

FINAL REPORT
New York State Onion Research and Development Program
(Marketing Order)
2013-2014

Problem Weed Management in Onions: Report 1: Simulated Fall Chemical Burn Down of Perennial Sow Thistle

Funding Period and Amount Allocated:
April 1, 2013 to March 31, 2014 - \$4,000

PRINCIPAL INVESTIGATORS:

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GROWER COOPERATOR:

Matt Mortellaro, Mortellaro & Sons, Elba

OBJECTIVE:

To evaluate fall chemical burn down strategies for managing Perennial sow thistle following onion harvest.

PROCEDURES:

Rather than waiting until after onion harvest, this trial was conducted during the growing season within an onion field. Since movement from above-ground parts to below-ground parts increases in the fall as perennial weeds prepare for winter, it was expected that efficacy would increase when the treatments were actually applied in the fall. The purpose of this “simulated” trial was to be able to provide onion growers with recommendations for fall-burn down strategies for Fall of 2013.

Trial Design: The trial was set up in a field of direct seeded onions (cv. Patterson) that were planted on April 25, 2013. Treatments included **2,4-D Amine** (EPA No. 34704-120; Loveland; a.i. dimethylamine salt of 2,4-Dichlorophenoxyacetic acid 46.5%), **Roundup PowerMax** (EPA No. 524-549; Monsanto; a.i. glyphosate 48.7%), **2,4-D Amine + Roundup PowerMax**, **Roundup PowerMax + Stinger** (EPA No. 62719-73; Dow AgroSciences, a.i. clopyralid 40.9%) and **2,4-D Amine + Roundup PowerMax + Stinger**, which were applied only once when perennial sow thistle was at the rosette and bud stages (Table 1). Two untreated controls were included, results of which were averaged together. The trial was arranged as a randomized complete block design (RCBD) with a total of 12 treatments and 3 replications. Each treatment-replicate was 5 feet wide x 10 feet long. Treatments were applied using a CO₂ backpack sprayer with 40 gpa, 2.6 mph and Teejet 8005XR nozzles on Jun-20 (rosette stage) and Jul-17 (bud stage). Table 2 details specific spray conditions.

Evaluations: Four weeks after the rosette treatments were applied on Jul-15, overall above-ground weed control was visually rated from fair to poor (Excellent = at least 95% control; Very Good = 87-94%; Good = 75-85% control; Fair = 65-74% control; Poor = less than 65%), and notes made on the stages of Perennial sow thistle that were killed and escaped. On Jul-30 (5.5 weeks post rosette spray & 2 weeks post bud spray), % ground cover was estimated by counting how many alive weeds occurred every foot along two diagonal

transects across each plot. On Aug-21, 5 weeks after the bud-stage applications, % ground cover was measured using the transect method, and % weed injury visually estimated. Comments on above and below-ground weed injury were also made.

RESULTS (Table 3):

- The only treatment that provided 100% control of perennial sow thistle was achieved **with Roundup 2 pt with AMS + 2,4-D Amine 3 pt + Stinger 8 fl oz** when applied to weeds in the **rosette stage**. This treatment had the fastest kill time, especially at the bud-stage timing.
- **Best control** was achieved when applications were made at the **rosette stage** for all treatments except Roundup with AMS alone, compared to when applications were made at the bud stage. This increases growers' chances of achieving effective control with fall chemical burn down strategies, because then less time will be required in the fall after onion harvest for the weeds to re-grow to an acceptable stage for the herbicides to be effective.
- **Roundup 2 pt + 2,4-D Amine 3 pt** also provided **excellent control (99%) during the rosette stage timing**. Compared to Roundup with AMS + 2,4-D Amine + Stinger, Roundup with AMS + 2,4-D took slightly longer to kill the weeds, and had a few escapes in the bolt stage, although these plants were severely injured.
- Roundup with AMS alone provided the least control (76% at rosette and 73% at bud). At this relatively low rate, weeds in the late-rosette stage and larger tended to escape treatment. Although they were injured and stunted, re-growth and recovery to both above- and below-ground parts was apparent 5 weeks post-treatment. In retrospect, the 2 pt rate may be low, as the PowerMax label suggests 3 to 4 pt for perennial sow thistle.
- Roundup with AMS + Stinger (99% control at rosette 5.5 weeks post-app) improved control over Roundup with AMS alone. Although control was comparable to Roundup with AMS + 2,4-D above-ground, after 5.5 weeks, new shoots were beginning to grow in some of the escapes below ground.
- When applied at the rosette stage, 2,4-D Amine alone performed better than Roundup with AMS alone with 86% control 5 weeks post treatment. Weeds in the early-bolt stage and larger escaped death, but were severely injured. Weeds that were dead above-ground were also dead below ground.

