

Sweet Corn Herbicide Advancements

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Sweet Corn Pocket Guide

U of M contributions

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ID-405

SWEET CORN

Pest Identification and Management

The Great Lakes Vegetable Working Group and
North Central Integrated Pest Management Center

North Central
IPM
Center

Soil Applied Herbicide Options

Preemergence options

- **Annual grasses: Metolachlor products, Outlook, Micro-Tech, Prowl, Define, Acetochlor products (Harness, Surpass), Eradicane**
- **Annual broadleaves: Atrazine, Princep, Callisto**

Premixes

- **G-Max Lite (Outlook + atrazine)**
- **Bicep Lite II Magnum (Dual II Magnum + atrazine)**
- **Bullet or Lariat (Micro-Tech + atrazine)**
- **Camix, Lumax, Lexar**

Postemergence Herbicide Options

Annual grasses

- ☞ **Accent***, **Accent Q***
- ☞ **Poast**, **Poast Plus**
- ☞ **Option***

Annual broadleaves

- ☞ **Aim**
- ☞ **Atrazine***
- ☞ **Basagran**
- ☞ **Callisto**
- ☞ **Impact***
- ☞ **Laudis***
- ☞ **Permit**
- ☞ **Starane**
- ☞ **Stinger**
- ☞ **2,4-D**

* Activity on grasses
and broadleaves

Postemergence Herbicide Options

POST Package Mixtures

- ☛ **Laddok (atrazine + Basagran)**
- ☛ **Priority (Aim + Permit / Sandea)**

New in 2008 Sweet Corn Herbicides

- ☞ **Most (all?) acetochlor products labeled**
- ☞ **Option**
- ☞ **Laudis (747)**

New Sweet Corn Herbicides in 2009

 **Accent Q**



New products

**= improve weed mgt
options, and**



**= new tolerance
concerns**



HPPD inhibitors

**Bleaching: Inhibition of
4-hydroxyphenyl-pyruvate-dioxygenase
(4-HPPD)**

In order on market introduction:

Isoxaflutole (Balance)

Mesotrione (Callisto)

Topramezone (Impact)

Tembotrione (Laudis)

HPPD Review (In Order of Labeling)

Balance (Isoxaflutole)

- **Never approved by MN or WI**
- **Tested on sweet corn in late 90's**
- **Bayer continues to pursue MN, WI label**

Callisto (mesotrione)

- ☛ **Mesotrione 6 to 7.7 oz PRE labeled 2005**
 - ☛ **Below label 5 to 6 oz/A if t.m. with 0.75 lb/A atrazine have worked well in WI trials**
- ☛ **PRE application lacks bleaching of POST**
- ☛ **But, PRE decreased weed control spectrum**



Callisto (mesotrione)

PRE package mixes

• **Camix 3.67**

- **2.4 qt = 2 metolachlor + 0.2 mesotrione lb ai/A**
- **4 qt = 3.34 metolachlor + 0.33 mesotrione lb ai**

• **Lumax 3.94**

- **3 qt = 2 metolachlor + 0.75 atrazine + 0.2 mesotrione lb ai/A**
- **4 qt = 2.68 metolachlor + 1.0 atrazine + 0.268 mesotrione lb ai**

• **Lexar 3.7**

- **3 qt = 1.3 metolachlor + 1.3 atrazine + 0.168 mesotrione lb ai/A**
- **4 qt = 1.74 metolachlor + 1.74 atrazine + 0.224 mesotrione lb ai**

Callisto

- ☛ **NIS, no UAN/28% POST**
- ☛ **Recommend t.m. with atrazine**
 - ☛ **0.25 to 0.5 POST, 0.75 lb/A PRE**
 - ☛ **Adds control of common ragweed**
 - ☛ **Enhances residual control**
 - ☛ **Some grass help**
- ☛ **Organophosphate insecticides interactions**
 - ☛ **Do not t.m. with OP insecticides**
 - ☛ **Do not apply OP insecticides within 7 days of applying Callisto**
 - ☛ **Do not use at all if Counter or Lorsban used**

