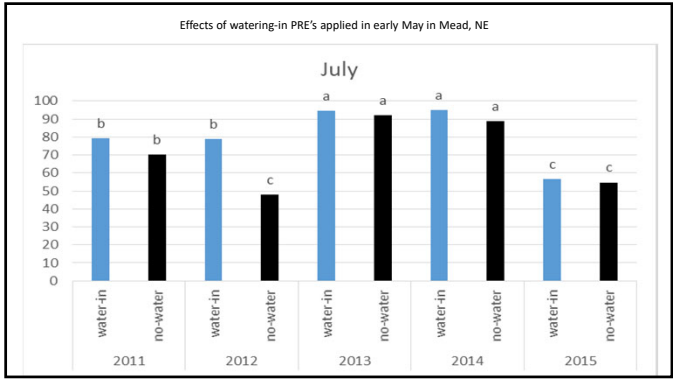


11

Preemergence Herbicide "efficacy"

- Less than adequate control
- Timing and application rates are correct, so...?
- Reasons for "failure"
 - Poor turf conditions
 - Tough weeds/lots of them
 - High rainfall/irrigation
 - Non-Uniform application
 - Insufficient early irrigation/rainfall

12



13

Effective Use of Preemergence Herbicides

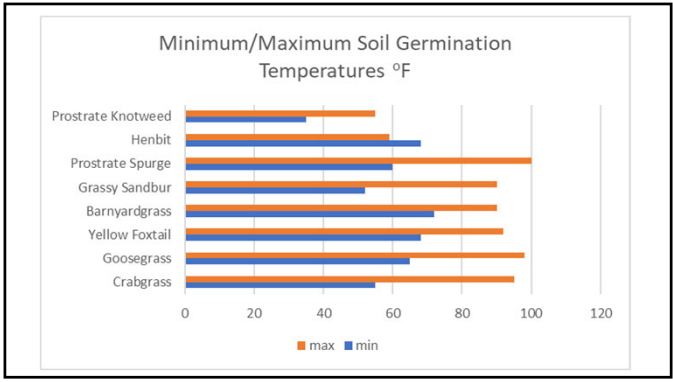
- Start with heathy turf
- Better to apply too early
- App timing is flexible within reason (earlier/split apps)
- Water in
- Uniform application is essential
- Label rates
- Split applications can provide extended season control

14

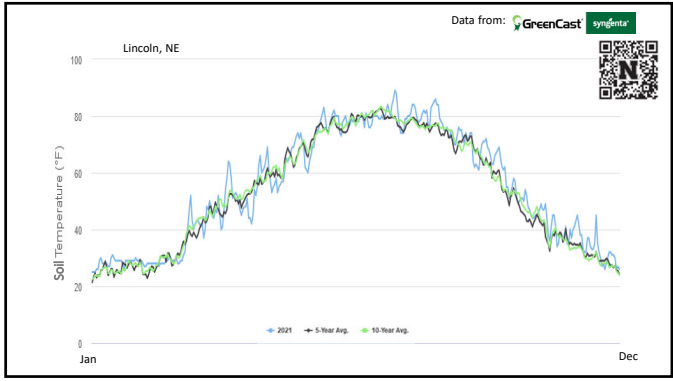
Weed Seed Germination Soil Temperatures

- Crabgrass >55° to 60°F for 7 to 10 days up to 95°F
- Goosegrass >65°F for several weeks
- Yellow Foxtail 68° to 92°F
- Barnyardgrass 72° to 90°F
- Grassy Sandbur 52 F to 75 F
- Prostrate Spurge 60°F to 100°F
- Henbit 68 and 59
- Prostrate Knotweed 35-40 cease at 50° F

15



16

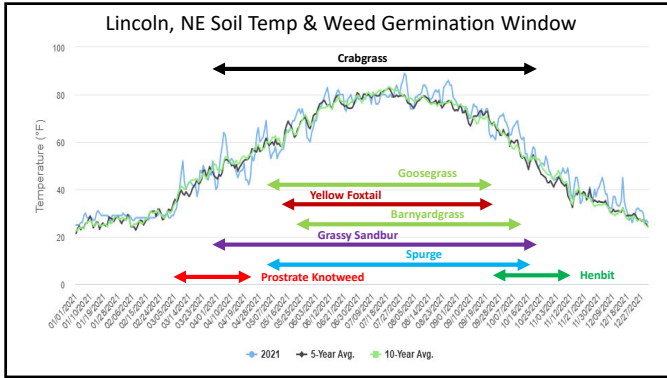


17

Weed Seed Germination Soil Temperatures

- Crabgrass >55° to 60°F for 7 to 10 days up to 95°F
- Goosegrass >65°F for several weeks
- Yellow Foxtail 68° to 92°F
- Barnyardgrass 72° to 90°F
- Grassy Sandbur 52 F to 75 F
- Prostrate Spurge 60°F to 100°F
- Henbit 68 and 59
- Prostrate Knotweed 35-40 cease at 50° F

18



19

Show me the data!