RECOMMENDATIONS:

Based on our experience and the literature, it takes about 3-6 weeks for a perennial sow thistle rhizome with buds to produce a plant at the mid-rosette stage, depending on the size and depth of the rhizome. Shorter pieces of rhizome and rhizomes buried deeper in the soil grow at a slower rate. Perennial Sow thistle will tolerate a light frost or two, but growth will be slowed considerably. In the Elba muck land, the first light frost (30 to 32 °F) occurred between Sep-17 and Oct-23 between 2008 and 2013. In our simulated fall chemical burn down trial in the summer, it took our best treatment 3-4 weeks to achieve 100% kill. When used in the fall, we expect the burn down treatments to work faster and more effectively, because of the shorter days and colder weather. A light frost is expected to trigger translocation from the leaves into the below-ground parts, thus, moving the herbicide along with it. Even so, there is not a lot of time after onion harvest to allow for the weeds to re-grow to the mid-rosette stage, apply the herbicide and achieve kill (including below-ground parts) before a hard frost. In the Elba muck land, a hard frost (25 °F or lower) occurred between Oct-12 and Nov-2 from 2008 to 2013. We estimate that **about 7 weeks are needed after onions are harvested to achieve an**

effective fall chemical burn down, which means that **onions need to be out of the field by mid- to late-August**, and the earlier the better.

- Strategically plant early maturing onion varieties or early transplants in fields with heavy perennial sow thistle pressure in order to achieve successful fall chemical burn down. Allow perennial sow thistle to re-grow after onion harvest.
- **Apply Roundup 4 pts with AMS + 2,4-D 3 pts when the majority of perennial sow thistle have reached the mid-rosette stage** (4-5" in diameter with 5-7 true leaves with half of them expanded). Error on the side of the weeds being smaller (e.g. early rosette), rather than bigger (e.g. early bolt stage).
- To increase rate of kill, make application within 1-2 days of a light frost (30 to 32 °F).
- To increase rate of kill, Stinger 8 fl oz may be added to this tank mix, **only if the field is not going into onions**. Stinger has a rotation restriction of 10.5 months for onions. It is labeled on field and sweet corn, spinach, cabbage, fallow crop land, etc., and may be used in these crops the following year to help manage perennial sow thistle.
- If by chance, re-growth occurs after the first application, make a second application of Roundup 4 pts with AMS + 2,4-D 3 pts (+ Stinger 8 fl oz if field is not going into onions).

FUTURE RESEARCH PLANS:

To conduct a chemical burn down trial in the fall following harvest of onions. Note: In 2013, we were not able to find a field that had sufficient re-growth of perennial sow thistle to set up a trial. In 2014, we have a grower cooperator who is planning to plant early onions in his fields with perennial sow thistle, so we should have a trial site for fall of 2014.

- We will increase the rate of Roundup from 2 pts to 4 pts
- We will compare the efficacy of using a high (4 pt) and a low (2 pt) rate of 2,4-D by itself, in combination with Roundup, and in combination with Roundup and high (8 fl oz) and low (4 fl oz) rates of Stinger.
- We will trial other growth regulator herbicides including Clarity (a.i. dicamba), Garlon (a.i. triclopyr) and Crossbow (a.i. triclopyr + 2,4-D ester) for their efficacy against perennial sow thistle in the rosette stage.

We will conduct a crop tolerance plant-back study. In fall of 2013, several herbicides that we are trialing for their effectiveness as chemical burn down products were applied to bare-ground, which will be direct seeded to onions in spring 2014. We will evaluate the effect of these treatments for crop tolerance in 2014 including stand, plant height and vigor, and yield and grade.

