

# **Managing all the weeds on the orchard floor**

**Bernard Zandstra**

**Michigan State University**

**Tree Fruit IPM School**

**Traverse City, MI**

**February 1, 2017**

# Weed Control Challenges in Tree Fruit Crops

1. Plantings maintained for many years
2. Perennial weeds
3. Annual weeds predominate mid – late season
4. Use of herbicides with one MOA
  1. Weed species shift
  2. Weed resistance
5. Mowing helps

# Common Perennial Weeds in Fruit

<b>Species</b>	<b>Family</b>
<b>Asparagus</b>	<b>Liliaceae</b>
<b>Buckhorn plantain</b>	<b>Plantaginaceae</b>
<b>Canada thistle</b>	<b>Asteraceae</b>
<b>Dandelion</b>	<b>Asteraceae</b>
<b>Goldenrod</b>	<b>Asteraceae</b>
<b>Perennial sowthistle</b>	<b>Asteraceae</b>
<b>White heath aster</b>	<b>Asteraceae</b>
<b>Clover spp.</b>	<b>Fabaceae</b>
<b>Alfalfa trefoil</b>	<b>Fabaceae</b>
<b>Field bindweed</b>	<b>Convolvulaceae</b>

# Common Perennial Weeds in Fruit


<b>Species</b>	<b>Family</b>
<b>Curly dock</b>	<b>Polygonaceae</b>
<b>Broadleaf dock</b>	<b>Polygonaceae</b>
<b>Red sorrel</b>	<b>Polygonaceae</b>
<b>Common milkweed</b>	<b>Asclepiadaceae</b>
<b>Hemp dogbane</b>	<b>Apocynaceae</b>
<b>Common pokeweed</b>	<b>Phytolaccaceae</b>
<b>Horsenettle</b>	<b>Solanaceae</b>
<b>Poison ivy</b>	<b>Anacardiaceae</b>
<b>Yellow toadflax</b>	<b>Scrophulariaceae</b>
<b>Common mullein</b>	<b>Scrophulariaceae</b>



# Perennial Grasses

<b>Species</b>	<b>Family</b>
<b>Bermudagrass</b>	<b>Poaceae</b>
<b>Hard Fescue</b>	<b>Poaceae</b>
<b>Nimblewill</b>	<b>Poaceae</b>
<b>Orchardgrass</b>	<b>Poaceae</b>
<b>Quackgrass</b>	<b>Poaceae</b>
<b>Perennial Ryegrass</b>	<b>Poaceae</b>
<b>Wirestem muhly</b>	<b>Poaceae</b>





**QUACKGRAS  
S  
in  
GRAPE**

2014 7 24





**Orchardgrass in Apple**

2015 6 3





**Orchardgrass**

2015 6 11





**Horsenettle**





**Poison Ivy**

2016 6 21



# Common Annual Weeds in Apple

<b>Species</b>	<b>Family</b>	<b>Life Cycle</b>
<b>Common lambsquarters</b>	<b>Chenopodiaceae</b>	<b>Annual</b>
<b>Common groundsel</b>	<b>Asteraceae</b>	<b>Annual</b>
<b>Common ragweed</b>	<b>Asteraceae</b>	<b>Annual</b>
<b>Horseweed</b>	<b>Asteraceae</b>	<b>Annual</b>
<b>Annual Sowthistle</b>	<b>Asteraceae</b>	<b>Annual</b>
<b>Rough fleabane</b>	<b>Asteraceae</b>	<b>Annual</b>
<b>Rough cinquefoil</b>	<b>Rosaceae</b>	<b>Annual</b>
<b>Pigweeds</b>	<b>Amaranthaceae</b>	<b>Annual</b>





**Common ragweed**



# Canada thistle







**Horseweed**



# Annual Grasses in Fruit Crops

<b>Species</b>	<b>Family</b>	<b>Life Cycle</b>
<b>Annual bluegrass</b>	<b>Poaceae</b>	<b>Annual</b>
<b>Barnyardgrass</b>	<b>Poaceae</b>	<b>Annual</b>
<b>Fall panicum</b>	<b>Poaceae</b>	<b>Annual</b>
<b>Foxtail spp.</b>	<b>Poaceae</b>	<b>Annual</b>
<b>Large crabgrass</b>	<b>Poaceae</b>	<b>Annual</b>

