

IT'S TIME TO GET
TOUGH

TOUGH 5EC INCREASES **CONTROL**



**COMMON
WATERHEMP**



KOCHIA



**PALMER
AMARANTH**



**COMMON
LAMBSQUARTERS**



RAGWEED

HOW DO YOU HANDLE HERBICIDE RESISTANCE?

Successfully addressing weed pressure is key to achieving optimal yields.

But weed management and control has become increasingly difficult in recent years with the rise of herbicide resistance in broadleaf weeds such as Waterhemp and Palmer Amaranth and Kochia. At the same time, tighter regulation has left growers with fewer available chemistries to eliminate resistant weeds.

*Enter **TOUGH® 5EC**, a pyridate-based solution from Belchim Crop Protection USA.*



A Great Tool for "TOUGH" to Control Weeds

- A **SELECTIVE HERBICIDE** For Postemergence Control Or Suppression Of Annual Broadleaf Weeds
- **GROUP 6 – PROVEN AND EFFECTIVE** Mode of Action
- **WIDE WINDOW** Of Application (Emergence To 8 Leaf Stage)
- Contact herbicide -> **NO ROTATIONAL** Issues
- **PROPRIETARY** Active Ingredient: Pyridate
- Formulated as a 5 lb ai/gal **EMULSIFIED CONCENTRATE**
- **RAINFAST** Within 1 Hour
- **NO RESIDUAL** Restrictions

TOUGH® 5EC PHOTOSYNTHESIS II INHIBITOR

Pyridate works by blocking a weed's photosystem II process, triggering the release of toxic forms of oxygen and causing rapid cell wall degradation. Pyridate is a highly effective mode of action in corn and shows increased levels of weed control in tank-mix combinations.

- Pyridate is applied after emergence of the weed.
- Pyridate is quickly absorbed by the leaves (rain-fast within 60 minutes).
- Pyridate blocks photosystem II of the weed by irreversibly binding to the D1 protein and inhibiting the transport of electrons. High energy electrons then interact with oxygen, producing toxic forms of oxygen.
- The toxic forms of oxygen interact and degrade the cell's membranes resulting in necrosis (browning) and ultimate death to the weed.

TOUGH® 5EC SYNERGIZES HPPD's

For over a decade, weed resistance (Palmer Amaranth and Common Waterhemp) to HPPD inhibitors (Group 27) has been on the rise. TOUGH® 5EC is an ideal tank mix partner, as a resistance management tool, with HPPD inhibitors. TOUGH® 5EC herbicide puts a charge in your post emergence weed control program with rapid and complete control of your broadleaf weeds including resistant Common Waterhemp, Palmer, Pigweed and Giant Ragweed. Field research has shown adding TOUGH® 5EC to the mix, improves performance; promoting faster weed death and overcoming HPPD resistance.

Pyridate Increases Free Radicals:

- Free radicals are single oxygen molecules that disrupt cell membranes causing cell collapse

HPPD's:

- Reduce the plants ability to detoxify these free radicals so its a one, two punch.

Image below depicts weed degradation symptoms 7 days after an application of TOUGH® 5EC and a HPPD herbicide.



A trial was conducted at Purdue University in 2020.

Glyphosate resistant Palmer amaranth was treated with 3 oz of Callisto® (left) and Callisto + 8 oz of TOUGH 5EC (right).

Photos were taken 7 days after treatment.

