

# ***Are Organic Herbicides Effective for Burndown Prior to Crop Establishment?***

**(2022 final research report)**

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## **Introduction:**

Weed management in organic cropping systems is extremely challenging. In most cases, it is accomplished with various tactics including tillage, cover crops, mulches, among others. Planting vegetable crops into an organic no-till system provides its own set of unique challenges and significantly reduces the number of weed control options. However, some growers are always looking for ways to make this system work. One option is to apply OMRI-approved herbicide products such as HomePlate, Axxe, or Scythe during the burndown phase prior to crop planting. However, reliable information is limited on the overall weed control effectiveness of these types of products. Initial university data indicates that high product use rates and high spray volumes will likely be necessary for adequate burndown of existing weeds.

We propose to evaluate these products for burndown control especially on problem weeds such as marestalk. We will compare HomePlate, Axxe, and Scythe (each of these is a different type of chemical) at various use rates, spray volumes, and with certain OMRI listed adjuvants to determine their effectiveness on burndown weed control over a few-week period. As a comparison, conventional burndown herbicides such as glyphosate and Liberty will be included. The study will be conducted at the Penn State research farm near Rock Springs, Centre County. Benefits to state and regional organic vegetable growers will include updated information in vegetable production guides and other educational resources on how to control weeds more effectively.

## **Objectives:**

1. To examine various OMRI approved herbicides to determine their effectiveness on burndown weed control.
2. To evaluate these herbicides compared to competitive, non-OMRI approved products.

## **Work Statement:**

An experiment was conducted at the Russell E. Larson Agricultural Research Farm in Centre County in 2022. Several herbicide treatments (Table 2) were evaluated in a randomized complete block design with three replications. Each plot was 5 x 30 feet and established in a fallow area with marestalk and other winter annual or perennial weeds. Treatments were applied on May 5 using the parameters specified in the treatment listing below (Table 1). Standard flat fan spray nozzles (TeeJet XR 11003) and two spray volumes (35 & 70 gallons/acre) were used to maximize coverage on the weed foliage. Nu-Film P (OMRI-approved) adjuvant was included in some treatments. Weed control for all species present was evaluated on May 9 and May 20.

## **Results (refer to Table 2)**

- None of the “organic herbicide” treatments in this study provided effective burndown weed control.
  - In general, organic herbicides cause substantial leaf burning at first, but most weeds overcame this initial injury and thrived afterwards.
  - Rating taken two (2) weeks after application showed that none of the organic treatments provided greater than 70% control of the weeds present, with a few exceptions. Most ranged from 20-60% control.
  - In general, weed control with Liberty and Roundup continued to increase over time.

## Results (cont.)

- Highest labeled use rates were necessary to get better weed suppression.
- High spray volumes (70 gallons/acre) provided better coverage of weed foliage and tended to cause more leaf injury.
- Certain OMRI-approved adjuvants (e.g., Nu-Film P) slightly improved weed control in this study.

## Discussion and summary

The quest for effective organic herbicides still remains elusive. Of the organic herbicides tested in this study, none of them provided adequate control of weeds when applied early in the season (refer to Table 2 and images and other comments below). As in other studies conducted at Penn State with organic products (e.g., vinegar, clove oil), initial weed control seems promising but over time, the weeds rebound and tend to make a full recovery. In some cases, products such as vinegar, clove oil, and the ones named above can provide fair to good control (80-90%) of small (<4" tall) annual broadleaves such as lambsquarters and redroot pigweed; but are less effective on waxy or hairy weeds and provide poor control of grasses. In general, a spray volume of at least 60 gal/acre tends to be necessary for adequate herbicide performance. Also, environmental conditions and application time are very important. For best results, apply when temperature and relative humidity are each above 70 (°F and %, respectively) and sunlight is bright and abundant. Therefore, best results are usually obtained in late spring or summer. Furthermore, organic herbicides might not make economic (or philosophical) sense in many organic cropping systems since they can be expensive (e.g., \$200 to 400/acre) and could be deemed an input substitution for other acceptable tactics of weed management. However, they might be used effectively and efficiently as a spot treatment. Also, some products such as Scythe are not OMRI approved, so they would be immediately disqualified for use in organic settings.

