



The Cold Facts!:



Overwintering Nursery Containers

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COLD HARDINESS – ☒/ 3 FACTORS



- ❖ **G**enetic potential
- ❖ **E**nvironment - Conditioning for Expression
- ❖ **G + E** = Endogenous rhythm – Bark * .
1yr.



**Nine Types
of Cold Injury**

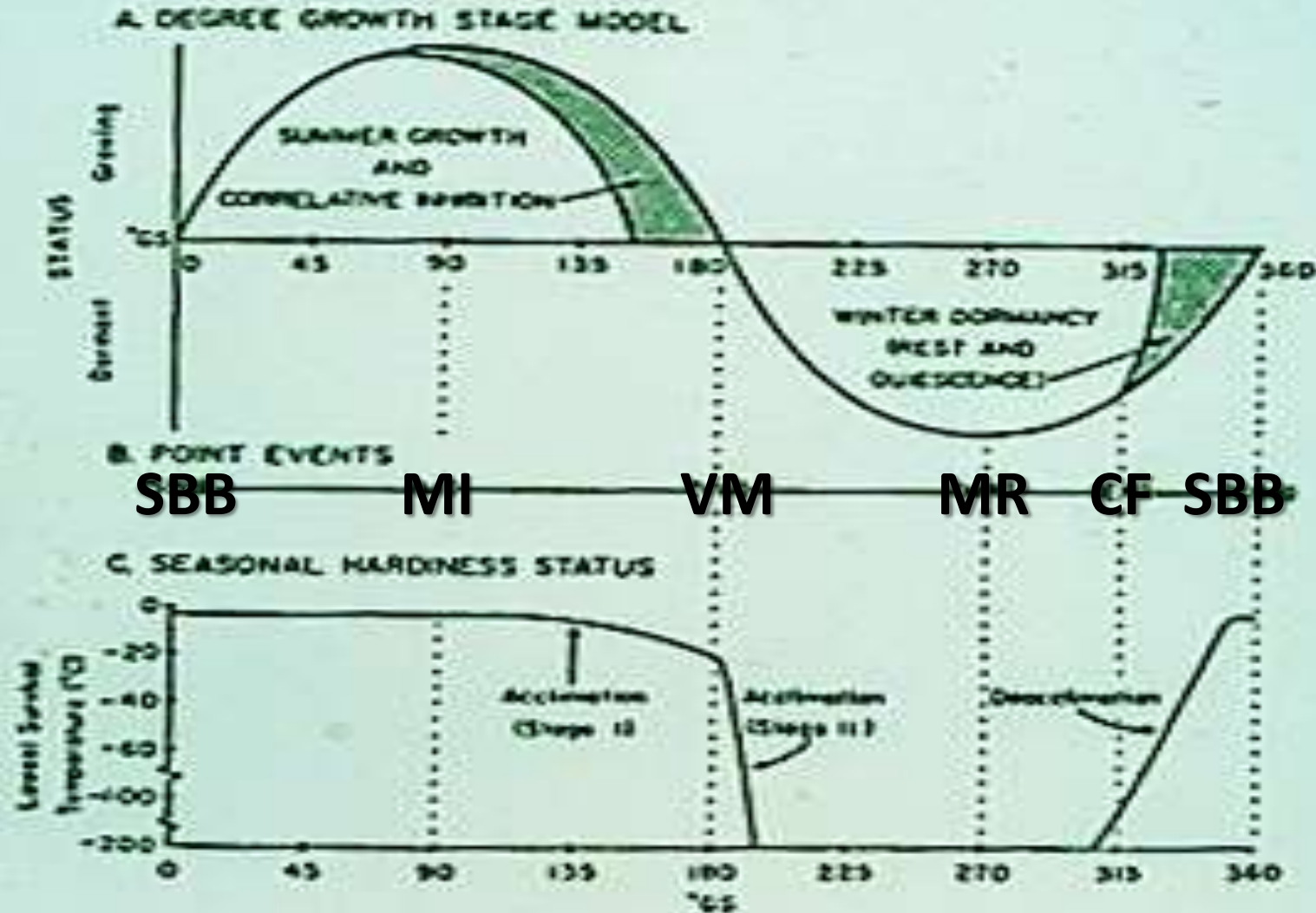
COLD ACCLIMATION/ DEACCLIMATION

- Fuchigami et al. proposed a Growth Stage Model (GS)