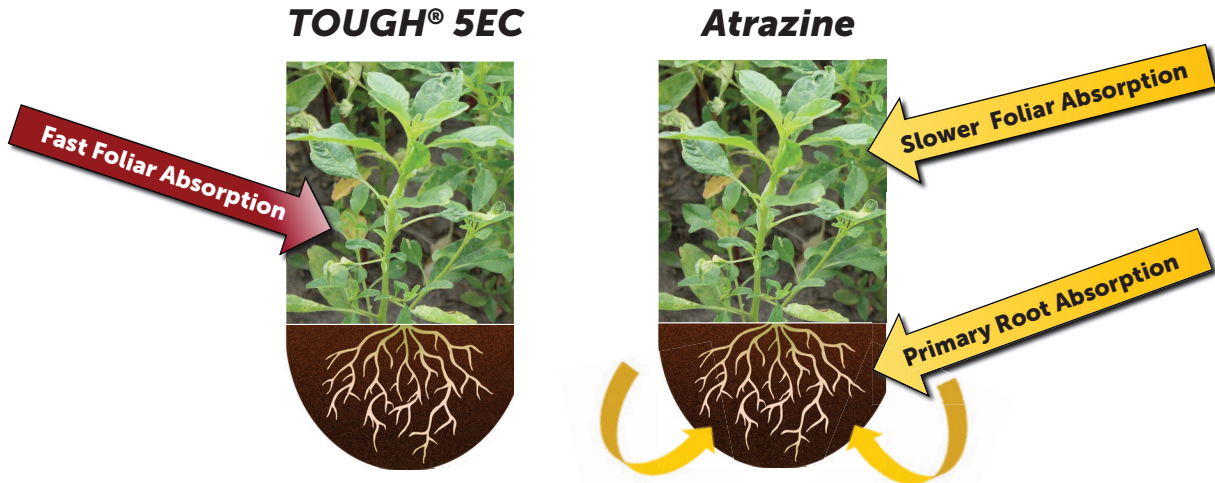
TOUGH increases the speed of kill!



Dual II Magnum® PRE; Roundup PowerMAX 32 oz to all treatments.
Bare ground trial with no corn planted so new emergence
3-12" weed size, 3/ft2

TOUGH® 5EC ENHANCES ATRAZINE

TOUGH® 5EC is a great product to combine with PSII's that interact with the weed differently, such as Atrazine. Pyridate has fast foliar absorption to get to the target site but also degrades rapidly in the soil to prevent carry over concerns. Atrazine has slow leaf absorption and primarily works through root absorption which requires moisture. Atrazine has residual effects for weed control but can result in carry over; maximize the PSII class with this combination.



Dual II Magnum – PRE
Roundup® + Atrazine – LPOST
10 Days After Application

Dual II Magnum – PRE
Roundup + Atrazine + TOUGH 5EC 8oz – LPOST
10 Days After Application



Glyphosate Resistant Common Waterhemp



15-30% Extra Control Can Be Significant!

WHY IS "SHARPENING" CONTROL 5-10% IMPORTANT??

Resistant weeds such as Palmer Amaranth and Common Waterhemp can produce 100,000 to 400,000 seeds when competing with a crop. These seeds are small (1-2mm) and are easily dispersed by wind, animals, livestock feed and equipment.

Say for example, a post emergence product provides 95% control; that would still allow 5% (50 seeds per acre) to escape. Based on this, the potential for escape is $50 \times 400,000 = 20$ million seeds per acre! That's 460 per square foot!

While tillage can bury a lot of seeds deeper than they can germinate the following year, research revealed viability, even when buried 6" deep: 1 year ~ 20% viable, 2 years ~ 10% viable, and 3 years ~ 5% viable.

Just 8 waterhemp per 11 square feet can reduce corn yield by 74% (Steckel 2007)

Add TOUGH® 5EC to the post emergence tank mix and reduce the seed bank!



TOUGH IN ACTION

TOUGH® 5EC is an ideal tank mix partner for combating herbicide-resistant weeds: Field and university trial data consistently shows that adding TOUGH 5EC to the postemergence tank mix increases weed control up to 30%—particularly when resistance to other herbicide classes are present in the weed population.

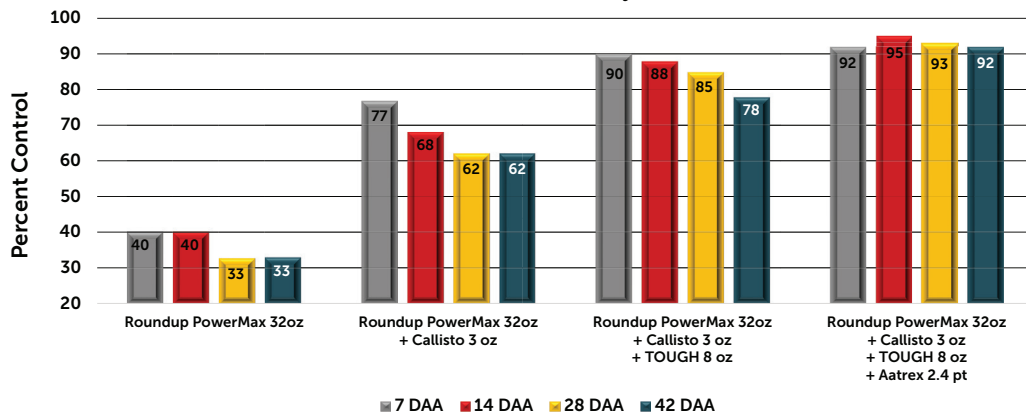
Contact your local retailer or Belchim representative, or scan below for additional trial results or more information about how you can Get TOUGH on Weeds!