## Biennial Weeds

<b>Species</b>	<b>Family</b>	<b>Life Cycle</b>
<b>White campion</b>	<b>Carophyllaceae</b>	<b>Annual/Biennial</b>
<b>Wild carrot</b>	<b>Apiaceae</b>	<b>Biennial</b>
<b>Common mallow</b>	<b>Malvaceae</b>	<b>Annual/Biennial</b>
<b>Common burdock</b>	<b>Asteraceae</b>	<b>Biennial</b>
<b>Purple deadnettle</b>	<b>Lamiaceae</b>	<b>Winter annual</b>
<b>Henbit</b>	<b>Lamiaceae</b>	<b>Winter annual</b>
<b>Yellow rocket</b>	<b>Brassicaceae</b>	<b>Winter annual</b>





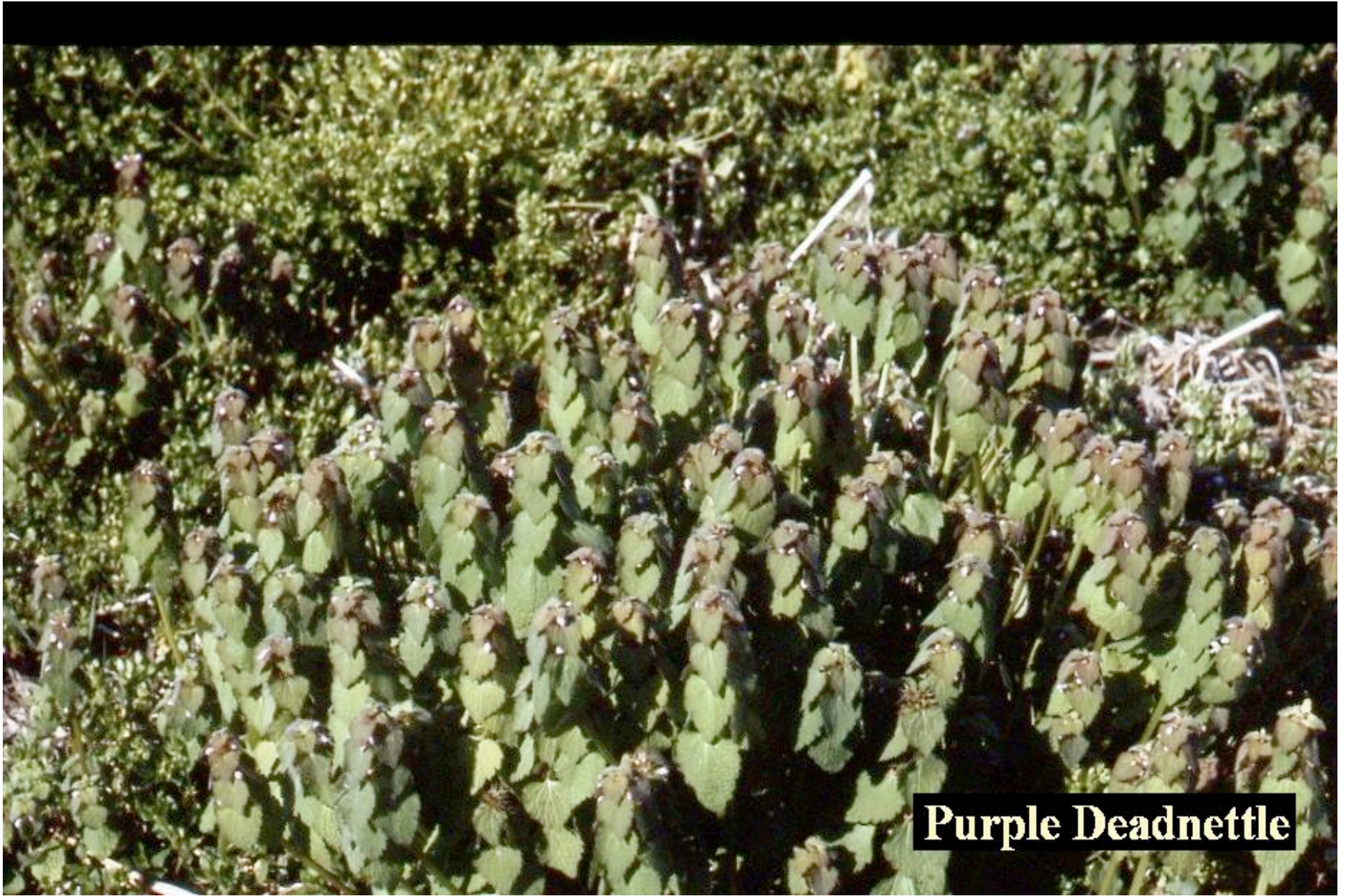
**White campion in Apple**





**Wild carrot in Apple**





**Purple Deadnettle**



# Yellow rocket





# Mode of action of PRE fruit herbicides (1)

<b>Trade name</b>	<b>Common name</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Karmex</b>	<b>diuron</b>	<b>PS II inhibitor</b>	<b>7 C<sub>2</sub></b>
<b>Princep</b>	<b>simazine</b>	<b>PS II inhibitor</b>	<b>5 C<sub>1</sub></b>
<b>Sinbar</b>	<b>terbacil</b>	<b>PS II inhibitor</b>	<b>5 C<sub>1</sub></b>
<b>Velpar</b>	<b>hexazinone</b>	<b>PS II inhibitor</b>	<b>5 C<sub>1</sub></b>

