

Highlights From 2017 Muck Onion Herbicide Trials

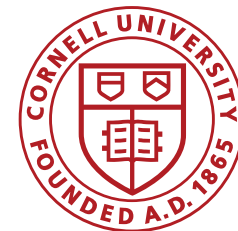
Christy Hoepting

Cornell Cooperative Extension

Cornell Vegetable Program

2018 Empire Expo – Onion Pest Management Session,
Syracuse, NY: January 17, 2018

Outline



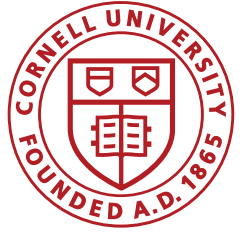
PRE-Emergent weed control:

- Prowl EC vs. H₂O
- Incorporating Chateau into pre-emergent onion program
- Mixed broadleaves featuring ragweed, smartweed and marsh yellowcress
- Pipeline products: Zidua, a.i. bicyclopyrone, Reflex
- Improved control of yellow nutsedge

POST-Emergent weed control:

- Featuring smartweed and ragweed, Chateau + Goaltender, bicyclopyrone

Acknowledgements



Funding provided by:

- New York Onion Research & Development Program (ORDP)
- Smith-Lever State Funds
- BASF
- Syngenta Crop Protection
- IR-4

CVP Technicians:

- Amy Celentano
- Audrey Klein

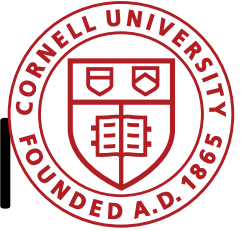
Grower Cooperators:

- Jeff Decker, Marion, NY
- John Dunsmoor, Oswego, NY



Prowl EC vs. H₂O

Effect of EC Rate on Weed Control



% Weed Control (/plot)	Wayne I		Oswego		Wayne 2			
	19 DAT (2-leaf)		29 DAT (2.5 leaf)		30 DAT (3-leaf)			
	RW	SW	SW	MYC	MYC	LQ	PW	HG
Prowl EC 2.4 pt			83 a	78 abc	20	36	33	38
Prowl EC 3.6 pt			92 a	87 a	48	86	52	27
Prowl EC 4.8 pt	8.2 e	97 a	95 a	86 ab	53	77	79	65

>95

90-94

80s

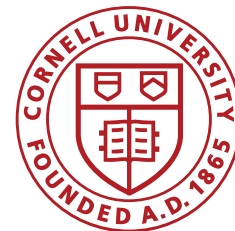
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Prowl EC vs. H₂O

EC Rate - Crop Tolerance



	Wayne I			Oswego			Wayne II		
	19 DAT (2-leaf)			29 DAT (2.5-leaf)			30 DAT (3-leaf)		
	% Inj	Stand	Ht	% Inj	Stand	Ht	% Inj	Stand	Ht
Untreated	0 d		7.4 ab	0 f	15.3 def	10.3 a		16.6 a	
Prowl EC 2.4 pt				4 cde	17 a-e	7.8 cd	2 f	14.5 bcd	10.8 b
Prowl EC 3.6 pt				5 cd	18 a-d	7.9 bcd	7 de	14.1 bcd	9.7 cd
Prowl EC 4.8 pt	2.5 d	15.4 abc	6.8 cd	6 cd	17 a-e	-3" (30%)	1 f	19.4 a	10.3 bc

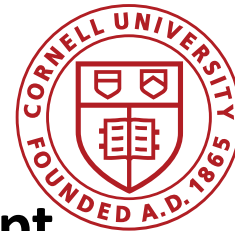


Statistically same as best treatment



Statistically same as worst treatment

Effect of Prowl EC Rate



Untreated

2.4 pt

3.6 pt

4.8 pt



JUN 22 2017 (37 DAT PRE)

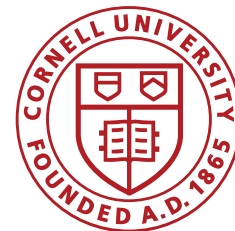
Cornell Cooperative Extension
Vegetable Program
PRE-Emergent Herbicide Trial
1. Untreated
- Weedy Check

Cornell Cooperative Extension
Vegetable Program
PRE-Emergent Herbicide Trial
3. Prowl EC
2.4 pt
PRE

Cornell Cooperative Extension
Vegetable Program
PRE-Emergent Herbicide Trial
4. Prowl EC
3.6 pt
PRE

Cornell Cooperative Extension
Vegetable Program
PRE-Emergent Herbicide Trial
5. Prowl EC
4.8 pt
PRE

Prowl EC vs. H₂O Weed Control



% Weed Control (/plot)	Wayne I		Oswego		Wayne 2			
	19 DAT (2-leaf)		29 DAT (2.5-leaf)		30 DAT (3-leaf)			
	RW	SW	SW	MYC	MYC	LQ	PW	HG
Prowl EC 2.4 pt			83 a	78 abc				
Prowl EC 3.6 pt			92 a	87 a				
Prowl EC 4.8 pt	8.2 e	97 a	95 a	86 ab				
Prowl H ₂ O 4 pt	10.0 e	95 a	75 ab	60 bcd				

>95

90-94

80s

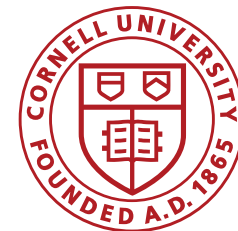
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Prowl EC vs. H₂O

Crop Tolerance



	Wayne I			Oswego			Wayne II		
	19 DAT (2-leaf)			29 DAT (2.5-leaf)			30 DAT (3-leaf)		
	% Inj	Stand	Ht	% Inj	Stand	Ht	% Inj	Stand	Ht
Untreated	0 d		7.4 ab	0 f	15.3 def	10.3 a			
Prowl EC 2.4 pt				4 cde	17 a-e	7.8 cd			
Prowl EC 3.6 pt			-1"	5 cd	18 a-d	-1.3"			
Prowl EC 4.8 pt	2.5 d	15.4 abc	(11%)	6 cd	17 a-e	(15%)			
Prowl H ₂ O 4 pt	1.2 d	16.0 abc	★ a	3 de	18.3 a-d	★ b			



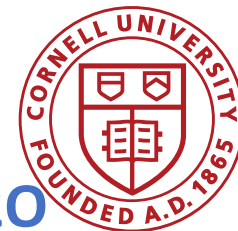
Statistically same as best treatment



Statistically same as worst treatment

Prowl EC vs. H₂O

JUN 22 2017 (37 DAT PRE)



