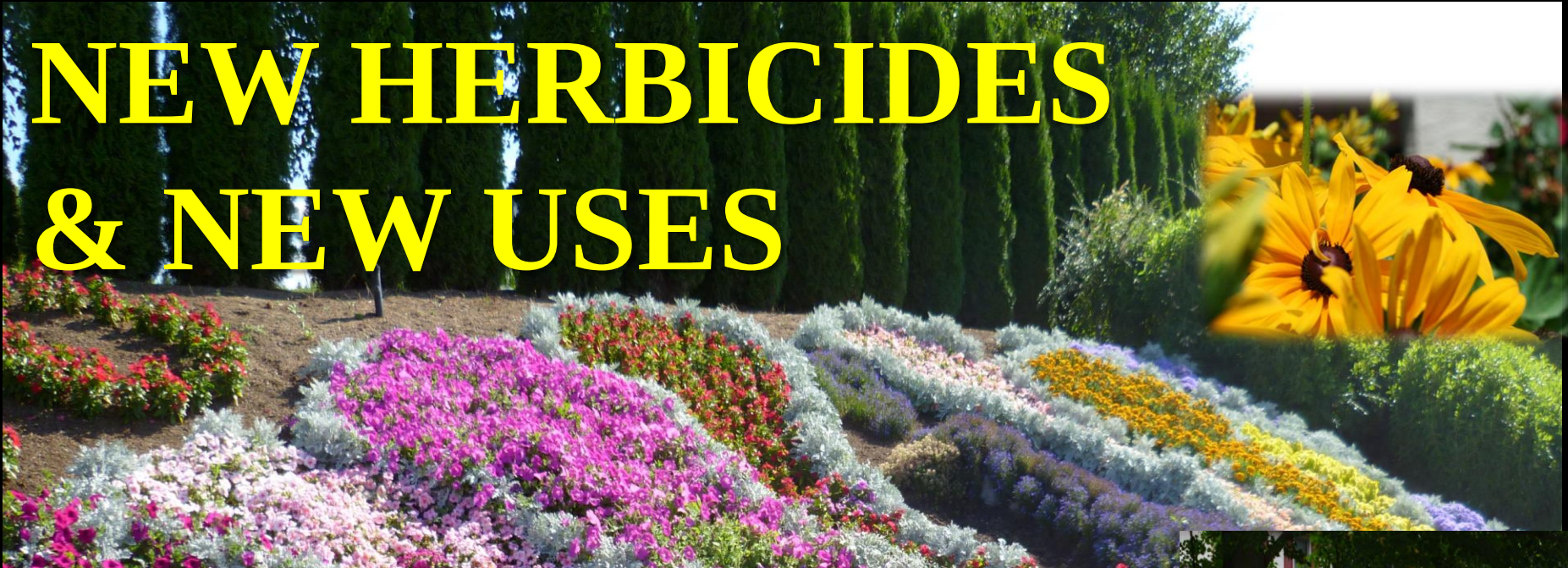


NEW HERBICIDES & NEW USES

Dr. Hannah Mathers
Independent Researcher/ Expert
Mathers Environmental Science Services,
LLC
Gahanna, OH
Website: www.mathersenvironmental.com



Older Combo Granular Herbicides

WSSA Group	Location	Trade Name	Company	REI	Genus/Sp.
14 + 3	N and L	OH2 (2012 Label) (including: <i>Rudbeckia</i> & <i>Echinacea</i>) Oxyflourfen + Pendimethalin	Everris	24	27
14 + 3	N and L	RegalStar (2009 (Label) (crabgrass, goosegrass, annual bluegrass and crowfoot on turf and golf courses) Oxadiazon + Prodiamine	Regal Chemical	12	4
21+ 3	N and L	Snapshot Isoxaben + Trifluralin	Dow	12	39
No longer available		Jewel Oxadiazon + Pendimethalin	Anything with Surflan (i.e., Rout, XL-2G, Surflan AS)		