In general, the conventional burndown herbicides (Roundup PowerMax and Liberty) provided better control of most weeds. Initial control rating showed that Roundup was much slower than the others but since it is a systemic herbicide it takes longer for symptoms and control to occur. Since lower than normal use rates of these products were used in this study, full effectiveness of these products was also limited. However, the marestalk population at this study location was glyphosate-resistant so it would not be killed by Roundup. Liberty is more effective on marestalk however, under cooler conditions in spring it tends to not be as effective as it would be when applied in the summer months.

**Table 1.** Application parameters for organic herbicide burndown field study at Centre Co., PA 2022

Application parameters		Weed species	Height at application (inches)
Application date	May 5, 2022	Marestalk/horseweed	2-4"
Air temperature*	67° F	Dandelion	6-10" diameter
Relative humidity (%)	53%	Mouse-ear chickweed	5-10" diameter
Wind speed	1-3 MPH	Corn speedwell	3-5"
Cloud cover	10%; sunny	Sulfur cinquefoil	8-12" diameter
Nozzle type	TeeJet XR11003		

\*The week after application, daytime air temperatures were in the mid-high 70s for several days.

**Table 2.** Effect of herbicides, use rate, spray volume, and adjuvant on burndown weed control at Centre Co., PA, 2022.

Treatment #	Herbicide(s)	Rate/A	Spray volume (GPA)	Marestail (May 9)	Marestail (May 20)	Dandelion (May 9)	Dandelion (May 20)	Mouseear chickweed (May 9)	Mouseear chickweed (May 20)
				% control					
1	Untreated	-	-	0	0	0	0	0	0
2	HomePlate	3% v/v (4.2 qt)	35	22	0	17	0	17	0
3	HomePlate	6% v/v (8.4 qt)	35	60	30	42	17	47	20
4	HomePlate	9% v/v (12.6 qt)	35	75	40	63	27	67	40
5	Axxe	8% v/v (11.2 qt)	35	47	28	37	23	47	23
6	Axxe	13% v/v (18.2 qt)	35	77	40	53	40	57	40
7	Scythe	5% v/v (7 qt)	35	82	70	60	38	53	35
8	Scythe	10% v/v (14 qt)	35	87	68	76	52	76	65
9	HomePlate	9% v/v (12.6 qt)	70	85	70	84	73	88	70
10	Axxe	13% v/v (18.2 qt)	70	85	63	83	61	86	63
11	Scythe	10% v/v (14 qt)	70	92	73	87	70	93	77
12	HomePlate + Nu-Film P	9% v/v (12.6 qt) + 8 fl oz	35	83	60	79	57	70	46
13	Axxe + Nu-Film P	13% v/v (18.2 qt) + 8 fl oz	35	84	65	81	50	68	52
14	Scythe + Nu-Film P	10% v/v (14 qt) + 8 fl oz	35	84	65	74	50	78	55
15	Roundup PM	22 fl oz	35	60	60	43	60	45	85
16	Liberty + AMS Liquid	32 fl oz + 2.5 %v/v	35	84	86	73	85	60	85
	LSD (P=0.05)			9	5	7	9	6	5

Treatment #	Herbicide(s)	Rate/A	Spray volume (GPA)	Corn speedwell (May 9)	Corn speedwell (May 20)	Sulfur cinquefoil (May 9)	Sulfur cinquefoil (May 20)
				% control			
1	Untreated	-	-	0	0	0	0
2	HomePlate	3% v/v (4.2 qt)	35	10	0	10	0
3	HomePlate	6% v/v (8.4 qt)	35	43	17	43	10
4	HomePlate	9% v/v (12.6 qt)	35	68	40	63	30
5	Axxe	8% v/v (11.2 qt)	35	43	20	40	20
6	Axxe	13% v/v (18.2 qt)	35	57	40	57	25
7	Scythe	5% v/v (7 qt)	35	75	50	30	30
8	Scythe	10% v/v (14 qt)	35	85	70	76	40
9	HomePlate	9% v/v (12.6 qt)	70	86	65	87	73
10	Axxe	13% v/v (18.2 qt)	70	85	63	80	60
11	Scythe	10% v/v (14 qt)	70	92	85	87	62
12	HomePlate + Nu-Film P	9% v/v (12.6 qt) + 8 fl oz	35	78	63	82	52
13	Axxe + Nu-Film P	13% v/v (18.2 qt) + 8 fl oz	35	75	53	73	52
14	Scythe + Nu-Film P	10% v/v (14 qt) + 8 fl oz	35	85	60	76	45
15	Roundup PM	22 fl oz	35	57	85	45	80
16	Liberty + AMS Liquid	32 fl oz + 2.5 %v/v	35	72	90	25	40
	LSD (P=0.05)			8	5	10	7