- 2 stages
- Stage 1 = Shortening of days - leaves required
- Stage 1 = Translocatable and reversible

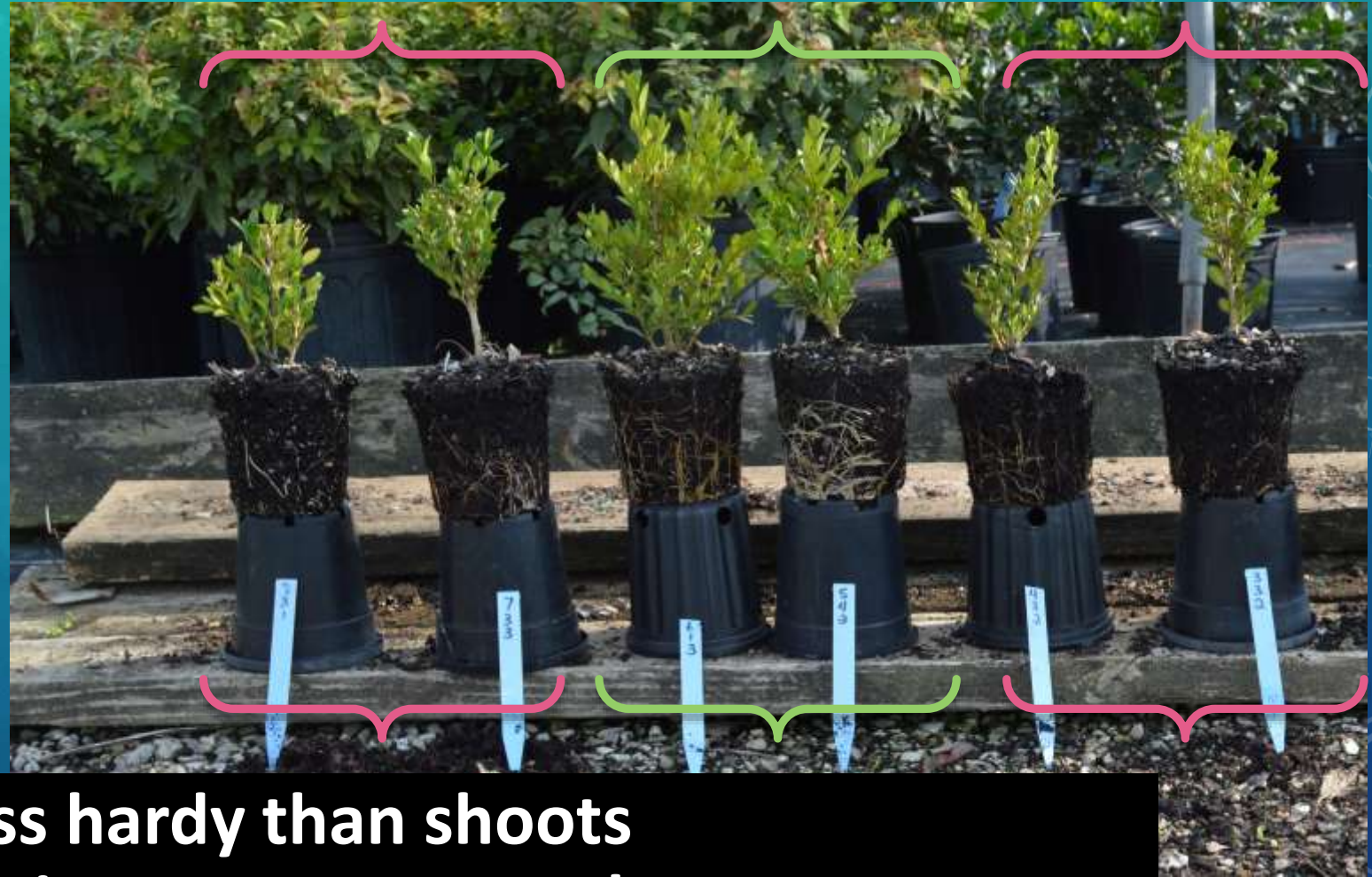
COLD ACCLIMATION/ DEACCLIMATION



EFFECT OF GIRDLING ON THE KILLING PT. OF *TAXUS CUSPIDATA* YOUNG AND MATURE ROOTS (MITYGA AND LANPHEAR 1971).