New Combo Granular Preemergence

WSSA Group	Location	Trade Name	Company	REI
3 + 21	N	Fortress (2018)	OHP	12
3 + 21	L	Crew (Revised label 2019)	Corteva	N/A
3 + 15	N and L	FreeHand (2011)	BASF	24
14 + 3	N and L	Biathlon (2011)	OHP	24
3 + 21	N and L	Gemini G (2015) Prodiamine (0.4%) + Isoxaben (0.25%)	Everris	12
3 + 14	N and L	Fuerte™ (2019)	OHP	12

Newer Single Active Granular & Liquid Preemergence

WSSA Group	Location	Trade Name	Company	REI
14	N and L (dir)	BroadStar (G) (dormant)	NuFarm	12
		SureGuard 51 WDG v. 4 SC		
29	N- only (dir)	Specticle G*	Bayer	12
		Specticle 74 SC		

Newer Single Active Liquid Preemergence

WSSA Group	Location	Trade Name	Company	REI
15	N and L	Tower 6EC	BASF	12

Newer Combo Active Liquid Preemergence

WSSA Group	Location	Trade Name	Company	REI
3 + 21	N and L	Gemini 3.7 SC (2015) Prodiamine (23.3%) + Isoxaben (15.5%)	Everris	12

Post- and Pre- Emergence Together

Best =

***Glyphosate + SureGuard** = Decrease
from multiple applications

Faster than either alone

SureGuard alone never as effective



TREATMENT PROTOCOL FOR SPRAYING

- **Wet foliage – dew or 5 to 10 minutes irrigation.**
- **Spray.**
- **Irrigate ASAP 20 - 25 minutes to wash off herbicides.**
- **Wind not more than 5-10 mph.**

Older Liquid Preemergence Herbicides

Gallery SC (14)

Called Non-selective

Pennant Magnum (15)

Dimension 2EW (3)

Dacthal WP (DCPA) (Group 3)

Devrinol DF-XL (15)

Dimension	Dithiopyr
2EW at 0.5 lb ai/A + Gallery SC at 1.0 lb ai/A	+ Isoxaben

Preemergence listed by (WSSA) SoA # Low volatility < 0.6 mPa

Highly volatile > 3.3 mPa

MoA	Common Name (active)	Trade Name	REI (h.)	Vapor Pressure (mPa)	K _{oc} (mL/g)	T _{1/2} (days)
3	dithiopyr	*Fortress/ Crew	12	0.533	1,638	23
21	isoxaben	*Fortress/ Crew	12	0.051	380	85
3	prodiamine	Various/ *Fuerte	12	0.003	13,000	69
14	flumioxazin	SureGuard *Fuerte	12	0.321	191	15
20	diclobenil	Casoron	12	133	400	60
29	Pendimethalin	17,000 44 days		0.00007	496	155
15	Dimethenamid-p	Tower/ FH	24	0.0368	125	20

#1 FORTRESS® / CREW (90) 150 lb/ac = 1X

131 Herbaceous and groundcovers genus/SP.

- **Isoxaben (Active ingredient in Gallery®) (21) + Dithiopyr (Active ingredient in Dimension®) (3)**
- Broad spectrum weed control - Broadleaf and Grasses.
- Pre-emergent activity *and* ***minor post** activity.
- Exceptional plant tolerance
 - Great choice for perennials and ornamental grasses.

*1-2 cotyledons or shoot to 1 tiller stage. Not all weed species.

TREATMENT PROTOCOL FOR GRANULAR

- **Dry foliage**
- **Irrigate ASAP 20 - 25 minutes to wash off herbicides.**
- **Knock off – esp. whorled plants**
- **Wind not more than 5-10 mph.**

FORTRESS® HERBICIDE



Not when new growth flushing
Not wet foliage

Fortress Herbicide on Verge Granule.
Clean, dust free formulation.