Table 1. Fall chemical burn down of Perennial sow thistle, Simulation Trial, Mortellaro, Elba, NY, 2013: Treatments.

Treatment		Stage of weed at time of app and spray date
No.	Product and rate (per acre)	
1	Untreated check	
2	2,4,-D Amine 3 pt	Weeds at bud stage (B)
3	2,4,-D Amine 3 pt	Weeds at rosette stage (A)
4	2,4,-D Amine 3 pt + Roundup PowerMax 2 pt + Request (AMS) 0.25% v/v	Weeds at bud stage (B)
5	2,4,-D Amine 3 pt + Roundup PowerMax 2 pt + Request (AMS) 0.25% v/v	Weeds at rosette stage (A)
6	2,4,-D Amine 3 pt + Roundup PowerMax 2 pt + Request (AMS) 0.25% v/v + Stinger 8 fl oz	Weeds at bud stage (B)
7	2,4,-D Amine 3 pt + Roundup PowerMax 2 pt + Request (AMS) 0.25% v/v + Stinger 8 fl oz	Weeds at rosette stage (A)
8	Roundup PowerMax 2 pt + Request (AMS) 0.25% v/v	Weeds at rosette stage (A)
9	Roundup PowerMax 2 pt + Request (AMS) 0.25% v/v	Weeds at bud stage (B)
10	Roundup PowerMax 2 pt + Request (AMS) 0.25% v/v + Stinger 8 fl oz	Weeds at rosette stage (A)
11	Roundup PowerMax 2 pt + Request (AMS) 0.25% v/v + Stinger 8 fl oz	Weeds at bud stage (B)
15	Untreated check	

Spray Dates: **A** – June 20; **B** - July 17

AMS: ammonium sulfate, used with Roundup to increase performance against perennial weeds.

Table 2. Fall chemical burn down of Perennial sow thistle, Simulation Trial, Mortellaro, Elba, NY, 2013: Spray conditions.

Spray	A	B
Date	June 20, 2013	July 17, 2013
Time	5:15 – 5:34 pm	2:25 – 2:35 pm
Onion stage	4.5 leaf	8 leaf, 1 inch bulbs
Weed stage	Rosette to early bolt	Bud stage
General Conditions	Sunny, breezy	Sunny, breezy
Foliage	Dry	Dry
Soil	Dry	Dry
Wind speed Average	5.3 mph	4.7 mph
Wind speed Maximum	7.7 mph	8.1 mph
Temperature	76 °F	100 °F
Relative Humidity	66%	53%
pressure	30 psi	23 psi

All sprays made with a CO₂ backpack sprayer with **40 gpa, 2.6 mph** and **Teejet 8005XR nozzles**.

Table 3. Fall chemical burn down of Perennial sow thistle, Simulation Trial, Mortellaro, Elba, NY, 2013: Results.