EC

2.4 pt

EC

3.6 pt

EC

4.8 pt

H₂O

4 pt



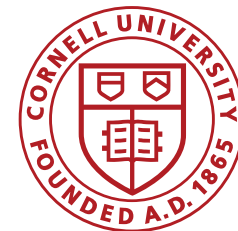
Cornell Cooperative Extension
Vegetable Program
PRE-Emergent Herbicide Trial
3. Prowl EC
2.4 pt
PRE

Cornell Cooperative Extension
Vegetable Program
PRE-Emergent Herbicide Trial
4. Prowl EC
3.6 pt
PRE

Cornell Cooperative Extension
Vegetable Program
PRE-Emergent Herbicide Trial
5. Prowl EC
4.8 pt
PRE

Cornell Cooperative Extension
Vegetable Program
PRE-Emergent Herbicide Trial
6. Prowl H₂O
4 pt
PRE

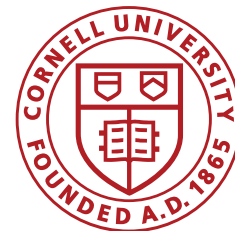
Prowl EC vs. H₂O - Summary



Effect of Rate with Prowl EC:

- Control of smartweed (SW), marsh yellowcress (MYC), and Lamb's quarters (LQ) was the same between the 3.6 and 4.8 pt rates, and not quite as good at the 2.4 pt rate.
- For hairy galingsoga (HG), control was only adequate (65%) at the high rate
- For pigweed (PW), control increased progressively as rate increased.
- Generally, no difference among rates for crop tolerance; all resulted in significant stunting up to 3" (=30%) compared to the untreated

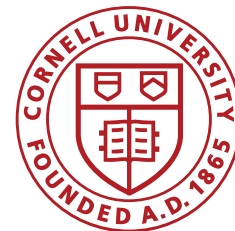
Prowl EC vs. H₂O - Summary



Prowl EC vs. H₂O:

- At Wayne I, there was no difference between 4.8 pt EC and Prowl H₂O for control of RW (= poor) or SW (= excellent).
- At Oswego, medium and high rate of EC provided numerically better control of SW (= excellent) and MYC (= very good) than H₂O by about 15-20%
- Prowl H₂O was generally safer than Prowl EC and was not significantly different than the untreated
 - 4.8 pt EC was significantly 1" shorter/stunted than H₂O

Prowl EC vs. H₂O With Chateau – Weed Control



% Weed Control (/plot)	Wayne I		Oswego		Wayne 2			
	19 DAT (2-leaf)		29 DAT (2.5 leaf)		30 DAT (3-leaf)			
	RW	SW	SW	MYC	MYC	LQ	PW	HG
Prowl EC 2.4 pt			83 a	78 abc	20	36	33	38
Prowl EC 3.6 pt			92 a	87 a	48	86	52	27
Prowl EC 4.8 pt	8.2 e	97 a	95 a	86 ab	53	77	79	65
Prowl H ₂ O 4 pt	10.0 e	95 a	75 ab	60 bcd				
Prowl EC 2.4 pt + Chateau 1 oz			92 a	90 a	93	63	82	69
Prowl H ₂ O 4 pt + Chateau 1 oz			80 a	77 abc	50	83	97	63

>95

90-94

80s

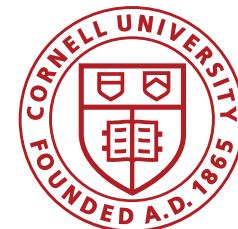
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Prowl EC vs. H₂O

With Chateau – Weed Control



% Weed Control (/plot)	Wayne I		Oswego		Wayne 2			
	19 DAT (2-leaf)		29 DAT (2.5 leaf)		30 DAT (3-leaf)			
	RW	SW	SW	MYC	MYC	LQ	PW	HG
Prowl EC 2.4 pt			83 a	78 abc	20	36	33	38
Prowl EC 3.6 pt			92 a	87 a	48	86	52	27
Prowl EC 4.8 pt	8.2 e	97 a	95 a	86 ab	53	77	79	65
Prowl H ₂ O 4 pt	10.0 e	95 a	75 ab	60 bcd				
Prowl EC 2.4 pt + Chateau 1 oz			92 a	90 a	93	63	82	69
Prowl H ₂ O 4 pt + Chateau 1 oz			80 a	77 abc	50	83	97	63
Chateau 1.0 oz			37 cd	19 fg				

>95

90-94

80s

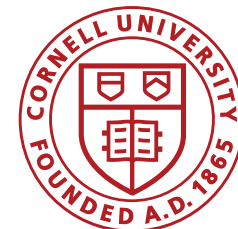
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Prowl EC vs. H₂O

With Chateau – Weed Control



% Weed Control (/plot)	Wayne 1		Oswego		Wayne 2			
	19 DAT (2-leaf)		29 DAT (2.5 leaf)		30 DAT (3-leaf)			
	RW	SW	SW	MYC	MYC	LQ	PW	HG
Prowl EC 2.4 pt			83 a	78 abc	20	36	33	38
Prowl EC 3.6 pt			92 a	87 a	48	86	52	27
Prowl EC 4.8 pt	8.2 e	97 a	95 a	86 ab	53	77	79	65
Prowl H ₂ O 4 pt	10.0 e	95 a	75 ab	60 bcd				
Prowl EC 2.4 pt + Chateau 1 oz			92 a	90 a	93	63	82	69
Prowl H ₂ O 4 pt + Chateau 1 oz			80 a	77 abc	50	83	97	63
Chateau 1.0 oz			37 cd	19 fg				
Chateau 3.0 oz			97 a	79 abc				

>95

90-94

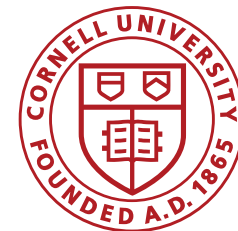
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Prowl EC vs. H₂O With Chateau - Crop Tolerance