- Barricade (proflamifone), Dimension (dithiopyr) and Pendulum (pendimethalin) applied at full rate on May 1 or June 1, 2022
- Same applied at 1/2 rate on May 1 FB same on June 15
- Drive XLR8 (quinclorac) applied at full rate on June 1
- Drive XLR8 applied with each pre on June 1
- 2 locations in proximity, one with heavy crabgrass and one with heavy yellow foxtail
- Data collected on cover and converted to % control based on untreated

20

-----% Control-----

			July 9, 2022		August 29, 2022	
			Crabgrass	Foxtail	Crabgrass	Foxtail
Untreated Check			0h	0g	0f	0g
Dimension 2EW	2 pt/a	1-May	100a	45cde	94a	51bcd
Dimension 2EW	1 pt/a	May 1-June 15	92ab	13fg	68a-d	13fg
Barricade 4FL	30 fl oz/a	May 1	90ab	18efg	76abc	42b-f
Barricade 4FL	15 fl oz/a	May 1-June 15	44efg	25efg	37de	48b-e
Pendulum Aquacap	4.2 pt/a	May 1	95ab	24efg	89a	43b-f
Pendulum Aquacap	2.1 pt/a	May 1-June 15	89ab	21efg	78ab	30d-g
Dimension 2EW	2 pt/a	June 1	84abc	32def	69a-d	43b-f
Barricade 4FL	30 fl oz/a	June 1	31fg	23efg	20ef	35c-f
Pendulum Aquacap	4.2 pt/a	June 1	27g	15fg	17ef	17efg
Drive XLR8; Dimension	64; 2 oz/s; pt/a	June 1	90ab	98a	45b-e	88a
Drive XLR8; Barricade	64; 30 oz/s; pt/ac	June 1	85abc	88a	43cde	63abc
Drive XLR8; Pendulum	64; 4.2 oz/s; pt/ac	June 1	83ab	93a	46b-e	66ab
Drive XLR8 + MSO	64 fl oz/a	June 1	73bcd	78ab	34ef	66ab

21

-----% Control-----

			July 9, 2022		August 29, 2022	
			Crabgrass	Foxtail	Crabgrass	Foxtail
Untreated Check			0h	0g	0f	0g
Dimension 2EW	2 pt/a	1-May	100a	45cde	94a	51bcd
Dimension 2EW	1 pt/a	May 1-June 15	92ab	13fg	68a-d	13fg
Barricade 4FL	30 fl oz/a	May 1	90ab	18efg	76abc	42b-f
Barricade 4FL	15 fl oz/a	May 1-June 15	44efg	25efg	37de	48b-e
Pendulum Aquacap	4.2 pt/a	May 1	95ab	24efg	89a	43b-f
Pendulum Aquacap	2.1 pt/a	May 1-June 15	89ab	21efg	78ab	30d-g
Dimension 2EW	2 pt/a	June 1	84abc	32def	69a-d	43b-f
Barricade 4FL	30 fl oz/a	June 1	31fg	23efg	20ef	35c-f
Pendulum Aquacap	4.2 pt/a	June 1	27g	15fg	17ef	17efg
Drive XLR8; Dimension	64; 2 oz/s; pt/a	June 1	90ab	98a	45b-e	88a
Drive XLR8; Barricade	64; 30 oz/s; pt/ac	June 1	85abc	88a	43cde	63abc
Drive XLR8; Pendulum	64; 4.2 oz/s; pt/ac	June 1	83ab	93a	46b-e	66ab
Drive XLR8 + MSO	64 fl oz/a	June 1	73bcd	78ab	34ef	66ab