Tissue	Killing Point °C	
	Non-girdled	Girdled
Young Roots	4.4	4.4
Mature Roots	-23.3 ^a	-5.2

- Outer edge of (B) not protected as well as (A)



Roots - less hardy than shoots
Some Species = Roots never dormant
→ Mature roots can acclimate
→ Young roots - high GA content – no accl.

CALCIUM



- Catch 22 - young roots = uptake Ca;
- injury = def.;
- Ca necessary for young roots formation

ROOT INJURY

- Late initiation = retarded top growth
- Tip dieback
- Flush and then collapse
- Stunted
- Death



Root injury = pt. of entry for disease

**Reduced Ca =
disease susceptibility**



DORMANCY

- **Definition: Plant cannot be forced to regrow**
- Essential for maintaining a proper hormonal balance for hardening and accumulation of reserves for overwintering

STAGE 2

- Begins at vegetative maturity
- Induced at low temperatures
- Effects non-translocatable and non-reversible
- Leaves not necessary

THREE STAGE PROCESS

- Short Days
 - Temperature $+3^{\circ}\text{C}$ to 0°C
 - Temperatures $< 0^{\circ}\text{C}$ = Frosts
- Acclimation type = genetic



BREAKING DORMANCY

A. Chilling requirements

- Effective temperatures 0 to 7°C, around 5°C
- Fluctuating temps. More effective than constant

B. Heat

- varies with species, genotype, location of buds on tree, weather of preceding summer, type of bud

CHILLING REQUIREMENTS

<u>Species</u>	<u>Chilling (hrs.)</u>
Scotch pine	1000
Sweetgum	1200 to 1600
Apple	750 to 1800

CHILLING REQUIREMENTS

Species

Chilling (hrs.)

Peach

750 to 1200

Quince

50 to 400

Cherry

500 to 1300

ROOT DORMANCY

- *Buddleia* sp.- possess root dormancy (Daniel and Mathers, 2013)
- *Azalea* sp., *Ilex* sp. and *Erica* sp. - Evergreen, ponderosa pine (*Pinus ponderosa*), root dormancy loss (Burr, 1990).
- *Magnolia* sp. - dormant roots (Daniel and Mathers, 2013)
- *Cornus* sp., *Viburnum* sp. and *Berberis* sp. - root dormancy (Daniel and Mathers, 2013).
- [*Malus pumila* (Mill.)] - dormant state (Young and Warner, 1984)
- Lime (*Citrus aurantium*) (Crider, 1928)
- Grape (*Vitis vinifera*) (Crider, 1928).

Nine Types

1. **Root Injury**
2. **Tip Injury (Desiccation)**
3. **Bud Injury**
4. **Winter Burn (Desiccation)**
5. **Trunk and Collar Injury**
6. **Crotch Injury**
7. **SouthWest**
8. **Bark Splitting**
9. **Black Heart**





Why 9 Types

“Love makes the world go round....”