	Wayne I			Oswego			Wayne II		
	19 DAT (2-leaf)			29 DAT (2.5-leaf)			30 DAT (3-leaf)		
	% Inj	Stand	Ht	% Inj	Stand	Ht	% Inj	Stand	Ht
Untreated	0 d		7.4 ab	0 f	15.3 def	10.3 a		16.6 a	
Prowl EC 2.4 pt				4 cde	17 a-e	7.8 cd	2 f	14.5 bcd	10.8 b
Prowl EC 3.6 pt				5 cd	18 a-d	7.9 bcd	7 de	14.1 bcd	9.7 cd
Prowl EC 4.8 pt	2.5 d	15.4 abc	6.8 cd	6 cd	17 a-e	7.2 d-g	1 f	19.4 a	10.3 bc
Prowl H ₂ O 4 pt	1.2 d	16.0 abc	7.7 a	3 de	18.3 a-d	8.5 b			
Prowl EC 2.4 pt + Chateau 1.0 oz				18 ab	15.5 def	6.9 fgh	17 cd	10.4 f	9.4 de
Prowl H ₂ O 4 pt + Chateau 1.0 oz				9 bcd	15.2 def	7.5 def	12 cde	10.7 ef	10.3 bc
Chateau 1.0 oz				3 ef	-23%	7.7 cde			
Chateau 3.0 oz				18 a	10.8 gh	6.4 h			

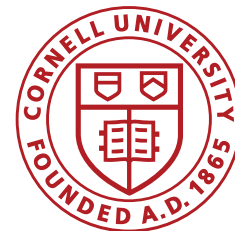


Statistically same as best treatment



Statistically same as worst treatment

Chateau



Chateau 1 oz

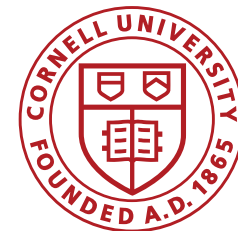


Chateau 3 oz



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Chateau



Chateau 1 oz

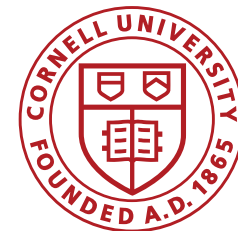


Chateau 3 oz



JUN 22 2017 (37 DAT PRE)

Prowl + Chateau



**Prowl EC
2.4 pt**



**Prowl EC 2.4 pt
+ Chateau 1 oz**



**Prowl H2O
4 pt**

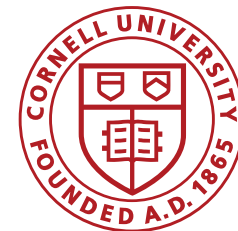


**Prowl H2O 4 pt
+ Chateau 1 oz**



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Chateau - Summary

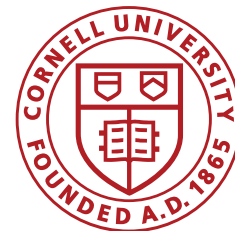


- Alone, Chateau 1 oz provided only poor control of SW and MYC.
- Alone, Chateau 3 oz provided excellent control fo SW and god control of MYC.
- Chateau is very “touchy” with respect to PRE-emergent control and rate.
- Chateau 1 oz resulted in 23% stand loss and significant stunting
- Chateau 3 oz resulted in unacceptable crop injury

Research Questions:

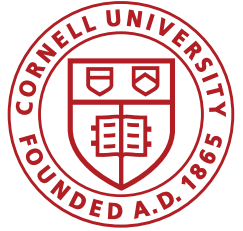
- What level of control does 2.0 oz provide?
- What level of control does 2.0 oz followed by 1.0 oz provide? Should 2 oz be followed by 1 oz for improved PRE weed control?

Chateau + Prowl - Summary



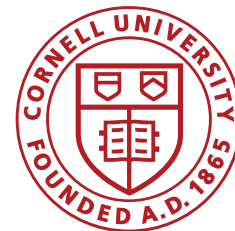
- In Oswego, tank mix of Prowl 2.4 pt/H₂O + Chateau 1 oz resulted in slightly better control of SW and MYC as Prowl alone, which was numerically only slightly better than Prowl H₂O.
- In Wayne II, tank mix of Prowl EC 2.4 pt + Chateau 1 oz improved control of MYC (by 73%), LQ (by 27%), PW (by 49%) and HG (by 31%) compared to Prowl alone.
- Compared to Prowl EC + Chateau 1 oz, Prowl H₂O + Chateau 1 oz had better control of LQ and PW by ~20%, while EC had better control of MYC, and no difference with HG.
- Both tank mixes resulted in ~37% stand reduction.
- Significant stunting: Prowl EC + Chateau - 3.4" (=33%); H₂O - 2.8" (=27%)

Prowl EC vs. H₂O With Chateau in a Program



Treatment (Products and Rate)	Timing
Standard with Prowl EC: Prowl EC 2 pt + Outlook 11 fl oz + Brox 2EC 1.5 pt Prowl EC 4.8 pt + Outlook 10 fl oz + Select 2EC 1 pt (barley kill)	PRE 1-leaf 1-leaf
Standard with Prowl H2O: Prowl H2O 4 pt + Outlook 11 fl oz + Brox 2EC 1.5 pt Prowl H2O 4 pt + Outlook 10 fl oz + Select 2EC 1 pt + COC 1% v/v (barley kill)	PRE 1-leaf 1-leaf
Prowl H2O/Chateau PRE: Prowl H2O 4 pt + Outlook 11 fl oz + Brox 2EC 1.5 pt + Chateau 1.0 oz Prowl H2O 4 pt + Outlook 10 fl oz + Select 2EC 1 pt + COC 1% v/v (barley kill)	PRE PRE 1-leaf 1-leaf

Prowl EC vs. H₂O With Chateau in a Program



Oswego 29 DAT (2.5 leaf)	% Weed Control		Crop Tolerance			
	SW	MYC	% Visual Injury	Stand (#/3ft)	Plant Height (inch)	Yield* (lb/plot)
Standard Prowl EC	96	100	9	16.8 b-e	7.2 d-g	19.5 ab
Standard Prowl H ₂ O	93	99	5	19.2 abc	7.4 d-g	17.2 ab
Prowl H ₂ O/Chateau PRE	95	98	45	-52%	-2.7" (32%)	-34%

*rest of the apps
before yield

Standard Prowl EC: Prowl EC 4.8 pt	4-leaf
Standard Prowl H₂O: Chateau 2.0 oz Prowl H ₂ O 4 pt + Chateau 1.0 oz	2-leaf 4-leaf
Prowl H₂O/Chateau PRE: Prowl H ₂ O 4 pt + Chateau 2.0 oz	4-leaf