Cardamine pennsylvanica 'Pennsylvania Bittercress'

Treatment	Rate/ac	Efficacy 90 DAT
Fortress/ CREW	100 lb/ac	10.0b
Fortress/ CREW	150 lb/ac	9.7b
Fortress/ CREW	200 lb/ac	9.6b
Gallery + Dimension 2EW	0.75 ai + 0.38 ai lb/ac	9.4b
Snapshot 2.5TG	150 lb/ac	9.6b
Control	--	0.4a



(1 to 10, ≥ 7)

***Stellaria media* 'Common Chickweed'**

Treatment	Rate/ac	Efficacy 90 DAT
Fortress/ CREW	100 lb/ac	10.0a
Fortress/ CREW	150 lb/ac	10.0a
Fortress/ CREW	200 lb/ac	9.1ab
Gallery + Dimension 2EW	0.75 ai + 0.38 ai lb/ac	8.0b
Snapshot 2.5TG	150 lb/ac	8.0b
Control		0a



Lower eff. only due to 2nd cycle, Winter annual germ.

Senecio vulgaris 'Common Groundsel'

Treatment	Rate/ac	Efficacy 90 DAT
Fortress/ CREW	100 lb/ac	7.4c
Fortress/ CREW	150 lb/ac	7.4c
Fortress/ CREW	200 lb/ac	7.6cd
Gallery + Dimension 2EW	0.75 ai + 0.38 ai lb/ac	5.9b
Snapshot 2.5TG	150 lb/ac	8.9d
Control	--	0.0a

Oxalis also good
Senesac - 2017



Capsella bursa-pastoris 'Shepherd's Purse'

Treatment	Rate/ac	Efficacy 90 DAT
Fortress/ CREW	100 lb/ac	9.0c
Fortress/ CREW	150 lb/ac	9.1c
Fortress/ CREW	200 lb/ac	10.0c
Gallery + Dimension 2EW	0.75 ai + 0.38 ai lb/ac	10.0c
Snapshot 2.5TG	150 lb/ac	7.4b
Control		0.3a



FORTRESS® Efficacy

Very Good to Excellent Control of Common Weeds

- ✓ White Clover
- ✓ **Oxalis**
- ✓ Bittercress
- ✓ Crabgrass
- ✓ Shepherds Purse
- ✓ Chickweed
- ✓ Spiny Sowthistle
- ✓ **American Burnweed**
- ✓ **Bittercress**
- ✓ **Mint family**



**49 broadleaf
weeds labelled
19 grassy weeds
labeled.**



#2 FreeHand = 59 groundcovers genus/sp.

- **Dimethenamid- p + pendimethalin**
(Freehand G) – BASF
- Freehand 1.75G, 150 lb/A = 1X
- 450 lb/A = 3X
- Excellent, broad-spectrum weed control
- **Landscape and nursery weeds –
missed by others**

FreeHand™ 1.75G Performance

	FreeHand	Snapshot	OH2	Broadstar	Pennant Magnum
Crabgrass	G	G	G	F-G	F
Goosegrass	G	G	G	F-G	F
Bittercress	G	F-G	G	G	P
Eclipta	G	P-F	F	F	P
Galinsoga	G	G	G	G	F
Spurge	G	G	G	G	F
Doveweed	G	P	F-G	G	F
Sedges	G	P	P-F	P	G

G=Good; F=Fair; P=Poor; FreeHand (dimethenamid-P + pendimethalin); Snapshot (isoxaben + trifluralin); OH2 (oxyfluorfen + pendimethalin); Rout (oxyfluorfen + oryzalin); Broadstar (flumioxazin); Pennant Magnum (s-metolachlor)

*FreeHand data from BASF-sponsored trials. All other data from Neal (NCSU) and Derr (VT) *Weeds of Container Nurseries in the US* publication