## Mode of action of PRE fruit herbicides (2)

<b>Trade name</b>	<b>Common name</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Chateau</b>	<b>flumioxazin</b>	<b>PPO inhibitor</b>	<b>14 E</b>
<b>Spartan, Zeus</b>	<b>sulfentrazone</b>	<b>PPO inhibitor</b>	<b>14 E</b>
<b>Goal</b>	<b>oxyfluorfen</b>	<b>PPO inhibitor</b>	<b>14 E</b>

# Mode of action of PRE fruit herbicides (3)

<b>Trade name</b>	<b>Common name</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Matrix</b>	<b>rimsulfuron</b>	<b>ALS inhibitor</b>	<b>2 B</b>
<b>Mission</b>	<b>flazasulfuron</b>	<b>ALS inhibitor</b>	<b>2 B</b>
<b>Sandea</b>	<b>halosulfuron</b>	<b>ALS inhibitor</b>	<b>2 B</b>
<b>Solicam</b>	<b>norflurazon</b>	<b>pigment inhibitor</b>	<b>12 F<sub>1</sub></b>

# Mode of action of PRE fruit herbicides (4)

<b>Trade name</b>	<b>Common name</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Alion</b>	<b>indaziflam</b>	<b>cellulose synthesis inhibitor</b>	<b>29 L</b>
<b>Casoron</b>	<b>diclobenil</b>	<b>cellulose synthesis inhibitor</b>	<b>20 L</b>
<b>Trellis, Gallery</b>	<b>isoxaben</b>	<b>cellulose synthesis inhibitor</b>	<b>21 L</b>

# Mode of action of PRE fruit herbicides (5)

<b>Trade name</b>	<b>Common name</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Prowl H<sub>2</sub>O</b>	<b>pendimethalin</b>	<b>microtubule inhibitor</b>	<b>3 K<sub>1</sub></b>
<b>Surflan</b>	<b>oryzalin</b>	<b>microtubule inhibitor</b>	<b>3 K<sub>1</sub></b>
<b>Kerb</b>	<b>pronamide</b>	<b>microtubule inhibitor</b>	<b>3 K<sub>1</sub></b>
<b>Dual Magnum</b>	<b>S-metolachlor</b>	<b>VLCFA synthesis inhibitor</b>	<b>15 K<sub>3</sub></b>

# New Herbicide premixes for fruit crops

Trade name	Common name	Mode of Action	WSSA HRAC
Zeus Prime XC	sulfentrazone	PPO inhibitor	14 E
	carfentrazone	PPO inhibitor	14 E
Pindar	oxyfluorfen	PPO inhibitor	14 E
	penoxsulam	ALS inhibitor	2 B

# Postemergence herbicides for fruit crops (1)

<b>Trade name</b>	<b>Common name</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Aim</b>	<b>carfentrazone</b>	<b>PPO inhibitor</b>	<b>14 E</b>
<b>Treevix</b>	<b>saflufenacil</b>	<b>PPO inhibitor</b>	<b>14 E</b>
<b>Venue</b>	<b>pyraflufen-ethyl</b>	<b>PPO inhibitor</b>	<b>14 E</b>
<b>Sandea</b>	<b>halosulfuron</b>	<b>ALS inhibitor</b>	<b>2 B</b>

# Postemergence herbicides for fruit crops (2)

<b>Trade name</b>	<b>Common name</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Gramoxone</b>	<b>paraquat</b>	<b>PS I inhibitor</b>	<b>22 D</b>
<b>Roundup</b>	<b>glyphosate</b>	<b>EPSPS inhibitor</b>	<b>9 G</b>
<b>Rely Reckon Lifeline</b>	<b>glufosinate</b>	<b>glutamine inhibitor</b>	<b>10 H</b>



# Postemergence herbicides for fruit crops (3)

<b>Trade name</b>	<b>Common name</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Stinger</b>	<b>clopyralid</b>	<b>auxin disruptor</b>	<b>4 O</b>
<b>Starane</b>	<b>fluroxypyr</b>	<b>auxin disruptor</b>	<b>4 O</b>
<b>Weedar 64</b>	<b>2,4-D</b>	<b>auxin disruptor</b>	<b>4 O</b>