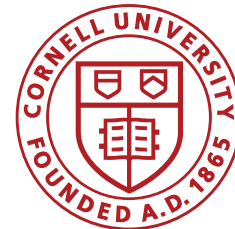


Statistically same as best treatment



Statistically same as worst treatment

Prowl EC vs. H₂O With Chateau in a Program



Standard
Prowl EC PRE, flag+



Standard Prowl H₂O
Prowl H₂O PRE, flag+
Chateau 2 oz 2L

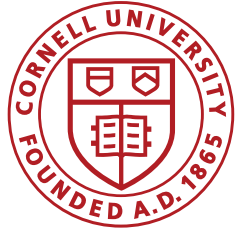


Prowl H₂O Chateau PRE
Prowl H₂O PRE, flag+
Chateau 2 oz 2L



JUN 22 2017 (37 DAT PRE)

Prowl EC vs. H₂O - Summary With Chateau in a Program



- No difference in control of SW or MYC between a program with Prowl EC or Prowl H₂O or with Prowl H₂O + Chateau 1 oz PRE (all >90%).
- Program with Prowl EC had significantly 12.5% reduced stand compared to program with Prowl H₂O.
- When Chateau 1 oz PRE was added to Prowl H₂O program, stand was significantly reduced by 52%, onions were significantly stunted by 2.3" (=32%) and yield was reduced by 34%.

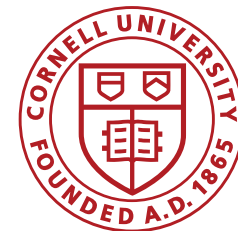
Conclusion:

- Chateau 1 oz is not going to fit into PRE-emergent program when applied with Outlook and Prowl at the PRE-emergent to onion timing.
- Prowl H₂O + Chateau improved weed control over Prowl H₂O alone by about 15% for SW and MYC

Future Research:

- Does Chateau 2 oz alone or followed by 1.0 oz after 7 days (when used for POST weed control at 2-leaf) offer enough weed control to reduce/skip an application of Prowl?

Single Actives – Weed Control



% Weed Control (/plot)	Wayne I		Oswego	
	19 DAT (2-leaf)		29 DAT (2.5 leaf)	
	RW	SW	SW	MYC
Prowl EC 4.8 pt	8.2 e	97 a	95 a	86 ab
Outlook 11 fl oz PRE Outlook 10 fl oz flag+		17 bc	75 ab	57 cde
Outlook 21 fl oz	81 ab	99 a	58 abc	68 a-d
Brox 1.5 pt	61 c	34 b	37 cd	32 ef
Zidua 2.5 oz	42 d	25 bc	25 cd	83 ab
Bicyclopyrone 3.4 fl oz	67 bc	5 bc	40 bc	54 cde
Reflex 8 fl oz			40 bc	50 de

>95

90-94

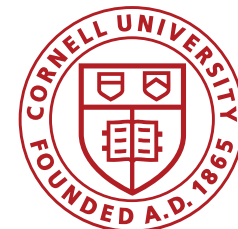
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<50

Single Actives – Crop Tolerance



% Crop Tolerance	Wayne I			Oswego		
	19 DAT (2-leaf)			29 DAT (2.5 leaf)		
	Visual Onion Injury %	Stand (/3 ft)	Plant Height (inch)	Visual Onion Injury %	Stand (/3ft)	Plant Height (inch)
Prowl EC 4.8 pt	2 d	15.4 abc	7.4 ab	6 cd	17.0 a-e	7.2 d-g
Outlook 11 fl oz PRE Outlook 10 fl oz flag+	1 d	15.4 abc	7.8 a	8 cd	20.0 ab	7.8 cd
Outlook 21 fl oz	11 b	16.2 abc	-1.3"	8 bcd	17.8 a-d	7.4 d-g
Brox 1.5 pt	5 cd	16.9 ab	7.2 bc	0 f	20.3 a	8.3 bc
Zidua 2.5 oz	3 cd	17.6 a	7.4 ab	8 bc	15.8 c-f	7.2 efg
Bicyclopyrone 3.4 fl oz	4 cd	16.7 abc	7.0 bc	4 cde	16.8 b-e	7.9 bcd
Reflex 8 fl oz				4 cde	15.5 def	7.8 cde

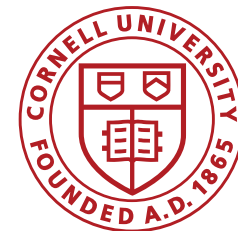


Statistically same as best treatment



Statistically same as worst treatment

Single Actives



Prowl EC 4.8 pt



Outlook 21 fl oz



Outlook split

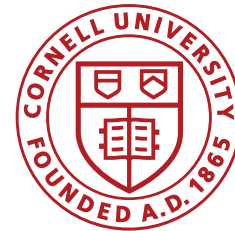


Brox 1.5 pt



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Synergy



Prowl EC **2.4 pt**



+

Outlook split



+

Brox 1.5 pt



+

Prowl EC **4.8 pt**

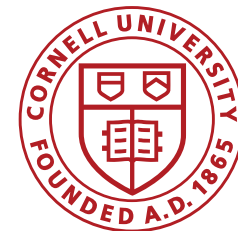


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Single Actives

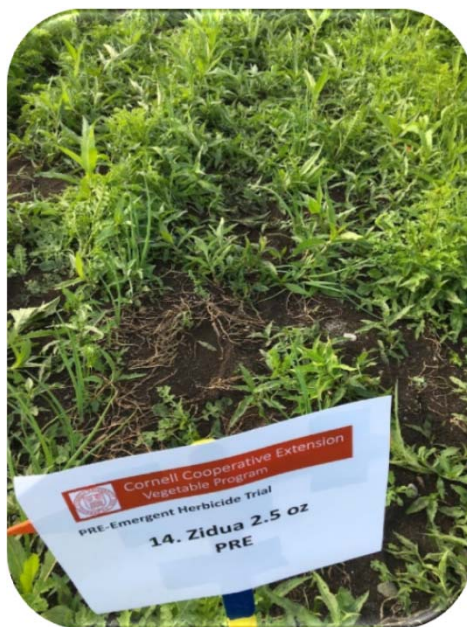


Outlook **21 fl oz**

Zidua 2.5 pt

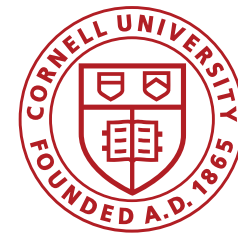
Bicyclopyrone
3.4 fl oz

Reflex 8 fl oz



JUN 22 2017 (37 DAT PRE)

Single Actives



Untreated



Brox 1.5 pt



Zidua 2.5 pt

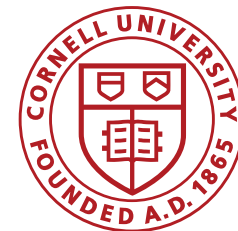


Bicyclopyrone
3.4 fl oz



JUN 27 2017 (45 DAT PRE)

