

**Mode of Action:**

- *Photosynthesis II inhibitor*
- *Targets unique pathway within the PSII group of herbicides (Groups 5, 6 & 7)*
- *WSSA Classification: Group 6*
- *No known cross-resistance to other PSII's*

ACTIVE INGREDIENT:

Pyridate (Carbonothioic acid, O-(6-chloro-3-phenyl-4-pyridiziny) S-octyl ester):..... 56.1%

OTHER INGREDIENTS: 43.9%

TOTAL: 100.00%

* Contains 5 lbs of pyridate per gallon of product

QUICK FACTS:

- *Post-emergent, contact application only*
- *Rainfast within 1 hour*
- *No residual or rotation restrictions*
- *Controls key broadleaf weeds such as but not limited to: Common Waterhemp, Palmer amaranth, Kochia, Common Lambsquarters*
- *Tank-mixed: 8 oz/ac with other products active on the key weeds*

Observing an increase in herbicide resistance across the USA, Belchim Crop Protection revitalized a valuable chemistry, **TOUGH® 5EC**, (pyridate) in effort to preserve the long-term use of the valuable class of HPPD herbicides in corn.

Beginning in 2017, Belchim Crop Protection USA coordinated with key universities across the corn belt, implementing trials to evaluate the effectiveness of **TOUGH® 5EC** in numerous research trials (>150 trials).

Results show significant increase in weed control when **TOUGH® 5EC** is included in the tank mix. Increases of 5% to as much as 29% was observed; especially when herbicide resistance to other classes of chemistry were present.

Preliminary research showed an evident synergy* with Callisto®, and the HPPD class of herbicides. In 2020 and 2021, trials expanded to include other HPPD herbicides such as ShieldEx® and Impact® in addition to dicamba based products such as Status.®

Enhancement of atrazine is also evident and the ability to increase the use of PSII class of chemistry while maintaining crop safety.

Common Ragweed (4" tall)		
University of Missouri 2020	% Percent Control	
Treatment	7 DAA	14 DAA
Roundup PowerMax 32 oz + ShieldEx 1.35 oz	73	64
Roundup PowerMax 32 oz + ShieldEx 1.35 oz + TOUGH 5EC 8 oz	95	95

Pitted Morningglory		
University Tennessee 2020	% Percent Control	
Treatment	7 DAA	14 DAA
Roundup PowerMax 32 oz + ShieldEx 1.35 oz	79	78
Roundup PowerMax 32 oz + ShieldEx 1.35 oz + TOUGH 5EC 8 oz	90	88

Glyphosate Resistant Palmer amaranth (3-12" tall)		
Purdue University 2020	% Percent Control	
Treatment	7 DAA	14 DAA
Roundup PowerMax 32 oz + ShieldEx 1.35 oz	85	87
Roundup PowerMax 32 oz + ShieldEx 1.35 oz + TOUGH 5EC 8 oz	97	97

Glyphosate Resistant Palmer amaranth (3-12" tall)				
Purdue University 2020	% Percent Control			
Treatment	7 DAA	14 DAA	28 DAA	42 DAA
Roundup PowerMax 32 oz + Callisto 3 oz	71	68	49	45
Roundup PowerMax 32 oz + + Callisto 3 oz + TOUGH 5EC 8 oz	98	98	88	81

Glyphosate Resistant Waterhemp (0-3" tall)				
Purdue University 2020	% Percent Control			
Treatment	9 DAA	14 DAA	27 DAA	41 DAA
Roundup PowerMax 32 oz + Callisto 3 oz	50	87	95	95
Roundup PowerMax 32 oz + + Callisto 3 oz + TOUGH 5EC 8 oz	90	100	100	100
Roundup PowerMax 32 oz + + Callisto 3 oz + TOUGH 5EC 8 oz + Aatrex 2.4 pt	100	100	100	100



RESEARCH UPDATE CORN TRIALS 2021

Glyphosate Resistant Palmer Amaranth (4-8" tall)		
University of Arkansas 2021	% Percent Control	
Treatment	14 DAA	28 DAA
Roundup PowerMax 32 oz	65	58
Roundup PowerMax 32 oz + Callisto 3 oz	76	91
Roundup PowerMax 32 oz + Calisto 3 oz + TOUGH 5EC 8 oz	96	93
Roundup PowerMax 32 oz + Calisto 3 oz + TOUGH 5EC 8 oz + Aatrex 1.0 pt	95	93