Callisto Rotation Restrictions

- 🐛 **Pea sensitivity to carryover**
 - **18 mo. rotation interval for pea, dry bean, snap bean, beets, etc.**
- 🐛 **Corn, soybean, potato, alfalfa 10 months**
- 🐛 **Small grains**
120 days



Impact (topramezone)

POST in field corn, sweet corn (processing and fresh mkt), pop corn labeled 2007 season

- **1° broadleaf weed control**
- **2° partial grass control**
 - **Synergized by atrazine**

Rate: 0.75 oz/A (2.8 lb ae / gal)

Adjuvant: MSO or COC plus nitrogen additive

PHI: 45 days

Impact (topramezone)

- ☛ 2ee - 9 mo for soybean plantback with reduced 0.5 fl oz rate
- ☛ 0.25 to 1.0 lb atrazine t.m. recommended
 - Reduced triazine rate to 0.5 to reduce carryover but reduces control
 - Reduces bdlf. efficacy and spectrum
 - Reduces carryover risk?

Impact (topramezone)

- Rotational restrictions (0.75 oz/A rate):
 - 3 mo – small grains
 - 9 mo – alfalfa, pea, potato
 - 18 mo – soybean, snap beans, other crops

2x Impact + atrazine



Laudis 3.5 SC (tembotrione + isoxadifen 2:1)

Formerly AE 0172747, 747

☞ **Field, seed, popcorn and sweet corn
(processing and fresh mkt)**

☞ **HPPD-inhibitor**

- **1° broadleaf weed control**
- **2° partial grass control**
 - **Synergized by atrazine**

☞ **Bayer safener technologies**

☞ **Aqueous solution (shake!)**

Laudis 3.5 SC (tembotrione)

POST Label in 2008

3 oz product / A +1% MSO + 8.5 lbs AMS/100 gal

- **0.082 lb ai/A tembotrione**
- **Efficacy with COC < MSO but COC can be used if:**
 - **Dicots main target**
 - **Excellent growing (kill) conditions**

Atrazine T.M.

- **Improves consistency**
- **Certain grasses and broadleaves from suppression to control**
- **Synergy interaction**

Laudis 3.5 SC (tembotrione)

Up to V7 (V8 field corn, popcorn)

No insecticide interactions (Callisto does)

Carryover? Rotation expected to be:

- Small grains 4 mo.
- Soybean 8 mo.
- Pea, potato, snap beans, alfalfa 10 mo.
- Dry bean (red kidneys), sunflower 18 mo.

HPPD Herbicides

So, which should I use?

**All three best used with
0.5 - 0.75 lb ai atrazine to
round out broadleaf efficacy**

HPPD Efficacy excellent



Tolerance?



New products
= new carryover
concerns?



HPPD Carryover Trials*

**Tested soybean (WI), pea, snap beans,
sugar beets (MN), red kidneys (MN)**

Impact

Snaps - 2X, GR, Bronzing

Soybean, red kidneys?

Callisto

Snaps, pea, sugar beets - 2X GR, Chlorosis

Laudis

Sugar beets 2X GR

Red kidneys?

***atrazine interaction, 0.75 / 1.25 lb ai 2006**

HPPD Herbicides

Callisto

Impact

Laudis

So, which should I use?

Efficacy

- **Broadleaves POST similar t.m. with atrazine**
- **Grasses Laudis \geq Impact \gg Callisto**

Crop Tolerance

- **Impact \geq Laudis $>$ Callisto**

Crop Rotation Limitations

- **Impact \sim Callisto $>$ Laudis**

Insecticide interactions

- **Only Callisto**

HPPD Herbicides

With the advent of Laudis and Impact:

Where do we use Callisto?

**Soil applied - Camix, Lumax are a good fit,
depending on crop rotation**

Vol. potato control POST with Callisto

– Better than Starane

HPPD Herbicides

With the advent of Laudis and Impact:

Where do we use Accent?