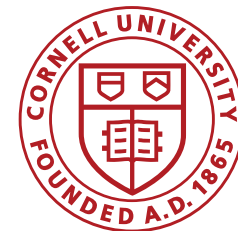
Single Actives - Summary



Outlook split vs. high PRE:

- Mixed results for SW:
 - Wayne I: 99% (High PRE) vs. 17% (split) control
 - Oswego: 58% (High PRE) vs. 75% (split) control
- In past trials, generally better control of broadleaves with Outlook High rate PRE than split
- Compared to Outlook, Prowl EC 4.8 pt better on MYC, and very poor in RW.
- Not too much difference in crop injury between split and High PRE, except significant stunting with High PRE (consistent with previous results)
- Alone, single applications of Prowl, Outlook and Buctril do not look that great
 - Amazing synergy when used together in a program
 - Where and how can rates be reduced?

Single Actives - Summary



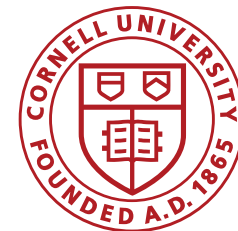
Brox (= Buctril):

- Had the poorest broadleaf weed control
- Was the safest
- Decent activity on RW
 - Similar to previous trial results
- Used 12 fl oz in trials previously
 - Now use 1.5 pt (= safe & better RW control)

Zidua:

- WSSA Group 15 (like Outlook, Dual Magnum)
- a.i. pyroxasulfone
- BASF is investigating a potential onion label
- Very good control of MYC (similar to Prowl 4.8 EC, better than Outlook), poor control of RW, SW
- Caused 20% stand reduction, 1" stunting (=13%)

Single Actives - Summary



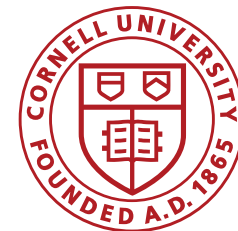
Bicyclopyrone: new active ingredient

- WSSA Group 27 (unlike other onion herbicides)
- Being developed by Syngenta in onions
- Decent activity on RW (similar to Buctril)
- Some activity on MYC, poor control of SW
- Minor stunting, 17% stand reduction

Reflex:

- WSSA Group 14 (like Goal, Chateau)
- a.i. fomesafen
- Both PRE and POST activity
- In IR-4 for weed control in onion
- Mediocre control of SW and MYC
- Minor stunting, 24% stand reduction

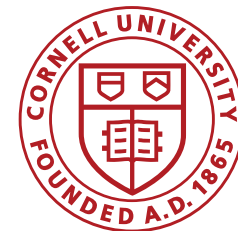
Programs – Yellow Nutsedge



Treatment (Products and Rate)	Timing
Standard with Prowl EC: Prowl EC 2 pt + Outlook 11 fl oz + Brox 2EC 1.5 pt Prowl EC 4.8 pt + Outlook 10 fl oz + Select 2EC 1 pt (barley kill)	PRE 1-leaf 1-leaf
Standard with Chateau: Above Chateau 2.0 oz	2-leaf
Prowl H2O Chateau: Prowl H2O 4 pt + Outlook 11 fl oz + Brox 2EC 1.5 pt Prowl H2O 4 pt + Outlook 10 fl oz + Select 2EC 1 pt (barley kill) Chateau 2.0 oz	PRE 1-leaf 1-leaf 2-leaf

Some YNS already emerged at time of first spray (PRE)

Programs – Yellow Nutsedge Chateau



	Wayne II				
	Jun-23: 30 DAT PRE; 16 DAT flag+; 9 DAT 2-leaf				
	Crop Tolerance			% Weed Control	
	Visual Onion Injury %	Stand (/3 ft)	Plant Height (inch)	PRE YNS	POST YNS
Standard Prowl EC	13 cde	14 bcd	9.2 d-g	65 abc	0 e
Standard Prowl EC Chateau	15 cde	13.8 b-e	8.7 ghi	60 abc	60 abc
Prowl H2O Chateau	8 de	13.4 b-f	8.4 cd	73 ab	70 ab

>95

90-94

80s

70s

60s
50s

<50

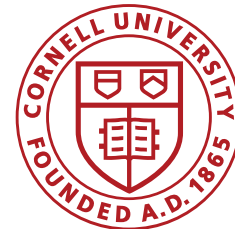


Statistically same as best treatment



Statistically same as worst treatment

Programs – Yellow Nutsedge Chateau



Standard
Prowl EC



Standard
Prowl EC
Chateau

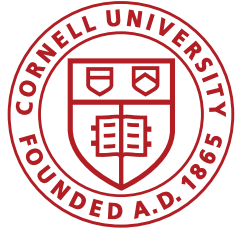


Prowl **H2O**
Chateau



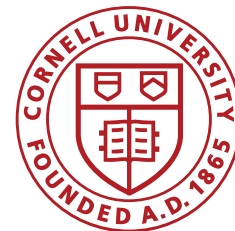
JUN 27 2017 (9 DAT 3-leaf)

Programs – Yellow Nutsedge Chateau - Summary



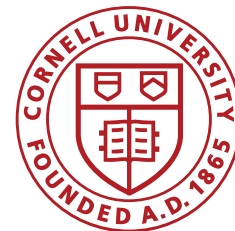
- When Chateau 2 oz is used at the 2-leaf stage, it provided 60-70% POST-emergent control of YNS escapes.
- In previous studies, optimum timing for POST control of YNS with Chateau was when YNS was no larger than 2 inches tall.
 - Typically occurred when onions were at 1-leaf

Programs – Yellow Nutsedge Outlook



Treatment (Products and Rate)	Timing
High Outlook Upfront Outlook 21 fl oz + Brox 2EC 1.5 pt Prowl H2O 4 pt + Select 2EC 1 pt + COC 1% v/v (barley kill) Chateau 2 oz Prowl H2O 4 pt + Chateau 1 oz	PRE 1-leaf 1-leaf 2-leaf 4-leaf
High Outlook late (label) Prowl EC 2 pt + Brox 1.5 pt Prowl EC 4.8 pt + Select 2EC 1 pt (barley kill) Outlook 21 fl oz Chateau 2 oz Prowl H2O 4 pt + Chateau 1 oz Goal 2XL 4 fl oz	PRE 1-leaf 1-leaf 2-leaf 2+-leaf 4-leaf 5-leaf

Programs – Yellow Nutsedge Outlook

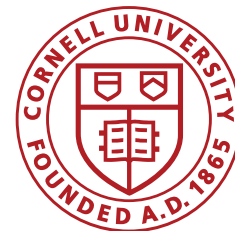


Treatment (Products and Rate)	Timing
High Outlook late (Grower Program) Brox 1.5 pt Prowl EC 4 pt + Outlook 24 fl oz + Goal 2XL 1 fl oz + Select 2EC 1 pt (barley kill) Chateau 2 oz Prowl H2O 4 pt + Buctril 2 fl oz + Goal 2XL 1 fl oz Goal 2XL 4 fl oz	PRE 2-leaf 2-leaf 2+-leaf 4-leaf 5-leaf

Full color indicates PRE-emergent to onion, and barley-kill timings.
Gray indicates applications made after Jun-23 (3-leaf).