FreeHand Longevity – 10 WAT

Dr. Joe Neal, NCSU - 2007

doveweed = MONOCOT

FreeHand @ 150 lb/A



spurge *doveweed eclipta *crabgrass bittercress

Snapshot @ 200 lb/A



* = monocot

OH2 @ 100 lb/A



BroadStar @ 150 lb/A

FreeHand

Weed	Control
Crabgrass	G
Goosegrass	G
Poa annua	G
Bittercress	G
Eclipta	G
Hairy Galinsoga	G
Spurge	G
Doveweed	G
Sedges	G
NWH	G



#2 - Freehand

SENSITIVE Ornamental Species - Special Precautions

Ornamental grasses		Unacceptable phytotoxicity may occur to ornamental grasses. FreeHand® 1.75G herbicide should not be applied.
Herbaceous perennials		Unacceptable phytotoxicity may occur to the following herbaceous perennials. FreeHand 1.75G should not be applied. Black-eyed Susan <i>Rudbeckia fulgida</i> Blue star <i>Amsonia</i> spp. Butterfly flower <i>Asclepias tuberosa</i> Butterfly weed <i>Asclepias tuberosa</i> Cape leadwort <i>Plumbago</i> spp. Columbine <i>Aquilegia</i> spp. Dead nettle <i>Lamium</i> spp. Periwinkle <i>Vinca minor</i> Phlox <i>Phlox paniculata</i> Pincushion flower <i>Scabiosa</i> spp. Speedwell, spiked <i>Veronica spicata</i> other <i>Veronica</i> spp. Tickseed <i>Coreopsis auriculata</i>
Annual bedding plants		Applications of FreeHand 1.75G to begonia, gomphrena, and impatiens (including New Guinea hybrids) may result in injury; therefore, FreeHand 1.75G should not be applied.
Chelone spp. Coneflower Creeping phlox Hydrangea Loropetalum Magnolia Salvia spp. Solidago spp. Spirea Thrift Viburnum spp. Western hemlock	<i>Echinacea</i> spp. <i>Phlox subulata</i> <i>Hydrangea</i> spp. <i>Loropetalum chinense</i> <i>Magnolia</i> spp. <i>Spiraea</i> spp. <i>Armeria</i> spp. <i>Tsuga heterophylla</i>	DO NOT apply FreeHand 1.75G sequentially to these species. During the growing season, a second application of FreeHand 1.75G can be made if a herbicide of a different mode of action is applied between FreeHand 1.75G applications. FreeHand 1.75G applications must be separated by at least 16 weeks.
Ferns		Applications of FreeHand 1.75G to immature ferns during periods of new growth of fronds may result in some injury.
Hydrangea		Not all hydrangea cultivars may respond to the herbicide application with the same tolerance. Before treating an entire block of plants, apply only to a small number of plants and evaluate for 2 months for tolerance.

FreeHand Vs. Snapshot with Mulch

Treatment	Rate	2 wat	4 wat	8 wat	12 wat
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Efficacy

FreeHand	200 #/ac	9.3	8.7	8.7a	7.0b
Snapshot	200#/ac	9.0	8.0	6.8b	6.0c

Phytotoxicity

		Salvia	Geranium	Snapdragon	Impatiens	Ageratum
FreeHand		1.9	2.1	2.9	5.8*	0.8
Snapshot		1.3	3.6*	2.0	3.7*	0.8

Tower - BASF

- New active ingredient dimethenamid-p (20 d 1/2 life)
- Seedling shoot growth inhibitor - chloroacetamide
- Safe directed-spray preemergence in nurseries and landscapes.
- Combine with **Pendulum® aqua cap (44 d ½ life)**
- **100 #/ac of each**
- Tower 6.6 EC, 21 oz/A = 1X, 64 oz/A = 3X

Tower and Pendulum



No Injury with BFN Field Liners:
Forsythia 'Lynwood Gold'
Lilac 'Common Purple'
Flowering Almond
Potentilla 'McKays White'