# Postemergence Grass herbicides for tree fruit (4)

<b>Herbicide</b>	<b>Use</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Poast</b>	<b>POST, grasses</b>	<b>ACCcase inhibitor</b>	<b>1 A</b>
<b>Select Max</b>	<b>POST, grasses</b>	<b>ACCcase inhibitor</b>	<b>1 A</b>
<b>Fusilade</b>	<b>POST, grasses</b>	<b>ACCcase inhibitor</b>	<b>1 A</b>
<b>Assure II</b>	<b>POST, grasses</b>	<b>ACCcase inhibitor</b>	<b>1 A</b>

**Rely 280 2.34 SC –**  
**glufosinate-ammonium**  
**Pome + Stone Fruit**

1. Desiccation of most weeds; resistance mgmt.
2. Avoid contact with green leaf or stems
3. Rate: 48-82 fl oz (0.88-1.5 lb ai)
4. Max 3 apps and 15 pt in 12 months – pome frt
5. Max 2 apps and 10 pt in 12 months – stone fruit
6. Do not spray suckers
7. 14 day PHI

**Venue 0.177 SC –**  
**pyraflufen-ethyl**  
**Pome + Stone Fruit**

1. Improved broadleaf control
2. Rate: 0.7-4 fl oz (0.001-0.0055 lb ai)
3. Apply with Roundup or Rely to improve broadleaf control
4. Use for sucker management
5. 0 day PHI

# Sandea 75 WDG – Apple halosulfuron

1. Yellow nutsedge control
2. Resistance management: horseweed, pigweed, ragweed
3. Rate: 0.5-1 oz/a (0.023-0.047 lb ai)
4. Add NIS
5. 14 day PHI

# Gramoxone SL 2.0 paraquat

- 1. Desiccation of all green foliage.
- 2. No residual activity
- 3. Very poisonous to humans if ingested
- 4. New label rules will require closed handling systems.
- 5. Back pack and hand-carried sprayers will be allowed, but handling will be closed system.

## Treevix 70 WDG saflufenacil

- 1. Apple and pear only.
- 2. Postemerge control of horseweed, ragweed, mustards, nightshade, lambsquarters, pigweeds, other BL
- 3. Spring, summer, or late fall.
- 4. 4 applications per year. 0 PHI.
- 5. 4-6 weeks residual control of BL.

# New herbicide registrations coming for fruit crops

<b>Herbicide</b>	<b>Use</b>	<b>Mode of Action</b>	<b>WSSA HRAC</b>
<b>Callisto</b>	<b>PRE, broadleaves and large crabgrass</b>	<b>HPPD inhibitor</b>	<b>27 F<sub>2</sub></b>
<b>Pindar</b>	<b>PRE, annuals</b>	<b>ALS and PPO inhibitors</b>	<b>2 B, 14 E</b>
<b>Trellis</b>	<b>PRE, broadleaves</b>	<b>cellulose synthesis inhibitor</b>	<b>21 L</b>
<b>Assure II</b>	<b>POST, grasses</b>	<b>ACCCase inhibitor</b>	<b>1 A</b>



# Develop a multi-year weed control program for fruit crops

1. Make maps of all blocks and fields
2. Identify all major weeds in each field
3. Look up weeds in the weed control guide to determine which herbicides control them
4. Create a 4 year herbicide plan

# Four Year Weed Control Plan

1. Spring, summer, and fall applications
2. Pre-emergence and post-emergence herbicides
3. 2 PRE residual herbicides (different MOA) each spray, plus POST herbicides in spring and fall

# Spring weed control

1. 2 residual herbicides with different MOA
2. Glyphosate (Roundup) to kill emerged weeds
3. Apply before May 1

## Residual herbicides labeled for mid-season application in apple

<b>Trade name</b>	<b>PHI</b>
<b>Solicam</b>	<b>60 days</b>
<b>Chateau</b>	<b>60 days</b>
<b>Prowl H<sub>2</sub>O</b>	<b>60 days</b>
<b>Zeus Prime XC</b>	<b>14 days</b>
<b>Alion</b>	<b>14 days</b>
<b>Sandea</b>	<b>14 days</b>
<b>Matrix</b>	<b>7 days</b>