Grass control:

- **Accent > Laudis**
 - **Green foxtail, woolly cupgrass**
- **Laudis > Accent**
 - **Crabgrass**

Long-term Laudis use could shift grasses to dominance by green foxtail and fall panicum

Accent rescue treatment?

- **But height cutoff if intend to rescue a failed POST trt.**

Acetochlor Sweet Corn Label 2008

2nd generation acetamide

- High unit activity on grasses and some broadleaves
- Safener allowed use on corn (& sweet corn)
 - Prior to acetochlor, acetamides that were marketed did not 'require' a safener for acceptable tolerance

Many products:

Degree/TopNotch ME, Harness/Surpass EC

Degree Xtra / Keystone, FulTime / Harness Xtra,
Harness Xtra 5.6, others

Acetochlor Sweet Corn Label 2008

EC (Harness/Surpass) or encapsulated/ME (Degree/TopNotch) acetochlor formulations

Do not apply early post to sweet corn (is allowed on field corn)

Restricted Use Product - ground water concerns

– surface water issues evolving in MN

Acetochlor Sweet Corn Label 2008

Do not apply to the following soils if ground water depth is \leq 30 ft.

Soil texture	O.M.
Sands	$< 3\%$
Loamy sands	$< 2\%$
Sandy loams	$< 1\%$

Limits use in both MN and WI

Acetochlor Sweet Corn Label 2008

Rotational crops - Surpass supplemental label 5/24/07

Corn (types not specified)

Anytime - 0 months after application

Wheat (types not specified)

4 Months after application

Acetochlor Sweet Corn Label 2008

Rotational crops - **Surpass** supplemental label 5/24/07

Spring following application³

Alfalfa, barley, clover, dry beans ², guar, kudzu lentil, lespedeza, lupin⁴, millet, pearl or proso, oats, pea ⁵, potatoes, rye sorghum, soybeans, sugar beets, sunflower, trefoil, tobacco, triticale, vetch, wild rice.

² Dry beans includes: adzuki, kidney, lima, navy, pinto

³ Approved rotation crops list does not include any species of succulent beans or succulent peas

⁴ Lupin includes: grain, white, white sweet

⁵ Pea includes: blackeyed, chick, cow, Crowder, field pigeon, Southern

Accent

Accent Q

- **nicosulfuron + isoxadifen safener**
 - Targeting high-value specialty crops
 - Differentiates from generics for DuPont
 - Accent through the 2008 season
 - Accent Q in in distribution system for 2009

Accent Q Evaluations

Accent Q = nicosulfuron + isoxadifen

- Sweet corn labeled in 2009
- Standard rate:
0.9 oz/a (equivalent to 0.66 oz/a Accent + isoxadifen)

Multi-state hybrid evaluation

- DE, MN, OR, WI
- Same 39 sensitive, intermediate and tolerant hybrids
- Accent vs Accent Q at increased rate
 - 1.09 oz/a Accent + 1% COC + 2 lb/a AMS
 - 1.09 oz/a Accent + 0.41 oz/a isoxadifen + 1% COC + 2 lb/a AMS

Does the safener increase tolerance to Accent?

Accent vs Accent Q

Injury Summary 7 DAT

Hybrid averages among locations

	<u>Chlorosis (%)</u>		<u>Stunting (%)</u>	
	<u>Accent</u>	<u>Accent Q</u>	<u>Accent</u>	<u>Accent Q</u>
DE	15	5	19	9
MN	1	0	2	1
OR	-	-	7	0
WI	10	4	18	11

Injury by Hybrid Tolerance Class

(avg. % stunting and range across locations)

	<u>Accent</u>	<u>Accent Q</u>
Sensitive	15 (5-16)	8 (0-9)
Intermediate	9 (4-22)	5 (3-16)
Tolerant	7 (2-16)	4 (0-9)