Tower

W. annual

- Poa annua – partial
- **Bittercress (Hairy)**
- Italian Ryegrass
- Goosegrass
- Barnyardgrass
- Crabgrass
- Fall Panicum
- Foxtails
- Sandbur
- Spurge spp.
- Annual sedges
- Nightshade spp.
- Nutsedge (Yellow) – partial
- Pigweed spp.
- Shepherds purse
- **Willowherb (*Epilobium* sp.)** = products with oxadiazon – Ronstar 200#/ac



BASF herbicide - Tower

- Tower is a liquid
- It can be used on containers, field, landscapes
- Over-the-top crop uses
- Tower controls yellow nutsedge
- It works best on soils with 2-3% or more OM
- Cost-in-use is \$48 - \$73 per acre

Perennials Tolerance

Freehand **150 lb** **600 lb**

Salvia	yes	yes
Lewisia	yes	no
Lavender	yes	yes
Mex. Heather	yes	yes
Ruttya	yes	yes
Verbena	yes	yes
Daylily	yes	yes
Honeysuckle	yes	yes

Tower

21 oz

42 oz

Salvia	yes	yes
Lewisia	yes	yes
Lavender	yes	yes
Ruttya	yes	yes
Verbena	yes	yes
Daylily	yes	yes
Honeysuckle	yes	yes

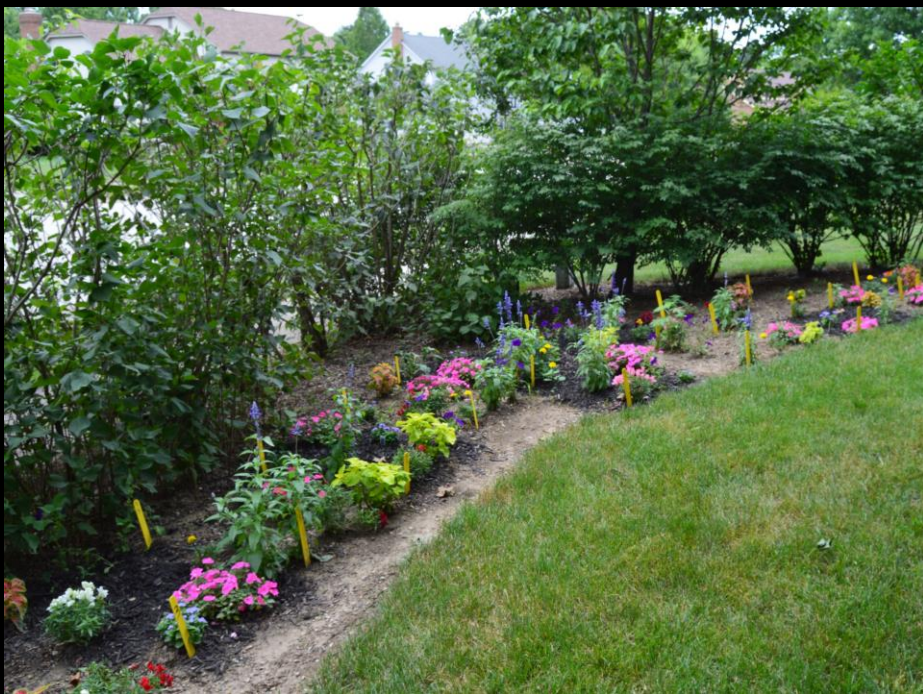
J. Derr, Virginia Tech, 2010

Two applications made on 6-8 week interval

#3 - Biathlon = 10 G/Sp.