Programs – Yellow Nutsedge

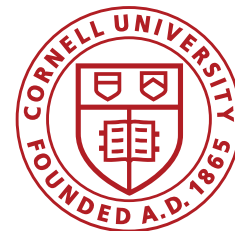
Zidua



Treatment (Products and Rate)	Timing
Zidua High Upfront instead of Outlook Zidua 2.5 oz + Brox 2EC 1.5 pt Prowl EC 4.8 pt + Select 2EC 1 pt (barley kill) Chateau 2 oz Prowl H2O 4 pt + Chateau 1 oz Goal 2XL 4 fl oz	PRE 1-leaf 1-leaf 2-leaf 4-leaf 5-leaf
Zidua Split instead of Outlook Zidua 1.25 oz + Brox 1.5 pt Zidua 1.25 oz + Select 2EC 1 pt + COC 1% v/v (barley kill) Prowl H2O 4 pt + Chateau 2 oz Chateau 1 oz Prowl H2O 4 pt + Goal 2XL 4 fl oz	PRE 1-leaf 1-leaf 2-leaf 4-leaf 5-leaf

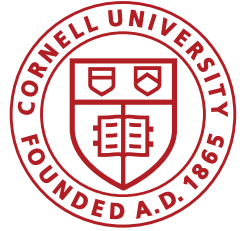
Programs – Yellow Nutsedge

Zidua



Treatment (Products and Rate)	Timing
<p>Zidua High Upfront with Outlook Split</p> <p>Zidua 2.5 oz + Outlook 11 fl oz + Brox 2EC 1.5 pt</p> <p>Prowl H2O 4 pt + Outlook 10 fl oz</p> <p>+ Select 2EC 1 pt + COC 1% v/v (barley kill)</p> <p>Chateau 2 oz</p> <p>Prowl H2O 4 pt + Chateau 1 oz</p> <p>Goal 2XL 4 fl oz</p>	<p>PRE</p> <p>1-leaf</p> <p>1-leaf</p> <p>2-leaf</p> <p>4-leaf</p> <p>5-leaf</p>
<p>Zidua/Outlook Split</p> <p>Zidua 1.25 oz + Outlook 11 fl oz + Brox 1.5 pt</p> <p>Zidua 1.25 oz + Outlook 10 fl oz + Prowl H2O 4 pt</p> <p>+ Select 2EC 1 pt + COC 1% v/v (barley kill)</p> <p>Chateau 2 oz</p> <p>Prowl H2O 4 pt + Chateau 1 oz</p> <p>Goal 2XL 4 fl oz</p>	<p>PRE</p> <p>1-leaf</p> <p>1-leaf</p> <p>2-leaf</p> <p>4-leaf</p> <p>5-leaf</p>

Programs – Yellow Nutsedge Outlook



6 DAT 2-leaf	Jun 23 (3-leaf)				
	Crop Tolerance			% Weed Control	
	Visual Onion Injury %	Stand (/3 ft)	Plant Height (inch)	PRE YNS	POST YNS
Standard Chateau (Outlook Split)	15 cde	13.8 b-e	8.4 ghi	60 abc	60 abc
High Outlook Upfront	11 cde	14.5 bcd	9.7 cd	78 a	65 ab

Just as we see with broadleaf weeds, PRE-control of YNS was ~20% better when Outlook applied PRE high rate compared to split-app.

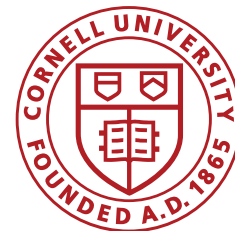


Statistically same as best treatment



Statistically same as worst treatment

Programs – Yellow Nutsedge Outlook



6 DAT 2-leaf	Jun 23 (3-leaf)				
	Crop Tolerance			% Weed Control	
	Visual Onion Injury %	Stand (/3 ft)	Plant Height (inch)	PRE YNS	POST YNS
Standard Chateau (Outlook Split)	15 cde	13.8 b-e	8.4 ghi	60 abc	60 abc
High Outlook Upfront	11 cde	14.5 bcd	9.7 cd	78 a	65 ab
High Outlook Late (label)	6 e	16.6 ab	10.1 c	43 bcd	72 ab
High Outlook Late (Grower)	9 cde	16.0 bc	10.3 bc	40 cd	76 a

- Applying Outlook even at high rates late (2-leaf stage) significantly reduced control of YNS by 17 to 38% compared to applying it PRE-onion emergence.
 - For best control of YNS, Outlook should be applied PRE-onions.
- Late applications of Outlook were safer on the onions with less stand reduction and stunting and visual injury.

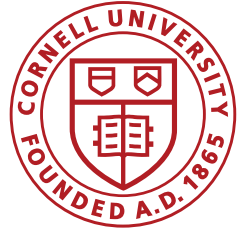


Statistically same as best treatment



Statistically same as worst treatment

Programs – Yellow Nutsedge Outlook



Standard
Prowl EC
Chateau



High Outlook
Upfront



High Outlook
Late (label)

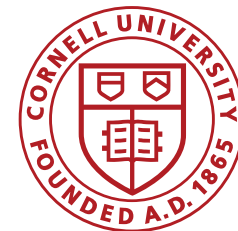


High Outlook
Late (Grower)



JUN 27 2017 (9 DAT 3-leaf)