Callisto and Dual Magnum are registered trademarks of Syngenta, Roundup is a registered trademark of Bayer.

TOUGH on Glyphosate Resistant Waterhemp

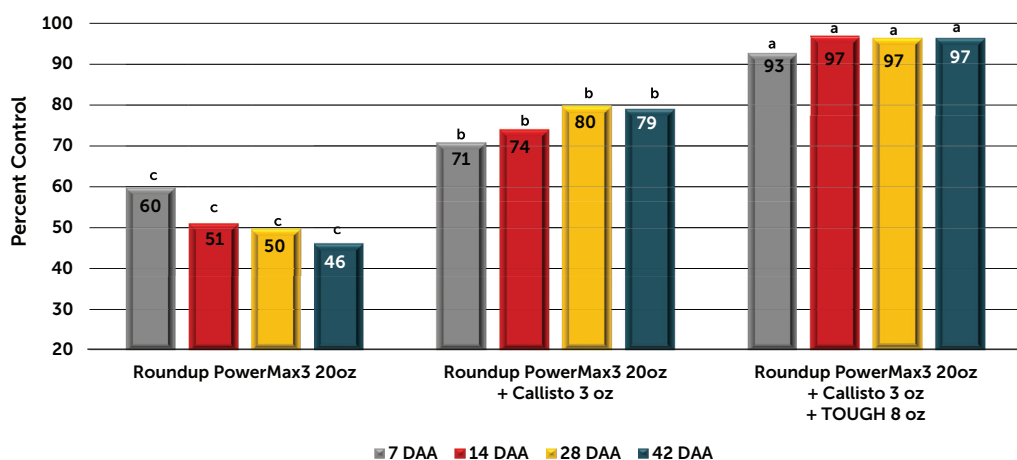
Iowa State University 2021



Waterhemp 4-6" tall

TOUGH on Glyphosate Resistant Palmer Amaranth

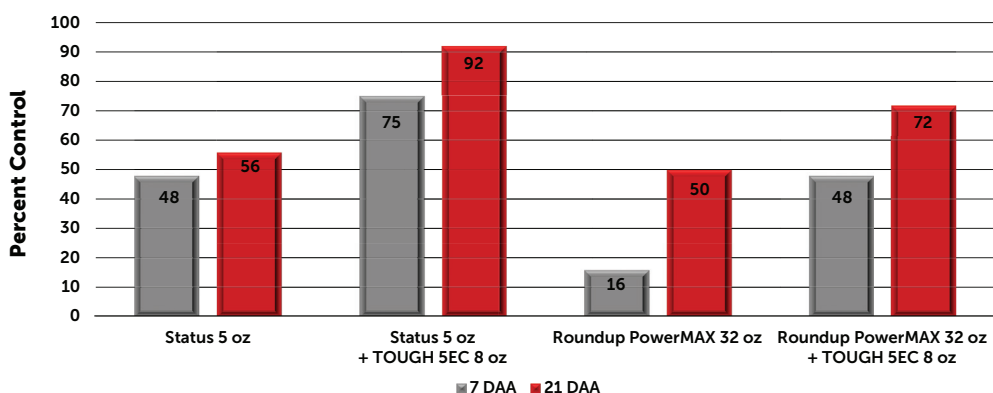
Purdue University I 2022



Palmer amaranth 1-11" tall

TOUGH on Kochia

Kansas State University - Hays - 2021



Kochia 3-4" tall
Note this was a greenhouse study