- **Biathlon- oxyfluorfen and prodiamine**
- **New - Verge granule technology**
- **The rate is 100 lbs./ac - max. two/ ac./yr.**
- **Re-applications - 3-month intervals.**
- **Controls grass and broadleaf weeds – field/landscape, containers, ground maintenance, non-crop areas.**
- **Biathlon may also be used on evergreens including Christmas trees.**

Biathlon Annual Flower Trial



Hemerocallis ‘Going Banana’s’ – Ray Wiegand’s, New Haven, MI

Treatment	Rate (/ac) ^v	40 WAT Phyto.		40 WAT Efficacy	
Gemini G	200 lb.	1.2	ab	7.0	b
Biathlon	100 lb.	2.3	b	8.6	c
FreeHand 1.75G	150 lb.	1.0	ab	7.6	bc
Fortress	150 lb.	1.0	ab	7.7	bc
Control	---	0.7	a	4.0	a

Sedum spurium ‘Dragon Blood’

Treatment	Rate (/ac) ^v	40 WAT Phyto.		40 WAT Efficacy		Ending GI
Gemini G	200 lb.	6.0	c	8.5	b	295.6
Biathlon	100 lb.	2.8	b	9.2	bc	505.0
FreeHand 1.75G	150 lb.	2.2	b	10.0	c	800.0
Fortress	150 lb.	2.8	b	9.6	bc	319.3
Control	---	0.6	a	4.0	a	311.0

2019

**Fortress
150 #/ac**

2nd

**Biathlon
100 #/ac**

2nd

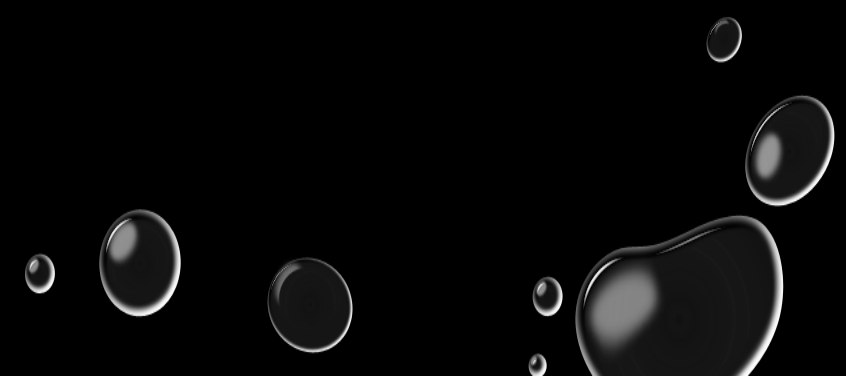
1st





Excellent Efficacy

need the Goal

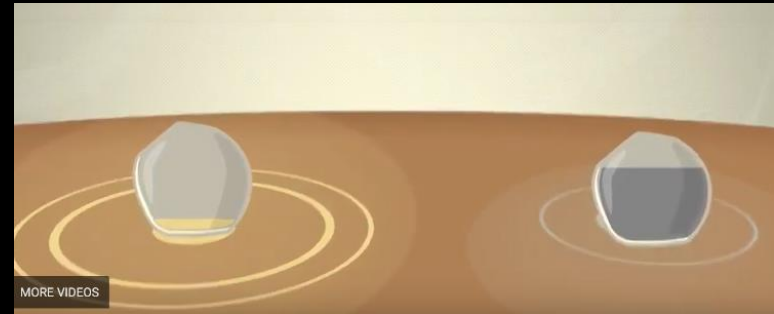
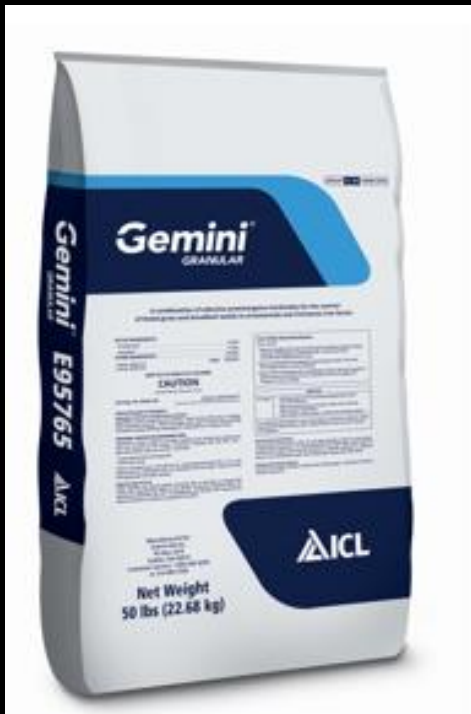
- Bittercress
 - Common Groundsel
 - Common Chickweed
 - Spurge
- 