22

-----% Control-----

			July 9, 2022		August 29, 2022	
			Crabgrass	Foxtail	Crabgrass	Foxtail
Untreated Check			0h	0g	0f	0g
Dimension 2EW	2 pt/a	1-May	100a	45cde	94a	51bcd
Dimension 2EW	1 pt/a	May 1-June 15	92ab	13fg	68a-d	13fg
Barricade 4FL	30 fl oz/a	May 1	90ab	18efg	76abc	42b-f
Barricade 4FL	15 fl oz/a	May 1-June 15	44efg	25efg	37de	48b-e
Pendulum Aquacap	4.2 pt/a	May 1	95ab	24efg	89a	43b-f
Pendulum Aquacap	2.1 pt/a	May 1-June 15	89ab	21efg	78ab	30d-g
Dimension 2EW	2 pt/a	June 1	84abc	32def	69a-d	43b-f
Barricade 4FL	30 fl oz/a	June 1	31fg	23efg	20ef	35c-f
Pendulum Aquacap	4.2 pt/a	June 1	27g	15fg	17ef	17efg
Drive XLR8; Dimension	64; 2 oz/s; pt/a	June 1	90ab	98a	45b-e	88a
Drive XLR8; Barricade	64; 30 oz/s; pt/ac	June 1	85abc	88a	43cde	63abc
Drive XLR8; Pendulum	64; 4.2 oz/s; pt/ac	June 1	83ab	93a	46b-e	66ab
Drive XLR8 + MSO	64 fl oz/a	June 1	73bcd	78ab	34ef	66ab

23

-----% Control-----

			July 9, 2022		August 29, 2022	
			Crabgrass	Foxtail	Crabgrass	Foxtail
Untreated Check			0h	0g	0f	0g
Dimension 2EW	2 pt/a	1-May	100a	45cde	94a	51bcd
Dimension 2EW	1 pt/a	May 1-June 15	92ab	13fg	68a-d	13fg
Barricade 4FL	30 fl oz/a	May 1	90ab	18efg	76abc	42b-f
Barricade 4FL	15 fl oz/a	May 1-June 15	44efg	25efg	37de	48b-e
Pendulum Aquacap	4.2 pt/a	May 1	95ab	24efg	89a	43b-f
Pendulum Aquacap	2.1 pt/a	May 1-June 15	89ab	21efg	78ab	30d-g
Dimension 2EW	2 pt/a	June 1	84abc	32def	69a-d	43b-f
Barricade 4FL	30 fl oz/a	June 1	31fg	23efg	20ef	35c-f
Pendulum Aquacap	4.2 pt/a	June 1	27g	15fg	17ef	17efg
Drive XLR8; Dimension	64; 2 oz/s; pt/a	June 1	90ab	98a	45b-e	88a
Drive XLR8; Barricade	64; 30 oz/s; pt/ac	June 1	85abc	88a	43cde	63abc
Drive XLR8; Pendulum	64; 4.2 oz/s; pt/ac	June 1	83ab	93a	46b-e	66ab
Drive XLR8 + MSO	64 fl oz/a	June 1	73bcd	78ab	34ef	66ab

24

Summary

- Apply early rather than later
- Split apps with lower rates were problematic
- Foxtail populations were near 100% resulting in poor control and questionable data for objective
- Use of post emergence annual grass herbicides (quinclorac (Drive); mesotrione (Tenacity); topramezone (Pylex) provides added benefit in timing flexibility and broadleaf activity

25

Herbicide Resistance

Definition

- genetic characteristic of a weed or plant biotype to survive a herbicide application

Biotype = a group of plants within a species that has biological traits that are not common to the population as a whole.

- *interestingly, plants also have a genetic capacity to develop resistance to many abiotic stresses like drought, heat, cold etc. based on exposure and subsequent selection pressure*

26


Herbicide Resistance

- **cross resistance**
- * weed biotype that has gained resistance to more than one herbicide with the same mode/mechanism of action. Same or different families.
- **multiple resistance**
- * weed biotype that has developed tolerance to more than one herbicide (or stress) brought about by different selection pressures (*different modes/mechanism of action*).

27

Herbicide Resistance


Around the World (2020)



- 509 Resistant Biotypes
- Resistance identified in 21 of the 31 herbicide sites of action: 164 different herbicides
- 266 Species (153 dicots and 113 monocots)
- More than 270,000 locations in 71 countries