Glyphosate Resistant Waterhemp (4-6" tall)				
Iowa State University 2021	% Percent Control			
Treatment	7 DAA	14 DAA	28 DAA	42 DAA
Roundup PowerMax 32 oz	40	40	33	33
Roundup PowerMax 32 oz + Callisto 3 oz	77	68	62	62
Roundup PowerMax 32 oz + Callisto 3 oz + TOUGH 5EC 8 oz	90	88	85	78
Roundup PowerMax 32 oz + Callisto 3 oz + TOUGH 5EC 8 oz + Aatrex 2.4 pt	92	95	93	92

Palmer amaranth (4-5" tall)				
Kansas State 2021	% Percent Control			
Treatment	7 DAA	14 DAA	28 DAA	42 DAA
Roundup PowerMax 32 oz	78	78	71	71
Roundup PowerMax 32 oz + Impact 0.75 oz	85	86	87	89
Roundup PowerMax 32 oz + Impact 0.75 oz + TOUGH 5EC 8 oz	91	94	94	94

Palmer amaranth (4-5" tall)				
Kansas State 2021	% Percent Control			
Treatment	7 DAA	14 DAA	28 DAA	42 DAA
Roundup PowerMax 32 oz	73	75	63	54
Roundup PowerMax 32 oz + Impact 1.0 oz	75	67	55	58
Roundup PowerMax 32 oz + Impact 1.0 oz + TOUGH 5EC 8 oz	87	85	76	72

Glyphosate Resistant Waterhemp (3-7" tall)				
Iowa State University 2021	% Percent Control			
Treatment	7 DAA	14 DAA	28 DAA	42 DAA
Roundup PowerMax 32 oz + Impact 1.0 oz	78	75	83	83
Roundup PowerMax 32 oz + Impact 1.0 oz + TOUGH 5EC 8 oz	85	90	90	90

Glyphosate and PPO Resistant Waterhemp (1.5-9" tall)				
University of Illinois 2021	% Percent Control			
Treatment	7 DAA	14 DAA	28 DAA	42 DAA
Roundup PowerMax 32 oz + Impact 0.75 oz	62	68	73	73
Roundup PowerMax 32 oz + Impact 0.75 oz + TOUGH 5EC 8 oz	80	80	82	82
Roundup PowerMax 32 oz + Impact 1.0 oz	68	70	70	75
Roundup PowerMax 32 oz + Impact 1.0 oz + TOUGH 5EC 8 oz	85	86	90	92

Kochia (3-4" tall)				
Kansas State 2021	% Percent Control			
Treatment	7 DAA	14 DAA	28 DAA	42 DAA
Roundup PowerMax 32 oz + Impact 0.75 oz	72	67	45	20
Roundup PowerMax 32 oz + Impact 0.75 oz + TOUGH 5EC 8 oz	87	87	84	85
Roundup PowerMax 32 oz + Impact 1.0 oz	73	68	45	30
Roundup PowerMax 32 oz + Impact 1.0 oz + TOUGH 5EC 8 oz	85	82	75	71

Glyphosate & Dicamba Resistant Kochia (3-4" tall)		
Kansas State 2021	% Percent Control	
Treatment	7 DAA	21 DAA
Status 5 oz	48	56
Status 5 oz + TOUGH 5EC 8 oz	75	92
Roundup PowerMax 32 oz	16	50
Roundup PowerMax 32 oz + TOUGH 5EC 8 oz	48	72

Note this was a greenhouse study

TOUGH 5EC is a registered trademark of Belchim Crop Protection. Roundup is a registered trademark of Bayer Crop Science, Callisto, and Aatrex are registered trademarks of Syngenta US. Impact is a registered trademark of Amvac. ShieldEx is a registered trademark of Summit Agro.

This is a synopsis from research conducted in 2020 and 2021. For complete trial information, please contact your local Belchim USA Representative.



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