Treatment Rates per Acre	Applied at Rosette Stage (Jun-20)				Applied at Bud Stage (Jul-17)					
	4 weeks post app (Jul-15)		5.5 weeks post app (Jul-30)		2 weeks post app (Jul-30)	5 weeks post app (Aug-21)				
	Weed Control		Weed Control		% weed control ²	% weed control ²	% weed kill	Stage ⁵ of weed escapes	Comments	
	Overall Rating ¹	Comments ⁵	% weed control ²	Comments					Above-ground	Below-ground
Roundup ³ 2 pt + AMS 0.25% v/v	G	Killed NE to ER, some MR. Injured larger weeds	76.3% (G)	-minimal death, lots of injury & stunting. -Roots & shoots showed recovery	66.1% (F)	73.2% (F)	48.3%	MB to flower	-inconsistent weed kill -moderate injury -killed buds & flowers -new yet abnormal (sage-like) top growth	-new branches growing on previously injured roots
2,4-D Amine 3 pt	F-G Inconsistent	Excellent kill of young stages	86.4% (G)	-Killed newly emerged through late rosette -EB and larger escaped but severely injured (with lots of adventitious roots) -dead above = dead below ⁶	45.8% (P)	64.3% (P)	52.5%	MB to flower	-moderate injury -new re-growth on MR	-dead above = dead below ⁶
Roundup 2 pt + AMS ⁴ 0.25% v/v + 2,4-D Amine 3 pt	E	Killed NE to LR, some bolts escaped	99% (E)	-High injury level on escapes -dead above = dead below ⁶ -some translocation to parent rhizomes	45.8% (P)	88.1% (VG)	90%	Ebud - Lbud	-severe injury -some Lbud are killed	-dead above = dead below ⁶
Roundup 2 pt + AMS 0.25% v/v + Stinger 8 fl oz	G-VG	Killed NE to LR, some EB. bolts escaped Some new emergence	99% (E)	-most bigger weeds eventually died -dead above = dead below ⁶ -on surviving plant, new shoots (although twisted) are growing from stem	45.8% (P)	79.2% (G)	63.3%	Ebud to Lbud	-moderate injury -killed flowers	-new growth of adventitious roots -new shoots off of rhizome
Roundup 2 pt + AMS 0.25% v/v + 2,4-D Amine 3 pt + Stinger 8 fl oz	E	Killed NE to LR, some EB, best control at this time	100% (E)	-Only treatment with 100% control -dead above = dead below ⁶ -fastest kill	76.3% (G)	91.1% (VG)	90%	Ebud - Lbud	-severe injury -buds killed	-dead above = dead below ⁶

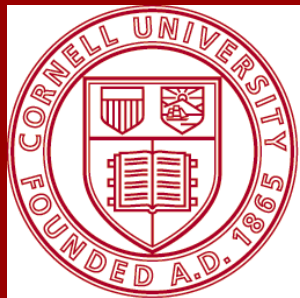
¹Overall Weed Control Rating: E = Excellent (95-100% control); VG = Very Good (87-94% control); G = Good (75-86%); F = Fair (65-74%); P = Poor (less than 65% control).

²% weed control based on ground cover as determined by number of live weeds every foot per 2 diagonal transects per plot.

³Roundup PowerMax. ⁴AMS ammonium sulfate, used with Roundup to increase performance against perennial weeds.

⁵Weed stages: NE – New Emergence; ER – Early rosette; MR – mid-rosette; LR – Late rosette; EB – Early bolt; MB – Mid-bolt; LB – Late bolt; Ebud – Early bud stage; Lbud – Late bud stage.

⁶Dead above = dead below: roots and rhizomes were dead in plants where the top growth was dead.

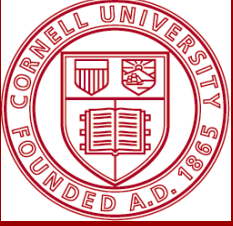


Cornell Cooperative Extension Vegetable Program

ORDP Report 1: Simulated Fall Chemical Burn Down of Perennial Sow Thistle

Christy Hoepting and Elizabeth Buck
Cornell Cooperative Extension Vegetable Program

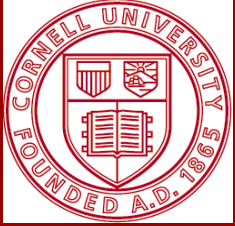
Empire Produce Expo, Syracuse, NY: January 21, 2014



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 - ORDP
- **Grower Cooperators:**
 - Matt Mortellaro, Elba, NY
- **Elizabeth Buck**, CVP Program Assistant

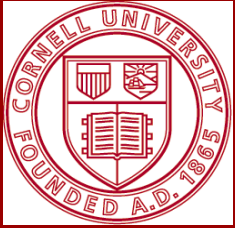




Perennial Sow Thistle

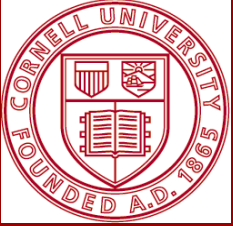
Sonchus arvensis (SONAR)