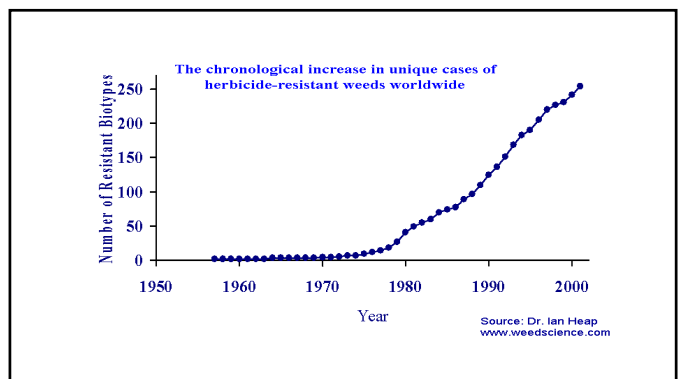
28

The Beginning of Documented Weed Resistance



- 1968 (Washington)
- nursery crops
- common groundsel
- atrazine and simazine

29



30

Weed Characteristics That Favor Resistance

- reproductive capability
- seed dispersal mechanisms

31

Herbicide Characteristics/Strategies That Impact Weed Resistance

- single site of action
- used multiple times during the growing season
- used for consecutive growing seasons
 - Resistance can be developed within 2 years depending on species and/or herbicide
- used without other control strategies

32

Herbicide Resistance Should Only Be Suspected When:

- other causes of herbicide failure have been ruled out
- the same herbicide or herbicides with the same mode of action have been used year after year
- weed that is normally controlled is not controlled while others weeds of the same species are
- healthy weeds are mixed with controlled weeds (same species)
- a patch of uncontrolled weed is spreading, post multiple applications of the same herbicide

33

Herbicide Resistant Weeds

Strategies for Control/Prevention

- proactive vs. reactive
- use other weed management tactics (healthy turf, mowing, compaction control, deficit irrigation)
- rotate herbicides with different MOA
- prevent seed production
- clean mowing and cultivation equipment

34

Herbicide-resistant weeds in turfgrass: current status and emerging threats (Brosnan et al, 2020)

Documented cases:

- smooth crabgrass (NJ)
- goosegrass (SE-US; cross resistance)
- annual bluegrass (world; cross resistance)
- annual sedge (*Cyperus* sp; SE-US)
- spotted spurge (SE-US)
- yellow nutsedge (in rice; halosulfuron)
- buckhorn plantain (IN, PA)
- barnyard grass
- green foxtail



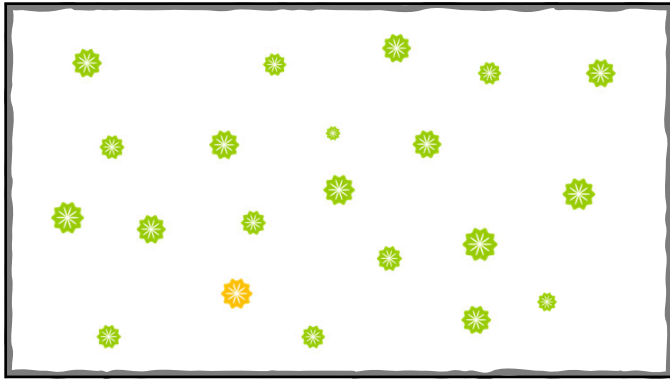
35

How does it happen?

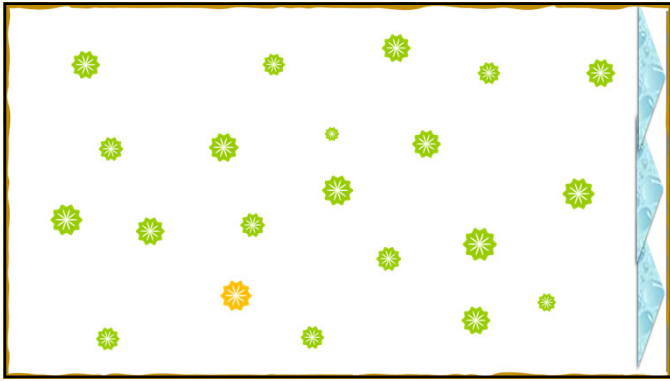
Two Possibilities

- Survival of the fittest (*I did everything right*)
 - Selects for naturally occurring resistance in pest population
 - Selection pressure
- What happened to my genes (*mutagenesis*)?
 - Induces physiological changes in plant
 - Extremely rare in plants, confined mostly to virus and other "simple" organisms