# Mid-season postemergence application (PHI)

- Grass control: Poast (14), Fusilade (14), Select Max (14)
- Perennial grasses (quackgrass, orchardgrass, bermudagrass, ryegrass, fescue): Fusilade, (Assure)
- Broadleaves: Roundup (1), Rely (14), Gramoxone (0), Aim(3), Treevix (0), Starane Ultra (14), 2,4-D (40), Venue (0)
- Composites, legume, nightshade, plantain: Stinger (30)

# Fall residual herbicides Labeled in apple

- Princep
- Solicam
- Goal
- Kerb
- Sinbar
- Casoron
- Chateau
- Matrix
- Alion

# Fall applications

1. After weeds are killed by frost
2. After trees and bushes are dormant
3. Before soil freezes; Nov., Dec.

# Potential weed control plans (1)

**1. Spring:** Princep + Surflan + Roundup

**Summer:** Matrix + Rely + Venue

**Fall:** Chateau + Kerb + Roundup

**2. Spring:** Karmex + Prowl H<sub>2</sub>O + Roundup

**Summer:** Zeus Prime XC + Stinger

**Fall:** Alion + Solicam + Roundup



## Potential weed control plans (2)

**3. Spring:** Chateau + Goal + Roundup

**Summer:** Matrix + Treevix + Poast

**Fall:** Sinbar + Stinger + Venue

**4. Spring:** Chateau + Prowl H<sub>2</sub>O + Roundup

**Summer:** Matrix + Gramoxone

**Fall:** Alion + Kerb + Rely

# Specific weed problems (1)

1. Quackgrass, orchardgrass – Fusilade (Assure II)
2. Horseweed, ragweed – Treevix, Stinger, Trellis
3. Field or hedge bindweed – Zeus Prime XC
4. Poison ivy – 2,4-D, Roundup
5. Horsenettle – Stinger, 2,4-D, Roundup

## Specific weed problems (2)

6. All composites and legumes - Stinger
7. Yellow nutsedge – Sandea, Solicam, Casoron
8. Virginia creeper – 2,4-D, Roundup
9. Pigweeds and amaranths – Zeus Prime XC,  
Chateau, Sandea, Goal
10. Common lambsquarters – Karmex, Sinbar,  
Treevix, Roundup

July 2, 2014

FALL & SPRING  
WEED CONTROL  
IN APPLE WITH  
PINDAR - CRC  
2013-2014

PINDAR GT 1.5  
DURANGO 1.35

Fall 2013  
FALL 2011



July 2, 2014

GOALTENDER 1.5  
DURANGO 1.35  
Fall 2013  
FALL 2011




July 2, 2014

PINDAR GT 1.5  
DURANGO 1.35  
AMS  
EPRE





July 2, 2014



GOALTENDER 1.5  
DURANGO 1.35  
AMS  
EPRE



July 2, 2014

DURANGO 1.35  
AMS  
EPRE, LPOS





July 2, 2014

ZEUS PRIME XC 0.162  
KARMEX 3  
ROUNDUP PM 0.95  
N PAK (AMS) 2.5%  
EPRE

ZEUS PRIME XC  
0.162  
MATRIX 0.016  
NIS 0.25%  
EPOS

2014 7 2



July 2, 2014

ZEUS PRIME XC 0.162  
ALION 0.065  
ROUNDUP PM 0.95  
N PAK (AMS) 2.5%  
EPRE

ZEUS PRIME XC  
0.162  
SANDEA 0.047  
NIS 0.25%  
EPOS

2014 7 2



July 2, 2014

CHATEAU 0.383  
SURFLAN 3  
EPRE  
TREEVIX 0.044  
EPOS

2014 7 2



July 2, 2014

MATRIX 0.063  
KARMEX 3  
GRAMOXONE SL 1  
EPRE

TM 11

2014 7 2



July 2, 2014

UNTREATED

2014 7 2





# Summary (1)

1. Use 2 – 4 residual herbicides with different MOA each year.
2. Use at least 2 POST herbicides with different MOA at some time of the year.
3. Apply herbicides at least 3 times during the year.



## Summary (2)

4. Observe and identify weeds that escape herbicide applications.
5. Have a written weed control plan and follow it. Record changes in plan. Keep complete herbicide records and weather information.

# Bernard Zandstra

[zandstra@msu.edu](mailto:zandstra@msu.edu)

[http://www.hrt.msu.edu/people/dr\\_bernard\\_zandstra](http://www.hrt.msu.edu/people/dr_bernard_zandstra)

- Resources
- *Michigan Fruit Management Guide*, MSU Extension Bulletin E-154
- *Weeds of the Northeast* – Uva, Neal, and DiTomaso
- <http://weedid.wisc.edu/weedid.php> - weed ID key
- [www.cdms.net](http://www.cdms.net) - labels