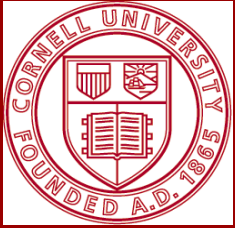
Perennial Sow Thistle





Perennial Sow Thistle





Chemical Fall Burn Down: Perennial Sow Thistle

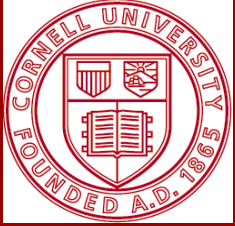
Treatment	Rate per acre
Untreated weedy check	
Roundup PowerMax + Request (AMS)	2 pt 0.25% v/v
2,4-D Amine	3 pt
2,4-D Amine + Roundup PowerMax + Request (AMS)	3 pt 2 pt 0.25% v/v
Roundup PowerMax + Request (AMS) + Stinger	2 pt 0.25% v/v 8 fl oz
2,4-D Amine + Roundup PowerMax + Request (AMS) + Stinger	3 pt 2 pt 0.25% v/v 8 fl oz

Each treatment applied
when weeds at:

rosette	bud
Jun-20	Jul-17

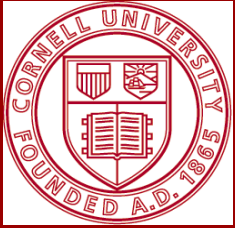


AMS: ammonium sulfate



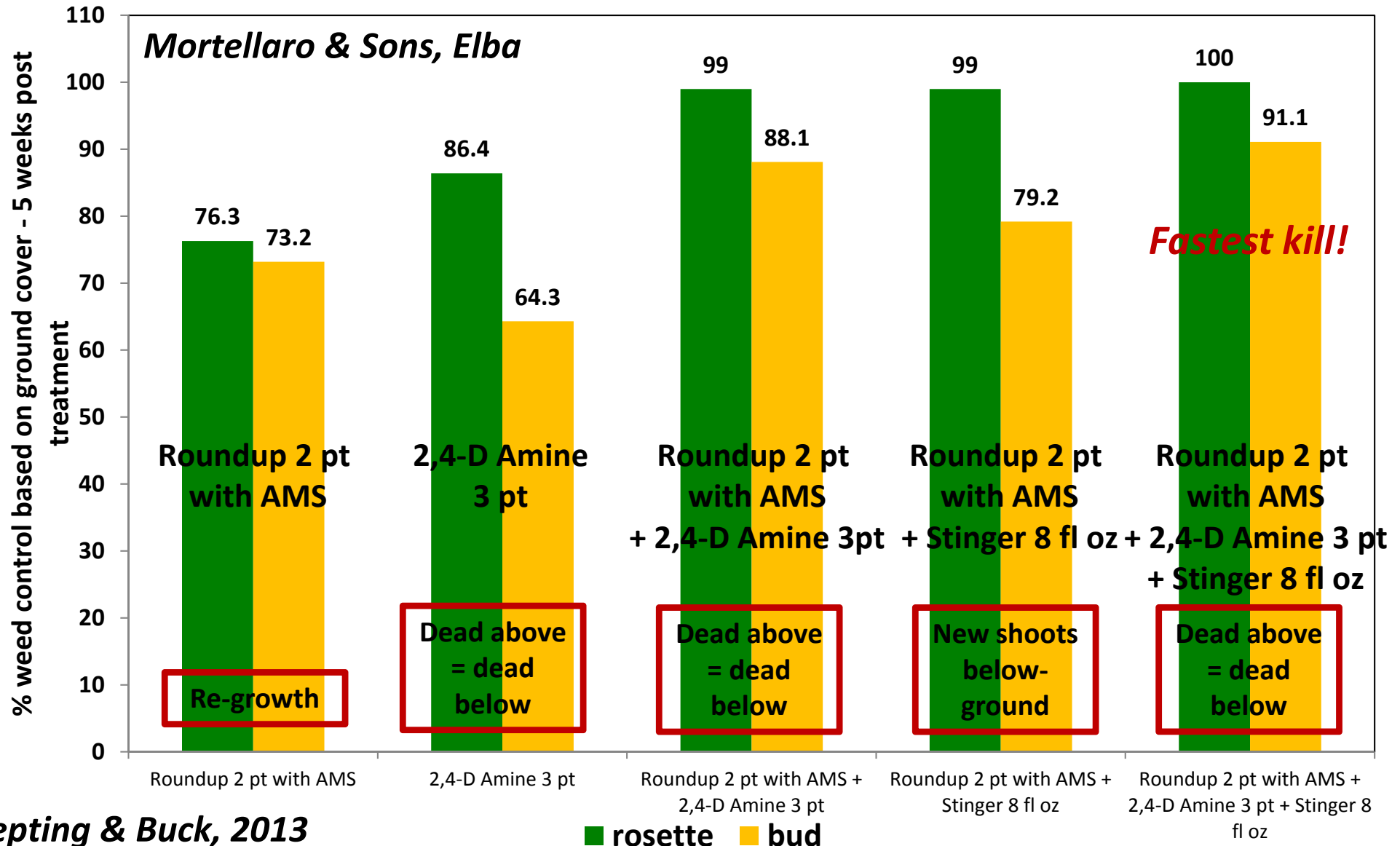
**Ground Cover Measured by: No. live plants
every foot per 2 transects per plot**