#4- Gemini® G – 78 G/Sp. (Including: Carex sp., Phlox, Ferns) Everris -2017

Active Ingredients % By Weight

Prodiamine.....0.40%

Isoxaben.....0.25%



**R-50 Optimizer™ + Gemini® = power
to stop weeds with less active ingredient
= 120 weeds, 1 app. 4 mo.**

Coreopsis verticillata ‘Red Hot Vanilla’	Gemini	0	No
	Biathlon	0	No
	Freehand	0	No
Coreopsis verticillata ‘Curry Up’	Biathlon	0.3	No
	Freehand	0	No
	Fortress	0	No
Vernonia ‘Southern Cross’	Biathlon	1.1	No
Aster novae-angliae ‘Purple Dome’	Biathlon	1.6	No
	Freehand	1.0	No

Gemini 3.7 SC (2015)

Prodiamine (23.3%) + Isoxaben (15.5%)



Tmt 3 = 28.4 gal ai/100m² at 28 DAT

*Sedum
pachyclados*



Tmt 4= worst = 5.6 Barricade + Gallery 8.4 gal ai/100m²
at 56 DAT

Ground ivy
(*Glechoma hederaceae*)

Lamiaceae
(MINTS)

Purple-dead nettle
(*Lamium purpureum*)

Lamiaceae

****Gallery**
Pendimethalin



#5- FUERTE™ – 10 G/Sp. (for woody plants 1st)

Everris -2019

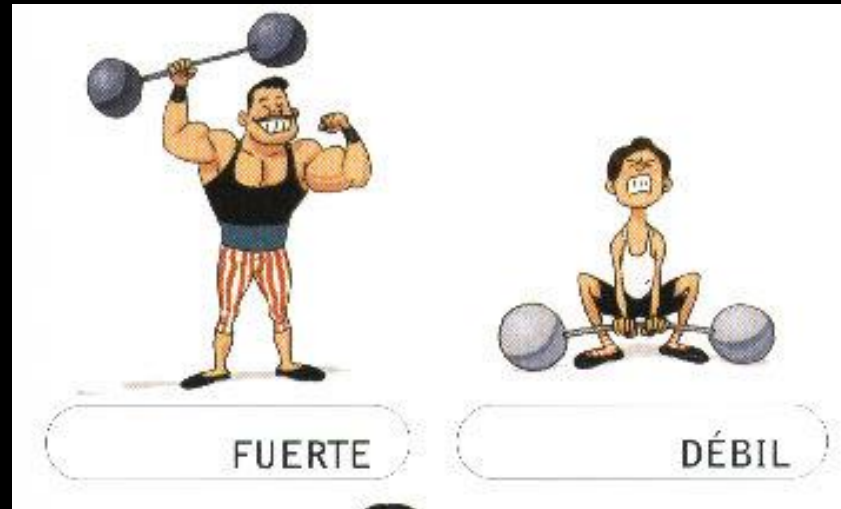
Strong in Spanish

100 lb/ac

Active Ingredients % By Weight

Flumioxazin.....0.125%

Prodiamine..... 0.75%



109 weeds, 3 mo., repeat

#5 - Fuerte

Senecio vulgaris 'Common Groundsel'

Treatment	Rate/ac	Efficacy 90 DAT
Fuerte	100 lb/ac	5.6
Fuerte	150 lb/ac	7.6
Fuerte	200 lb/ac	7.4
Broadstar	150 lb/ac	5.6
Control	--	1.3

Cardamine pennsylvanica
'Pennsylvania Bittercress'