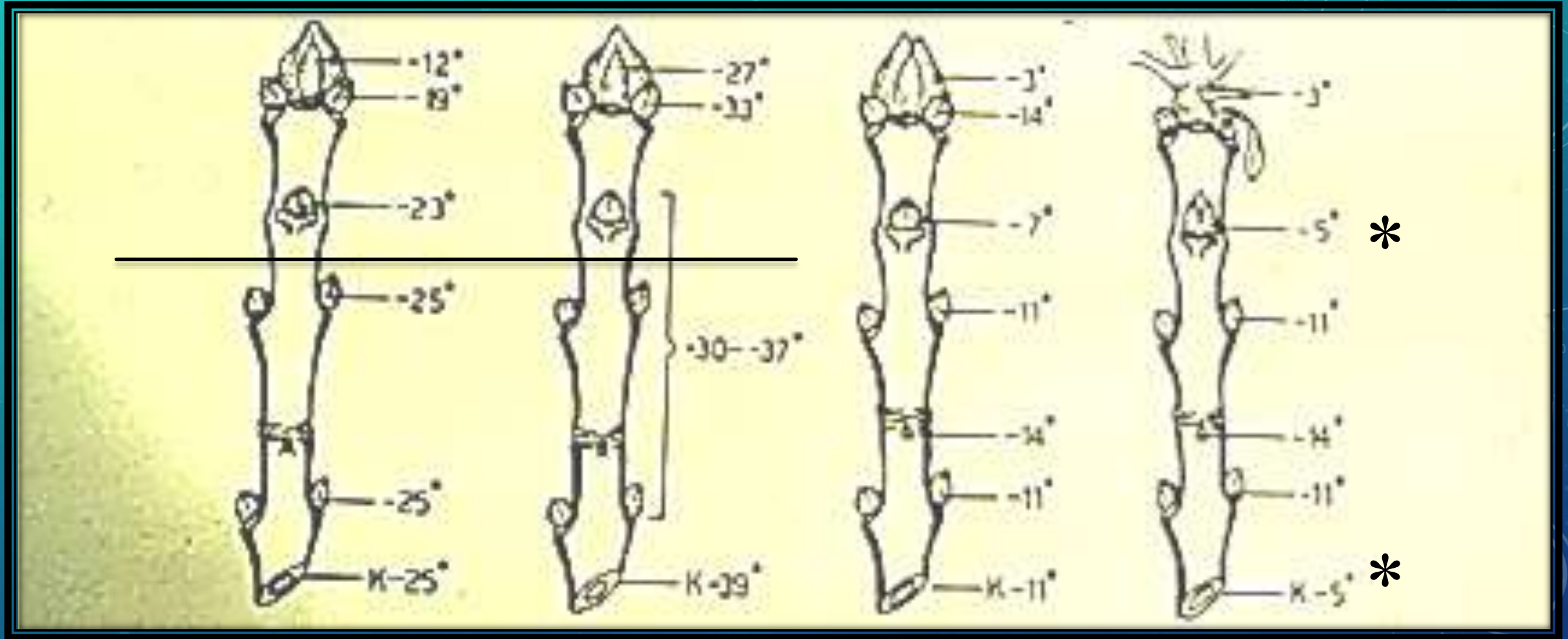
VARIABILITY- TISSUE TYPES:

- Reproductive parts the less hardy vs veg
- Roots – far less hardy than shoots
- Leaves least hardy of vegetative parts
- Bark, phloem, cambium - dehydration
- Xylem – Supercooling – quite hardy



Variability in Time:

Fraxinus sp.