Programs – Yellow Nutsedge Outlook, Zidua



6 DAT 2-leaf	Jun 23 (3-leaf)				
	Crop Tolerance			% Weed Control	
	Visual Onion Injury %	Stand (/3 ft)	Plant Height (inch)	PRE YNS	POST YNS
Standard Chateau (Outlook Split)	15 cde	13.8 b-e	8.4 ghi	60 abc	60 abc
High Outlook Upfront	11 cde	14.5 bcd	9.7 cd	78 a	65 ab
High Outlook Late (label)	6 e	16.6 ab	10.1 c	43 bcd	72 ab
High Outlook Late (Grower)	9 cde	16.0 bc	10.3 bc	40 cd	76 a
Zidua High Upfront Instead Outlook	13 cde	14 bcd	9.2 d-g	65 abc	15 e
Zidua Split Instead Outlook	11 cde	12.3 def	8.4 e-h	10 d	36 de
Zidua High Upfront/ Outlook Split	40 b	11.3 def	8.2 hi	67 abc	72 ab
Zidua/Outlook Split	20 c	12.3 def	8.8 e-h	70 abc	58 cd

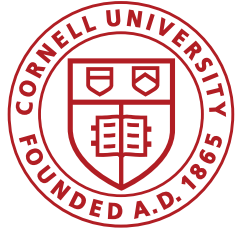


Statistically same as best treatment



Statistically same as worst treatment

Programs – Yellow Nutsedge Outlook, Zidua



Zidua High PRE
No Outlook



Zidua Split
No Outlook



Zidua High PRE
Outlook Split

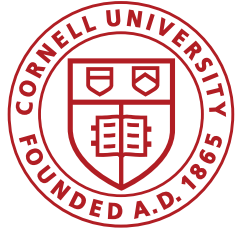


Zidua/Outlook Split



JUN 27 2017 (9 DAT 3-leaf)

Programs – Yellow Nutsedge Outlook, Zidua - Summary



Zidua Alone:

- Zidua at the high rate PRE provided the same control of YNS as Outlook split and High PRE.
- Zidua split failed to control YNS
- **Conclusion:** Zidua is not as good on YNS as Outlook.

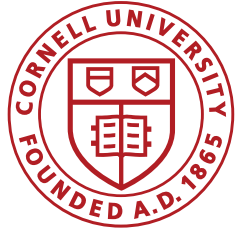
Zidua with Outlook:

- Zidua high PRE + Outlook split was as good as Outlook alone
- Zidua split + Outlook split was as good as Outlook alone
- **Conclusion:** No synergy between Zidua and Outlook for YNS control
- Treatments with Zidua as part of a program caused too much injury

Conclusion:

- Zidua does not have a fit in the early onion PRE-emergent program.
- It may have potential as a late application for PRE control of PW and mustards with its longer residual than Prowl.
 - May be synergy with Prowl at this timing

POST-Emergent Control Ragweed



7 DAT 5-leaf	Jun 27 (6-leaf)		
	Crop Tolerance		% Weed Control RW
	Visual Onion Injury %	Plant Height (inch)	
Goal 2XL 2 fl oz @ 1-leaf Stinger 8 fl oz @ 3.5 leaf Stinger 4 fl oz @ 6-leaf	3 def	20.9 d	45 b
Bic 6.8 fl oz + Chateau 2 oz @ 2-leaf Bic 6.8 fl oz + Chateau 1 oz @ 3.5-leaf	17 a	19 fg	100 a
Goaltender 2 fl oz + Chateau 2 oz @ 2-leaf Goaltender 2 fl oz + Chateau 1 oz @ 3.5-leaf	14 ab	19.7 ef	31 c
Buctril 4 fl oz + Bic 3.4 fl oz @ 2-leaf Buctril 8 fl oz + Bic 6.8 fl oz @ 5-leaf	11 bc	18.4 g	100 a

>95

90-94

80s

70s

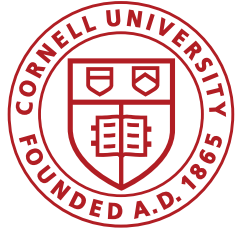
60s
50s

<50

Statistically same as best treatment

Statistically same as worst treatment

POST-Emergent Control Ragweed



Goal 2XL 2 fl oz
Stinger 8 fl oz



Chateau + Bic
2x



Goaltender 2 fl oz
Chateau 2 oz

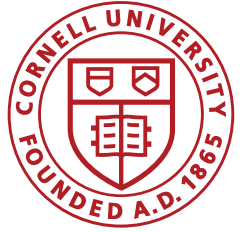


Buctril + Bic



JUN 27 2017 (5 DAT 5-leaf)

POST-Emergent Control Ragweed



Goal 2XL 2 fl oz
Stinger 8 fl oz



Chateau + Bic
2x



Goaltender 2 fl oz
Chateau 2 oz

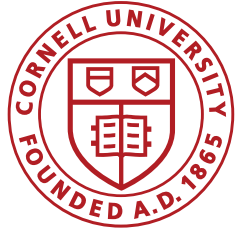


Buctril + Bic



SEP 1 2017

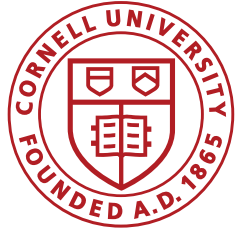
POST-Emergent Control Ragweed - Summary



Goal 2XL 2 fl oz (1-leaf) fb Stinger 8 fl oz (4-leaf):

- Initially, resulted in less control of RW than expected, only 45% control
 - Weeds were not dead, but not actively growing either.
 - At harvest, after a 2nd app of Stinger 4 fl oz (6-leaf) was made, **plots looked pretty clean (RW eventually died)**
 - In 2016, injured RW made a comeback following Stinger, but were injured until the beginning of August, buying a lot of time to get a weeding crew into the field.
- Injury from this treatment was acceptable.