Punch

- at 7 days at WI
- note chlorosis

Accent



Accent Q

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Accent Q

**Homozygous sensitive hybrids
still killed by Accent Q**

**Injury from Accent Q about
50% less than Accent**

General ranking of tolerance
– Accent Q > Accent > Option

**Reduced risk of injury should expand options for using
Accent Q on sweet corn**

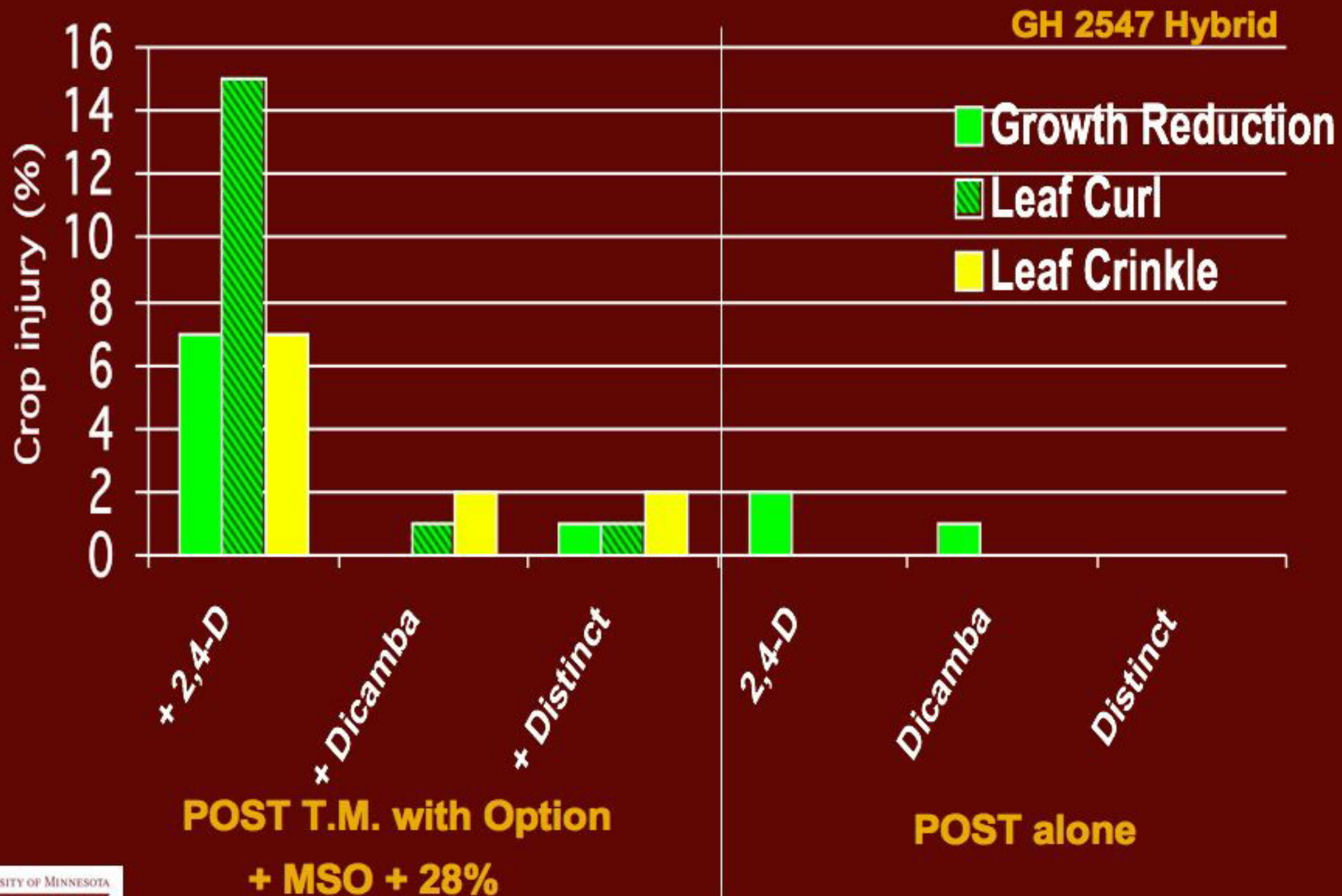


Merit

Option PGR Safener Potential

Waseca MN 2004

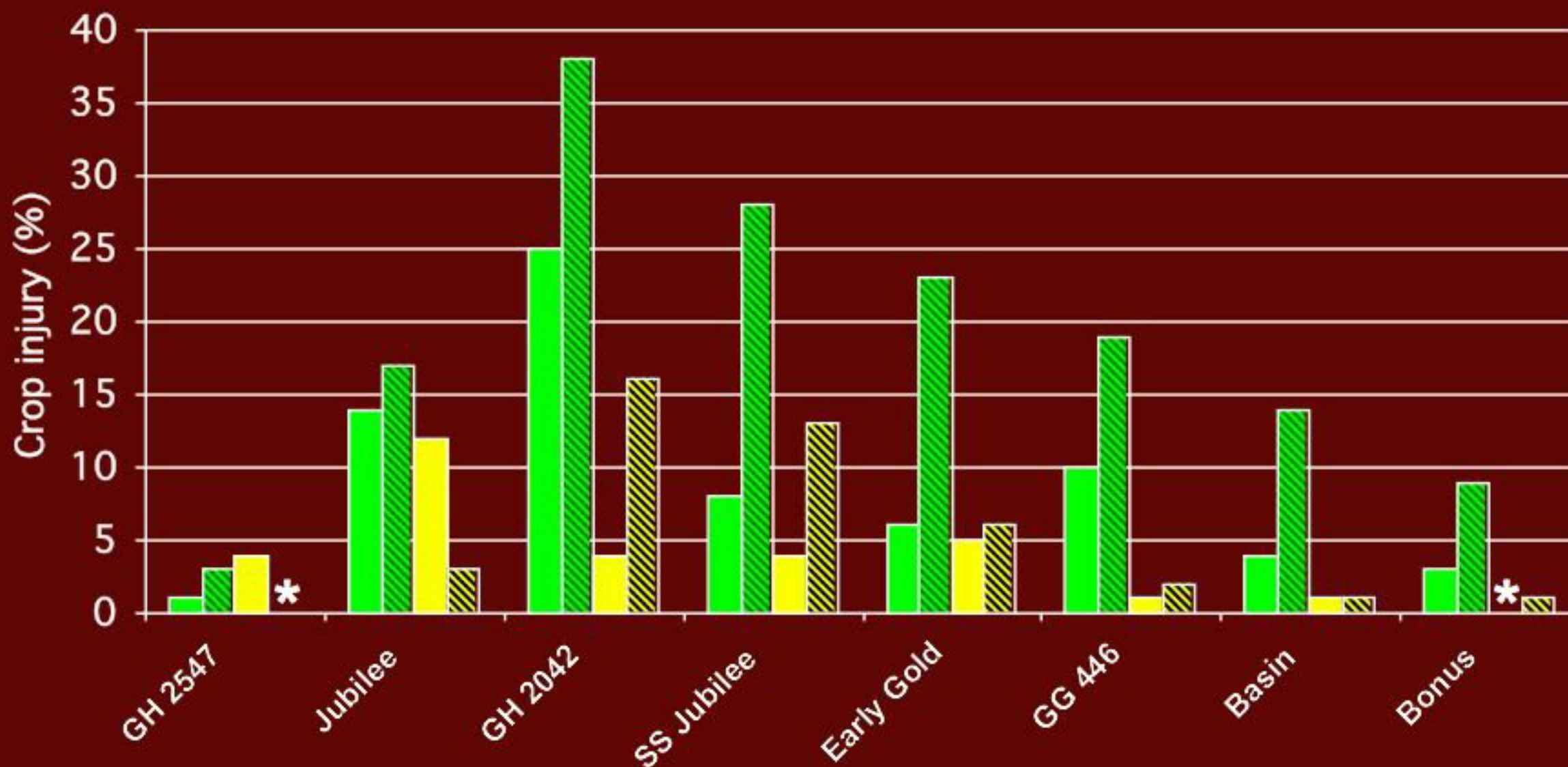
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Option vs Accent Tolerance Evaluation