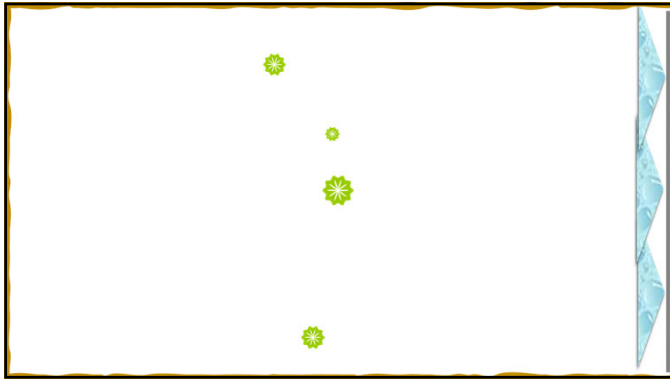
36



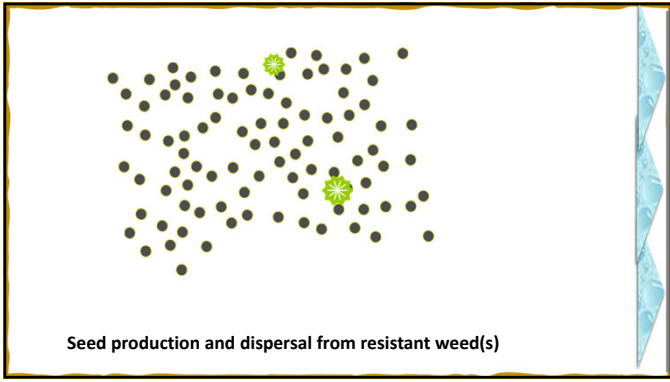
37



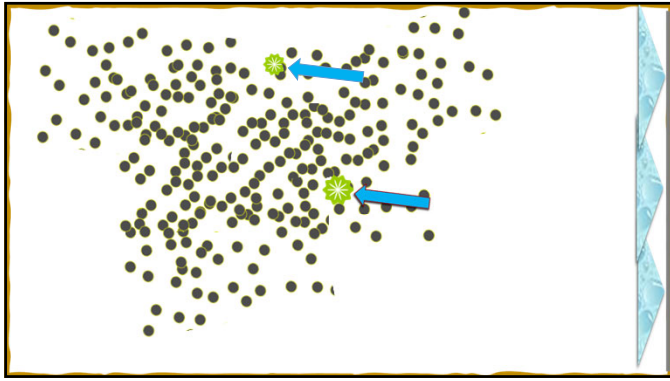
38



39



40



41



42

Summary of Herbicide Mechanism of Action According to the Weed Science Society of America (WSSA)

- 1 Acetyl CoA Carboxylase (ACCe) Inhibitors**
 Aryloxyethoxypropionate (OPE) cyclohexanedione (DHAs) and phenylpyrazolin (OENs) herbicides inhibit the enzyme acetyl-CoA carboxylase (ACCe), the enzyme catalyzing the first committed step in the biosynthesis of fatty acids. Folic acid and chlorthalidol (1987) inhibitors of fatty acid synthesis practically block the production of phospholipids used in building new membranes required for cell growth. Broadleaf species are naturally resistant to cyclohexanedione and aryloxyethoxypropionate herbicides because of an insensitive ACCe enzyme. Similarly, natural tolerance of some grasses appears to be due to a less sensitive ACCe (Stoltberg 1989). An alternative mechanism of action has been proposed involving destruction of the electrochemical potential of the cell membrane, but the contribution of this hypothesis remains in question.
- 2 Acetolactate Synthase (ALS) or Acetylhydroxy Acid Synthase (AHAS) Inhibitors**
 Imidazolinones, pyrimidinylthioharnozates, sulfonamidecarbonyltriazolones, sulfonureas, and steviolglycosides are herbicides that inhibit acetolactate synthase (ALS), also called acetylhydroxyacid synthase (AHAS), a key enzyme in the biosynthesis of the branched-chain amino acids isoleucine, leucine, and valine (Lafosse and Schloess 1984). Plant death results from events occurring in response to ALS inhibition and low branched-chain amino acid production, but the actual sequence of phytotoxic processes is unclear.
- 3 15 23 Mitosis Inhibitors**
 Benzamide, benzoic acid (DCPA), dinitroanilines, phosphoramidate, and pyridine herbicides (Group 3) are examples of herbicides that bind to tubulin, the major microtubule protein. The herbicide-tubulin complex inhibits polymerization of microtubules at the assembly end of the protein-based microtubule but has no effect on disassembly of the tubule on the other end (Wauson and Laven 1991), leading to a loss of

Sample Partial Page

43

Touchdown Total
 Herbicide
 Nonselective Foliar Systemic Herbicide for Weed Control