POST-Emergent Control Ragweed - Summary

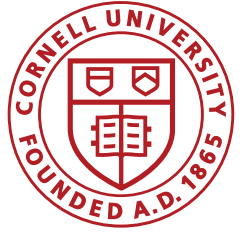


Goaltender 2 fl oz + Chateau 2 oz (2-leaf) fb

Goaltender 2 fl oz + Chateau 1 oz (3.5-leaf):

- Started investigating this tank mix as a substitute for Chateau + Nortron, which had improved broad-spectrum of weed control and improved control of larger weeds than either herbicide alone.
 - Thought crop safety might be okay
- Poor RW control
 - Thought this treatment would have done better.
 - At harvest, injured RW had re-grown
- Injury from this treatment was pushing the limits of what would be acceptable.
 - May be tolerated if weed control was amazing

POST-Emergent Control Ragweed - Summary



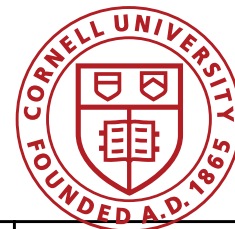
1) Bicyclopyrone 6.8 fl oz + Chateau 2 oz (2-leaf) fb

Bic 6.8 fl oz + Chateau 1 oz (3.5-leaf)

2) Bic 3.4 fl oz + Buctril 4 fl oz (2-leaf):

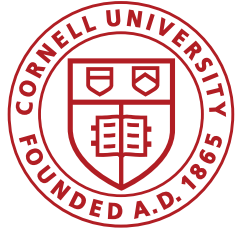
- Both treatments resulted in 100% RW control
- Significant stunting and above-average visual injury
 - Use bic 3.4 instead of 6.8 fl oz at 2-leaf
 - Injury may be tolerated for level of weed control achieved

POST-Emergent Control Smartweed



Oswego	Visual Onion Injury %		% Weed Control SW Jul 12	Yield (lb/plot)
	7 DAT 2nd	Jul 14		
Chateau 2 oz @ 2.5 leaf Chateau 1 oz @ 4-leaf (1 week)	11	1	20	17.4
Chateau 2 oz @ 1-leaf Chateau 1 oz @ 2.5-leaf (1 week)	10	0	60	21.1
Goaltender 2 fl oz + Chateau 2 oz @ 2.5-leaf Goaltender 2 fl oz + Chateau 1 oz @ 4-leaf (1 wk)	17	5.5	75	20.3
Chateau 2 oz + Nortron 16 fl oz @ 2.5 leaf Chateau 1 oz + Nortron 16 fl oz @ 4-leaf (1 wk)	13	3	92	21.5
Bic 3.4 fl oz @ 1-leaf Bic 6.8 fl oz @ 2.5 leaf (1 week)	9	0	100	17.1
Bic 3.4 fl oz + Chateau 2 oz @ 2.5 leaf Bic 3.4 fl oz + Chateau 1 oz @ 5 leaf (2 weeks)	10	5	100	22.0
Bic 3.4 fl oz + Brox 2EC 8 fl oz @ 2.5 leaf Bic 3.4 fl oz + Brox 2EC 4 fl oz @ 5 leaf (2 weeks)	10	3	99	21.0

POST-Emergent Control Smartweed - Chateau



Chateau 2 (2L)
Chateau 1 (4L)



Chateau 2 (1L)
Chateau 1 (2.5 L)



Goaltender 2 fl oz
+ Chateau 2 oz (2L)
Goaltender 2 fl oz
+ Chateau 1 oz (4L)

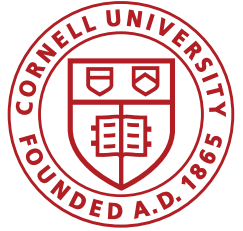


Chateau 2 oz
+ Nortron 16 fl oz (2L)
Chateau 1 oz
+ Nortron 16 fl oz (4L)



Jul 12 2017

POST-Emergent Control Smartweed – Chateau - Summary

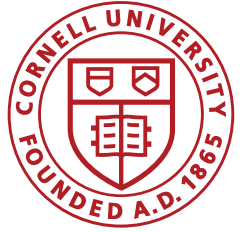


- Applying **Chateau hi-low starting at 1-leaf** resulted in 40% better SW control than starting at 2-leaf when weeds were bigger without any increase in crop injury.
 - Timing first Chateau to small weeds (<2 inch) is critical
- **Chateau hi-low starting at 2-leaf + Goaltender 2 fl oz** increased SW control by 55% compared to Chateau alone.
 - Also increased visual injury from 11 to 17%, but the plants grew out of it and there was no yield drag.

Chateau hi-low starting at 2-leaf + Nortron 16 fl oz increased SW control even better (to 92%) than Chateau + Goaltender.

- Visual injury was similar to Chateau alone (13%)
- Highest level of visual injury observed with Chateau + Nortron
- No yield drag.

POST-Emergent Control Smartweed - Bicyclopyrone



Bic 3.4 fl oz (1L)
Bic 6.8 fl oz (2L)

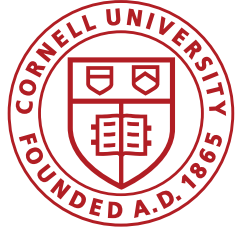
Bic 3.4 fl oz + Chat. 2 (2L) Bic 3.4 fl oz + Brox 8 fl oz (2L)
Bic 3.4 fl oz + Chat. 1 (5 L) Bic 3.4 fl oz + Brox 4 fl oz (5 L)



Jul 12 2017

POST-Emergent Control

Marsh Yellowcress - Bicyclopyrone



Bic 3.4 fl oz + Chat. 2 (2L)

Bic 3.4 fl oz + Chat. 1 (5 L)



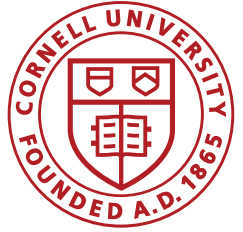
Bic 3.4 fl oz + Brox 8 fl oz (2L)

Bic 3.4 fl oz + Brox 4 fl oz (5 L)



Note: onions in poor shape (smothered by weeds) prior to herbicide app.

POST-Emergent Control Smartweed – Bicyclopyrone - Summary

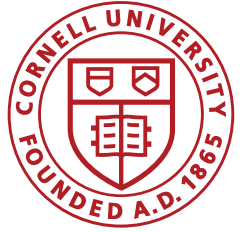


Bicyclopyrone treatments:

- All resulted in 100% SW control with acceptable levels of visual injury.
 - Yield drag resulted from bic 3.4 fl oz at 1-leaf fb 6.8 fl oz 1 week later = too much!
- Now have results showing phenomenal control of RW, SW and MYC with bicyclopyrone, especially when tank mixed with Chateau and Buctril
 - Would like to study other weed species, e.g. pigweed

POST-Emergent Control

Chateau 2.0 oz + Goaltender 2 fl oz



- Killed 6-8 inch pigweed; LQ fine
- This tank mix is touchy – need more experience

Day of treatment: Guard bed had 1-foot ragweed needing to be controlled.



After:

Brox 2EC 12 fl oz

+ Bic 6.8 fl oz



- Bicyclopyrone is going to revolutionize weed control in onions, especially for ragweed.
- It will only be labeled in muck – too hot on mineral soil.
- Syngenta estimates its availability no sooner than 2020.

Onion Team 2017