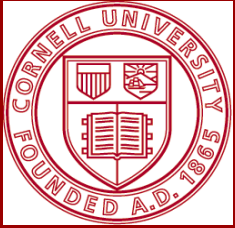




Chemical Fall Burn Down: Perennial Sow Thistle

Simulated Fall Chemical Burn Down of Perennial Sow Thistle



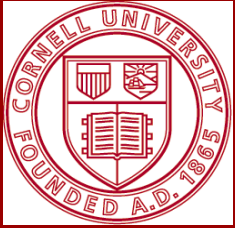


Chemical Fall Burn Down: Perennial Sow Thistle



Untreated Weedy Check

Photos taken August 21, 2013:
5 weeks post bud-stage app (Jul-17)
9 weeks post rosette stage app (Jun-20)



Chemical Fall Burn Down: Perennial Sow Thistle

Roundup 2 pt with AMS



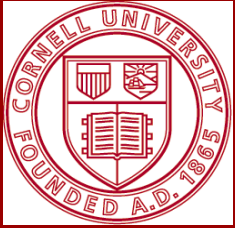
Sprayed at ***Rosette Stage***



Sprayed at ***Bud Stage***

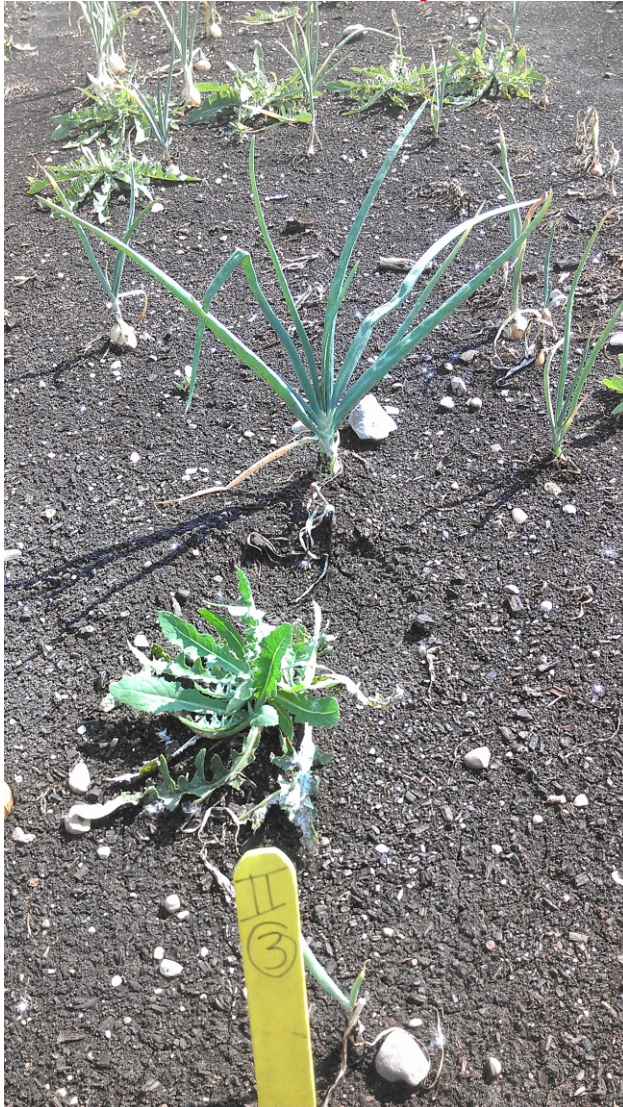


New shoots below-ground



Chemical Fall Burn Down: Perennial Sow Thistle

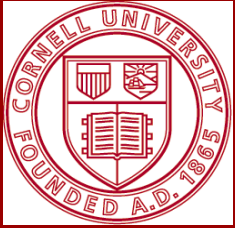
2,4-D Amine 3 pt



Sprayed at ***Rosette Stage***



Sprayed at ***Bud Stage***



Chemical Fall Burn Down: Perennial Sow Thistle

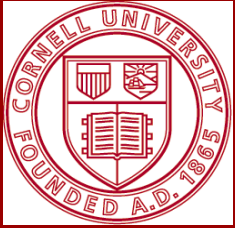
Roundup 2 pt with AMS + 2,4-D Amine 3 pt



Sprayed at ***Rosette Stage***



Sprayed at ***Bud Stage***



Chemical Fall Burn Down: Perennial Sow Thistle

Roundup 2 pts with AMS + Stinger 8 fl oz



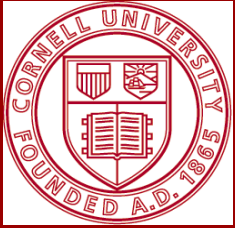
Sprayed at ***Rosette Stage***



Sprayed at ***Bud Stage***

Adventitious roots
& new shoots





Chemical Fall Burn Down: Perennial Sow Thistle

Roundup 2 pt with AMS + 2,4-D Amine 3 pt + Stinger 8 fl oz



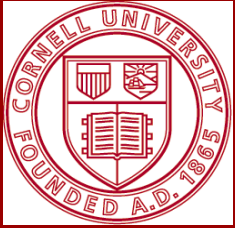
Sprayed at ***Rosette Stage***



Sprayed at ***Bud Stage***



Dead above-ground
= dead below-ground

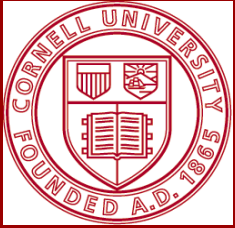


Chemical Fall Burn Down: Perennial Sow Thistle