Commercial Name: Touchdown Total
 Active Ingredient: glyphosate, N-(phosphonomethyl)glycine 36.5%
 Other Ingredients: 63.5%
 Total: 100.0%

Physical Quantity: Contains 500 grams per liter or 4.17 pounds per U.S. gallon of glyphosate acid.
 Signal Words: **CAUTION**
 See additional precautionary statements and directions for use inside booklet.
 EPA Reg. No. 100-1769
 EPA Est. 100-A-001
 SCP 11694-LTC 0507

2.5 gallons Net Contents syngenta

Mechanism/Mode of Action

Be Aware: Generic pesticides may not have the designation on the label

44

4 active ingredients:
 3 are Group 4
 1 is Group 14

ACTIVE INGREDIENTS:
 Quinclorac 8.43%
 Sulfentrazone 0.69%
 2,4-D, dimethylamine salt 11.81%
 Dicamba, dimethylamine salt 4.49%
 Dimethylnormida salt 7.58%
 TOTAL 100.00%

THIS PRODUCT CONTAINS:
 0.75 lb. 3-(1-dichloro-2-propylamino)acetic acid per gallon or 6.43%
 0.06 lb. 3-(1-dichloro-2-propylamino)acetic acid per gallon or 0.69%
 0.06 lb. 2,4-dichloro-1,1-dimethylaminoethyl ether per gallon or 0.69%
 0.88 lb. 2,4-dichlorophenoxyacetic acid equivalent per gallon or 8.91%
 0.10 lb. 3,4-dichloro-o-anisic acid equivalent per gallon or 1.24%
 Name: Specific by AHAC Methods.
 CAS Registry Numbers: Quinclorac (84087-01-4), Sulfentrazone (122836-35-5), Dicamba, dimethylamine salt (2202-68-5), 2,4-D, dimethylamine salt (2008-39-1).

45

Examples

- Rotate halosulfuron (**Group 2**) with mesotrione (**Group 27**) or sulfentrazone (**Group 14**) or bentazon (**Group 8**) for postemergence yellow nutsedge control
- Rotate pendimethalin, proflaminate, dacthal, dithopyr, benefin, oryzalin (**Group 3**) with mesotrione (**Group 27**) or oxadiazon (**Group 14**) or bensulfide (**Group 8**) or siduron (**Group 7**) for pre-emergence annual grass control
- Rotate 2,4-D, dicamba, MCPA, clopyralid, fluroxypyr (**Group 4**) with carfentrazone (**Group 14**) or mesotrione (**Group 27**) or quinclorac (**Group 26** also 4?) for postemergence broadleaf weed control

46

Pesticide resistance can be reduced by:

1. Using a pesticide until resistance develops than switch to another one
2. Rotate different pesticides
3. Rotate pesticides with different mode/mechanism of action (MOA) in cohort with appropriate management

47

Turfgrass Weed Control for Professionals

https://mdc.itap.purdue.edu/item.asp?item_Number=TURF-100

48

How to Use the Tables in this Publication	70	Successfully Using Plant Growth Regulators in Turf	117
Nonselective Herbicides/Fumigants for Turfgrass Renovation	71	Plant Growth Regulator Suppression and Suggested Reapplication Intervals	119
Nonselective Herbicides for Turfgrass Border Maintenance (Edging)	72	Annual Bluegrass Suppression in Creeping Bentgrass Putting Greens with Plant Growth Regulators (PGRs)	120
Preemergence Herbicides	73	Pesticide and Plant Growth Regulator Math	121
Weed Control Ratings for Preemergence Herbicides	73	Common Weights and Measures	121
Turfgrass Tolerance to Preemergence Herbicides	74	Ounces or Ounces	122
Preemergence Herbicides	75	Amount of Product Needed	122
Postemergence Herbicides	79	Amount to Add to the Spray Tank	123
Weed Control Ratings for Postemergence Broadleaf Herbicides	79	How Many Tanks (trips with my sprayer) Does it Take?	123
Weed Control Ratings for Postemergence Grass Herbicides	82	What If the Recommended Rate is in Pounds of Active Ingredient?	123
Turfgrass Tolerance to Postemergence Herbicides	84	How Much Does This Herbicide Cost per Acre (or 1,000 ft ²)?	124
Postemergence Herbicides	86		

49

Other resources:

- <http://www.mobileweedmanual.com/> Jim Brosnan, Ph.D.




50

Contact Information

- Roch Gaussoin
- rgaussoin1@unl.edu
- [@rockinsince57](https://twitter.com/rockinsince57)

Thank you!



51