November
-no frost

January

Bud Swell

Bud Opening

1. Tip Injury (Desiccation Injury)



- Early fall/ late spring
- even distribution over crown



Planted Spring 2007 – Harsh Spring – Late Frost



RRG Liners

Bareroot

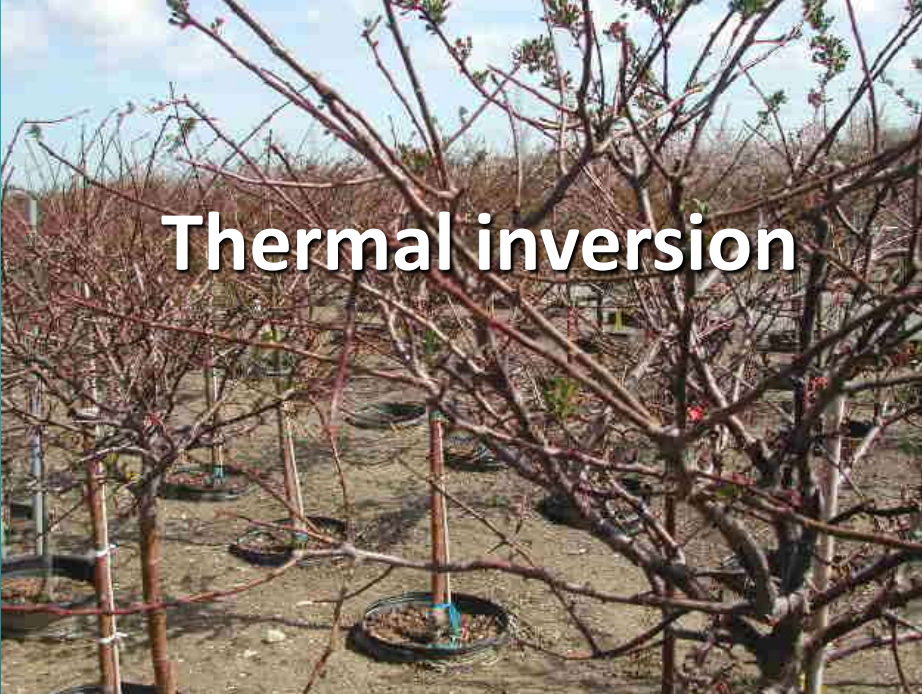
Rhoads Nursery, 09/17
Circleville, OH

2. Bud Injury

- Spring
- Bud/ cambium



Thermal inversion



Desiccation Injury



Winter 2013-14



20° to 30° warmer

Extreme Temperatures

Date	Precip	Max Air Temp	Min Air Temp
1/6/2014	0.08	44.5	-11.5
1/7/2014	0	3.9	-11.6
2/12/2014	0	31	-10.4
2/17/2014	0	30.9	-9.3

20° to 30° warmer

Species

Killing point of Young roots

°C °F
-7.7 18

Killing point Mature roots

°C °F
-13 9

Erica carnea

Ilex x meserveae 'Blue Boy'

Rhododendron carolinianum

Rhododendron catawbiense

Rhododendron P.J.M. Hybrids

Viburnum carlesi

Viburnum plicatum var. *tomentosum*

-17.8 0

-17.8 0

-23.3 -9

-9.4 15

-14 7



Date	Precip	Max Air Temp	Min Air Temp
1/6/2014	0.08	44.5	-11.5
1/7/2014	0	3.9	-11.6
2/12/2014	0	31	-10.4
2/17/2014	0	30.9	-9.3

Limited ability to irrigation 12/2013 to 03/2014 – long period below 0°
Growth initiation - March to April, 2014.
Insufficient available water to meet plant needs - warm to cold
fluctuating temperatures (March 18, 2014 and April, 2014)
← Desiccation injury