Control Recommendations:

- Strategically plant early maturing onion varieties or transplants in fields with heavy perennial sow thistle pressure.
- Allow perennial sow thistle to re-grow after onion harvest.
- Apply **Roundup 4 pts with AMS + 2,4-D 3 pts** when majority of perennial sow thistle are in **mid-rosette stage** (4-5" diameter with 5-7 true leaves with half of them expanded).

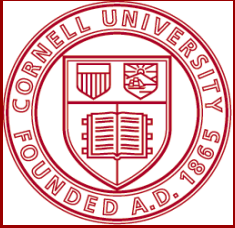




Chemical Fall Burn Down: Perennial Sow Thistle

Control Recommendations:

- To increase rate of kill:
 - make application within 1-2 days of a light frost.
 - Add Stinger 8 fl oz to tank mix (*only if field is not going into onions*). Stinger has a 10.5 month rotation restriction for onions.
- It takes about **3-6 weeks** for perennial sow thistle rhizome with buds to produce a plant at mid-rosette stage (depending on size & depth of rhizome).
- Perennial sow thistle will tolerate light frost
- About **7 weeks** are needed after onion harvest for re-growth and kill time for effective chemical fall burn down



Chemical Fall Burn Down: Perennial Sow Thistle

Future Research:

- Increase rate of Roundup from 2 pts to 4 pts.
- Compare efficacy of high (4 pt) and low (2 pt) rate of 2,4-D by itself, in combination with Roundup, and in combo with high (8 fl oz) and low (4 fl oz) rates of Stinger.
- Trial other growth regulators including Clarity (a.i. dicamba), Garlon (a.i. triclopyr) and Cross bow (a.i. triclopyr + 2,4-D ester) for efficacy at the rosette stage.
- Crop tolerance plant-back study.