Boerboom 2006 MWFPA

1X Option 2X Option 1X Accent 2X Accent



Crinkle

Only (MN)

Stunting - higher level of injury (WI)

Poast (sethoxydim) on Sweet Corn

Sethoxydim resistance

- **Insensitive ACC-ase inhibitor selected through tissue culture at the U of M**
- **Not transgenic (not GMO)**

Sethoxydim on Sweet Corn

- ☛ **Adjuvants: 1 qt/a COC + 2.5 lb/a AMS**
- ☛ **Timing: Emergence to before pollen shed**
(Poast/ Poast Plus pts/A)
- ☛ **Weeds:**

0.5 / 0.75	10"	wild proso millet
1.0 / 1.5	6"	crabgrass, 8" foxtails
1.5 / 2.25	8"	quackgrass
- ☛ **Tank mixtures:**
 - **atrazine, Basagran, Laddok S-12**
- ☛ **Rotational restrictions:**
 - **0 days (labeled crops) or 30 days (other crops)**

Poast Protected Sweet Corn

Wild proso millet control

- Poast – 2 applications maximum allowed

Recommendation

- ☞ **PRE grass herbicide; POST Poast**
 - limited number of hybrids
- ☞ **Alternatives:**
 - **Accent**
 - > narrower application window
 - > limited to approved hybrids
 - **Laudis / Impact**
 - > safer than Accent
 - > residual -> control but carryover?

Define (flufenacet) Bayer

Oxyacetamide - Bayer has indicated will be phased out

Various reasons

New and Potential Sweet Corn Herbicides

2008 field evaluations

Status

Accent Q

BAS 800 (Kixor or saflufenacil)

Leaf Wrapping From Status Suregold @ 7 DAT (not all plants affected)



Status Injury Summary at 7 Days

Trial averages among locations

- Delaware 30% injury
- Minnesota 3% “grassy”
- Oregon 9% lodging severity
- Wisconsin 13% leaf wrapping

Response among hybrids (average across locations)

- Sensitive 17% (range 8 - 48%)
- Intermediate 11% (range 6 - 21%)
- Tolerant 10% (range 2 - 18%)

Status at 5 oz/a on Celestial Arlington, WI



Status

At a potential 2.5 oz/a Status “sweet corn” rate

Suregold - similar or greater amount of leaf wrapping than Clarity at 7 days; rapid recovery

Differential injury among locations and hybrids at 5 oz/a rate; good recovery

Although injury is related to previous tolerance ratings for Accent, the level and variability of injury is concerning

Status is not labeled on sweet corn at this time

BAS 800 and BAS 781 from BASF

Kixor = saflufenacil (PPO inhibiting herbicide)

- Burndown and Preemergence corn herbicide**
- Broadleaf weed activity**
- 2010 launch anticipated**
- BAS 800 – saflufenacil**
- BAS 781 – saflufenacil + Outlook**

Limited evaluation on sweet corn

BAS 800 and BAS 781

Multi-state hybrid evaluation

- DE, MN, OR, WI
- Same 39 sensitive, intermediate and tolerant hybrids
- BAS 800 – 2x use rate
 - MN - 10 fl oz + Outlook 10 fl oz
 - DE, OR, WI - 6 fl oz/a + 10 fl oz/a Outlook
- BAS 781 – 2x use rate
 - MN - 50 fl oz
 - DE, OR, WI - 40 fl oz/a
- Applied Preemergence

Does sweet corn have tolerance to saflufenacil?

BAS 800 at Minnesota

GH 2042 – 60% stunting



Overland

– Treated 65% stunting



Lancaster – 35% stunting



– Nontreated check





Questions