Herbicide Matters



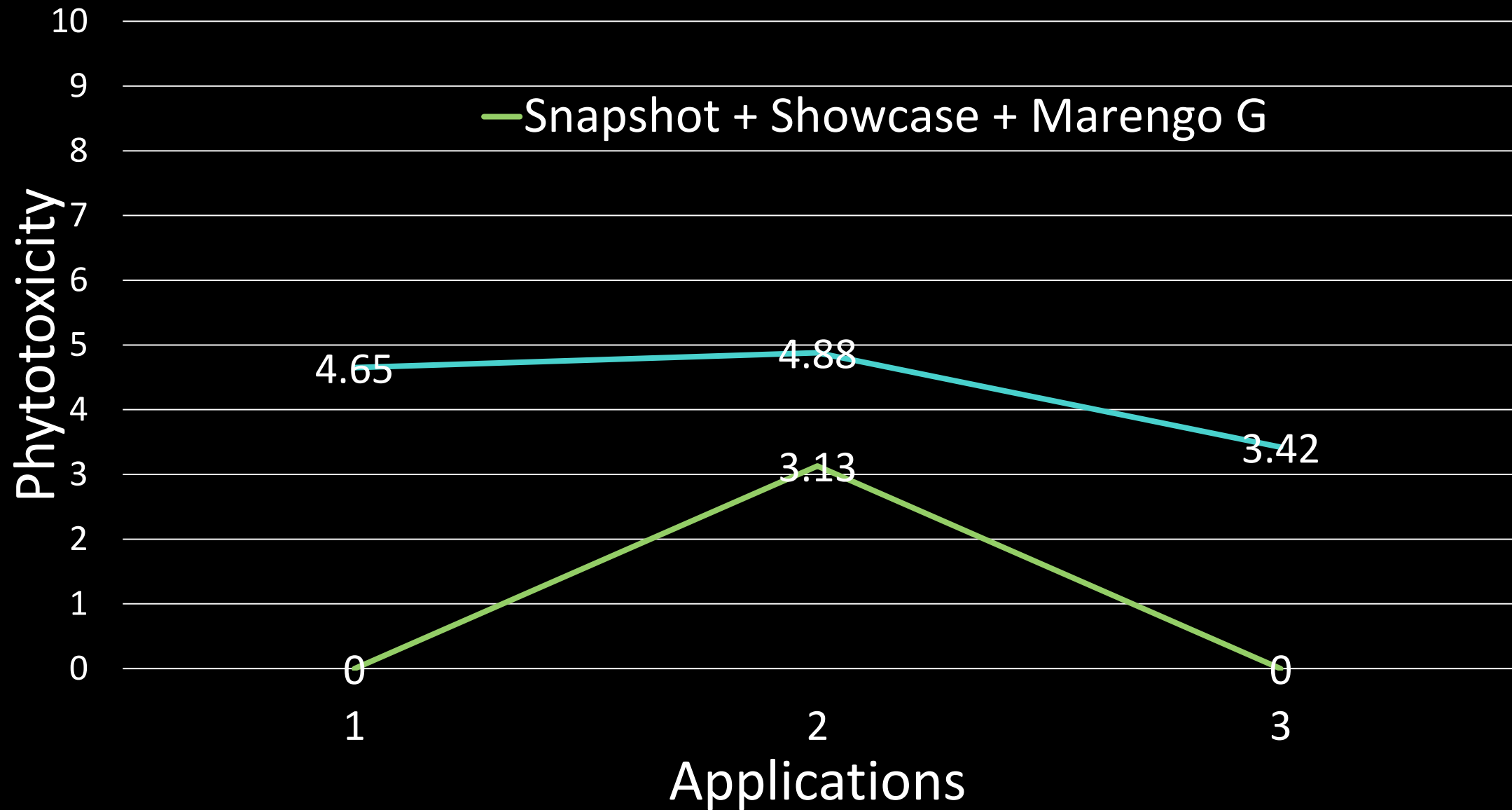
Snapshot

SureGuard 6 oz



Gallery + Dimension

Spirea Three Applications in Season (March to October, 2015)



Treatment	Av 3-13 WA1 T	No. Alive/ Start	Av 17- 24 WA1T 8 WA2T	No. Alive/ Start	29 WA1T/ 9 WA2T/ 5 WA3T	GI	No. Alive/ Start
<i>Klyn Nursery-Spirea bumalda 'Goldflame,' 3 gal – 2015 Season Long Trial</i>							
Control	0.12	12/12	0	12/12	0	3806.33	12/12
SureGuard + Biathlon G + Marengo G	4.02	12/12	0	12/12	0.17	NA	12/12
Marengo SC + Snapshot + Gallery/Dim	6.62	10/12	4.94	9/12	6.08	NA	9/12
Marengo SC 15+ Biathlon G + SureGuard	8.19	10/12	5.77	9/12	8.58	645.01	5/12
SureGuard + Marengo G + Gallery/Dim	4.74	12/12	0.04	12/12	4.75	1836.07	11/12
Snapshot + Showcase + Marengo G	0	12/12	3.13	12/12	0	NA	12/12
Marengo SC + Marengo G +Biathlon G	4.65	11/12	4.88	10/12	3.42	2581.26	10/12
Gallery/Dim + Showcase + SureGuard	4.30	12/12	0	12/12	6.67	1269.18	11/12

Snapshot + Showcase + Marengo G



Control



Marengo SC + Marengo G + Biathlon G

Snapshot + Showcase + Marengo G



Control



Marengo SC 15 + Biathlon G + SureGuard



3. METHODS OF OVERWINTERING



Pit storage below ground level:

Benefits:

Temperature moderation

Wind protection

Issues :

- ✓ Labor to lift from and set down
- ✓ Drainage
- ✓ Irrigation
- ✓ Light





Consolidation

***Not good for all types of plants especially evergreens.**

***Wait for leaf drop before covering with a frost blanket- geotextile – allows light and water through**

***Water before you cover and water when temperature rise above freezing.**

*** Apply disease control before covering.**



Poly inner liners are pulled over the plants in cold weather. This will conserve moisture and keep the wind off the plants.

The poly liner is set under the plants before the greenhouse is covered.



**Plastic Rolls:
White Co -Polymer 80%
3 to 4 mill plastics**



**Digging Trenches
to hold plastic down**



Poly is unrolled and then the folds are opened. Be sure the poly is not weak on the folds



Tack the poly down on the baseboard and then pull it over house. If windy use many people





6 wks before covering –
preemergent application

- **First Frost cover = +30 or 45 Days,
Columbus, OH = November 15**
- **Uncover = March 30**



**Air nailers can be used to quickly tack the poly down.
Be sure not to cut the poly with your nails or staples.**



Bury the poly to prevent rodents and wind from moving into the houses.