Treatment	Rate/ac	Efficacy 90 DAT
Fuerte	100 lb/ac	8.7
Fuerte	150 lb/ac	9.9
Fuerte	200 lb/ac	10.0
Broadstar	150 lb/ac	10.0
Control	--	9.4

#5 - Fuerte

Oxalis corniculata 'Creeping Woodsorrel'

Treatment	Rate/ac	Efficacy 90 DAT
Fuerte	100 lb/ac	7.9
Fuerte	150 lb/ac	8.0
Fuerte	200 lb/ac	10.0
Broadstar	150 lb/ac	8.6
Control	--	1.6

#5 - Fuerte

Stellaria media 'Common Chickweed'

Treatment	Rate/ac	Efficacy 90 DAT
Fuerte	100 lb/ac	5.4
Fuerte	150 lb/ac	7.0
Fuerte	200 lb/ac	8.3
Broadstar	150 lb/ac	7.0
Control	--	0.0

No phyto. on anything tested to date

Cotoneaster



Ilex verticillata



Viburnum



#5 Fuerte – no phyto

Pinus nigra



Magnolia 'Yellow Bird'



Single Active: Broad Spectrum

#6 -Specticle G[®] - over-the-top of with precautions. granules cannot remain in contact with foliage.

5 G/Sp. (incl. Hosta dormant)



- ✓ Bayer Environmental Science
granular 9/2013 – Nursery containers
- ✓ Long-lasting - Soil degradation 150 days = less apps.
- ✓ Low a.i./ac – 0.0224% Indaziflam
- ✓ 0.25” to activate within 21 days
- ✓ Non-volatile, does not move in soil once watered in
- ✓ Below benches in greenhouse

Pineapple-weed (*Matricaria matricarioides*)

	Treatment	Rate lb/ac	1 st Efficacy ^x 30 DAT (Av. Weed Count)	2 nd Efficacy 60 DAT (Av. Weed Count)	3 rd Efficacy 90 DAT (Av. Weed Count)	3 rd Efficacy 90 DAT (Rating)
1	Fuerte	100	2.2b [≠]	4.5b	6.0c	2.0a
2	Fuerte	150	0.2a	6.0c	5.0c	5.0b
3	Fuerte	200	0.0a	0.0a	0.5a	8.0c
4	Marengo G	200	0.2a	1.0a	3.0b	9.0c
5	Control	--	0.8a	10.0d	6.0c	1.0a



Specticle G

Broadleaf Plantain (*Plantago major*) (90 DAT)



Fuerte 100

Fuerte 150



Specticle 200

Control

Dormant: Materials and Methods

- Treatments were applied January 16, 2016 – High 41°F low was 30°F
- On January 17 (0.5 in. snow)
- All melted by Jan. 25, 2016
- 4 replications or blocks/treatment
- Each granular product was pre-weighed and applied to a 14" dia. Plot
- Yucca and Festuca = evergreen



Summary



Generally Specticle G 1X rate was as good or better than FreeHand and Snapshot in efficacy and reduced phytotoxicity = 6MAT dormant season application on mature beds.



HERBICIDE ROTATIONS

Prevent Herbicide-resistance

- ... are present in a population in very small numbers. The repeated use of one herbicide (*one MOA*) allows these few plants to survive and reproduce (Mallory-Smith et al. 1999).



Pink Family

- Chickweed

Ronstar

- tolerant

Mustards tolerant of Treflan?





Fortress/ Crew

Snapshot

Freehand

Alternate year

**Specticle G = Jan.
i.e., Dormant**

Recommend:

Fortress or Snapshot - use early

Freehand - summer months (grasses are a concern).

Fall: *Apply Crew – early Nov.



Acknowledgements:

- MNLA, MDA, USDA - SCBG
- Bayer CropSciences Inc., Research Triangle Park, NC
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- IR-4, Rutgers, Rutgers, Princeton, NJ
- Wiegand's, Walters Gardens, Acorn, Bailey's, Klyn, Willoway
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Merci



Grazie