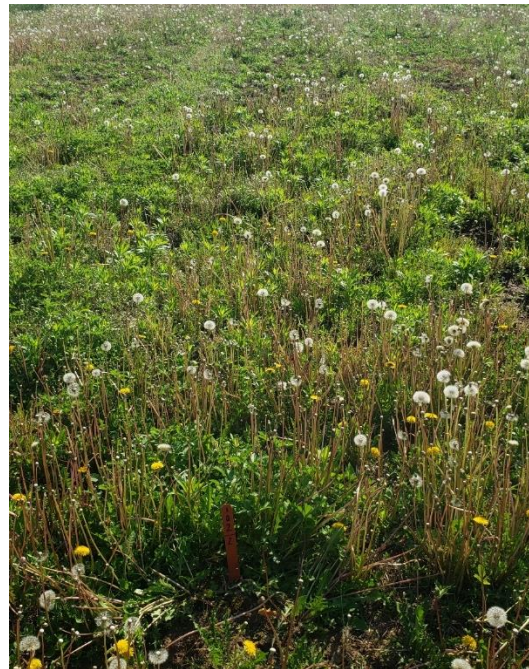
Signature:

Dwight D. Lingenfelter

**Pictures from the study at Rock Springs.**



General overview of study area (May 5)



Treatment 2 HomePlate 3% 35 GPA (Photos May 5, left and May 21, right). About two weeks after application treatment effects could not be seen.



Treatment 4 HomePlate 9% 35 GPA (Photos May 5, left and May 21, right). Symptoms were evident several hours after application (left); however, two weeks later many weeds recovered and were actively growing.



Treatment 9 HomePlate 9% 70 GPA (Photos May 5, left and May 21, right). The highest rate of HomePlate applied in 70 gallons/acre spray volume caused initial overall burning several hours after application (left) and provided some longer control of certain species a couple weeks later. However, weeds such as maretail and dandelion eventually recover. (Notice large dandelion plant in lower left corner, near orange stake, of each photo.)



Axxe 13% 70 GPA (Photo May 21)

Scythe 10% 70 GPA (Photo May 21)

These images show the effects of the high rates of Axxe and Scythe applied in 70 gallons per acre of spray volume two weeks after application. Notice regrowth of weeds.



Liberty 32 fl oz 35 GPA (Photo May 21). As a comparison, this is an image of a plot with a Liberty treatment. Overall control is much better than the other organic treatments two weeks after application.

**Addendum:** Below are images taken on June 10, 2022, from another field demo that contained HomePlate (6% v/v), Axxe (10% v/v), and Scythe (5% v/v). Treatments were applied in 35 and 70 gallons/acre spray volume on June 8. Annual broadleaf weeds were 1-3 inches tall and giant foxtail was 4-7" tall. Notice the speckling and burning on weeds. However, weeds were never killed even after a couple weeks, and they recovered soon after.



Notice velvetleaf and foxtail injury. These weeds recovered several days later.



Notice initial injury to common ragweed and foxtails but they recovered soon after.



This is an overview of a plot that was sprayed with Axxe 10% v/v at 70 GPA. The demo was conducted in a corn field with weeds. (**Note:** none of these types of herbicides are labeled for over-the-top applications in field corn, this was for demonstration purposes only.)