Tie downs

- String
- Plastic strips



String



Plastic



Shadecloth inside the poly

The shade cloth reduces light and heat buildup in the house.
It may prolong spring growth.



Don't place shade cloth over the poly. It will catch rain that may freeze and then cut the poly.



Concrete wire is placed over plants and covered with white poly. Be sure plants are well watered and they are properly baited.

The poly is held down with sand. Be sure that rodents can't get under the poly. Poly needs to be removed early before heat builds up quickly on sunny days.



RODENT CONTROL ?



Doors





- **Be sure that you can pump water anytime during the winter period.**
- **Systems must be able to be drained when you get finished to prevent damage from freezing.**

2/9/2017

Reduction of waste stream



Dormant Applications

Spray swath
14-ft.

No products currently registered for
this use

KLC-5 nozzle - for backpack spray



FIELDJET NOZ, BRASS

Product Description:

Item number: S1/4KLC-5

\$25.34

Chemical Containers, Inc.

413 ABC Road

Lake Wales, FL 33859-6849

Phone - 863-638-1407

1. SureGuard



OBJECTIVES

1. Compare efficacy and phytotoxicity of Marengo G 'Verge' - 200 lb/ac to Marengo SC – 7.5, 15 and 30 oz/ac and SureGuard – 6 oz/ac and an untreated control
2. Determine the efficacy and phytotoxicity on seven species of dormant containerized plants, pre-winter close up.
3. Dormant applications that can carry through spring into mid or late June before in-season applications are required

MATERIALS AND METHODS:

Smith's Gardens, Inc., Delaware, OH, 43015

- ✓ Seven species with varying levels of phytotoxicity to indaziflam and flumioxazin, in active growth, were chosen for dormant evaluations:
- ✓ *Spirea japonica* 'Little Princess'
- ✓ *Stachys minor*
- ✓ *Berberis thunbergii* 'Concord'
- ✓ *Juncus effuses*
- ✓ *Rhododendron* 'Dandy Man Pink'
- ✓ *Hydrangea macrophylla* 'Endless Summer'
- ✓ *Phlox paniculata*
- 8 replications, CRD

MATERIALS AND METHODS

- Efficacy and Phytotoxicity – rated scores:
- $\text{Eff} \geq 7$ = commercially acceptable (0-10),
10 = complete control
- Phyto. (0-10), 10=dead, ≤ 3 = commercially acceptable

RESULTS

- Even dormant – *Spirea*, *Berberis* and *Hydrangea* phytotoxicity was higher than commercially acceptable with all five treatments.



Control versus Marengo G 200 lb/ac at 26 WAT



24 WAT with SureGuard 6 oz/ac.

RESULTS



Stachys minor - Marengo G at 26 WAT

- Dormant – Marengo G 200 lb/ac was safe on *Stachys*, *Juncus* and *Phlox*



Marengo SC 7.5 oz/ac,
15 oz/ac and 30 oz/ac at
21 WAT

RESULTS

By 28 WAT 2 reps of SureGuard had died but there was no death with Marengo G



Phlox paniculata 'Flame Coral' moving from left to right:
Control, SureGuard 6 oz/ac, Marengo G 200 lb/ac, Marengo SC 30 oz/ac, 15 oz/ac and 7.5 oz/ac at 19 WAT

CONCLUSIONS

- Marengo G applied dormant for *Phlox* and *Stachys* is significant for herbaceous growers who previously have used only hand weeding on these two species due to their sensitivity to herbicide.
- Dormant applications maybe a viable weed control method for *Stachys*, *Juncus* and *Phlox*.
- No benefit of reduced phytotoxicity was found with dormant applications on sensitive woody species *Spirea* and *Hydrangea*.



ACKNOWLEDGEMENTS

- OHP
- Smith's Gardens, Inc.
- Millcreek Gardens, LLC.
- Cottage Gardens, Inc.
- Spring Meadow Nursery, Inc.
- Studebaker Nurseries, Inc.

Merci

Gracias

THANK YOU

The End!

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