

Postemergence Herbicides for Broadleaf Weed Control in Lettuce

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Introduction

Chemical weed control used for lettuce grown in Arizona has changed little over the last 50 years. An “Insect, disease and weed losses” survey that has been conducted in Yuma for the last 15 years has indicated that almost all of the lettuce is treated preemergence with Benefin, Bensulide or Pronamide to control weeds. Postemergence applications of Clethodim and Sethoxydim have been used to control grasses since the mid 1980’s. There have never been herbicides registered for the postemergence control of broadleaf weeds in lettuce. Those that escape preemergence herbicide treatments are controlled with cultivation and/or hand labor.

There are three main reasons for the absence of postemergence herbicides to control broadleaf weeds in lettuce. 1) Lettuce is a relatively short season fresh market crop for which there is little tolerance for crop injury, 2) Lettuce is often double cropped with a variety of other annual crops and herbicides that have much soil activity cannot be used and 3) lettuce is a high value, relatively minor acreage specialty crop that major international companies cannot justify the cost and liability on.

The focus of this project was to evaluate the potential for both new and older herbicides for the postemergence control of broadleaf weeds in lettuce.

Method

Herbicides were identified that were thought to have potential as postemergence activity on broadleaf weeds in Arizona lettuce. These included mesosulfuron (Osprey), pelargonic acid (Sythe), imazethapyr (Pursuit), imazamox (Raptor), and pronamide (Kerb). Replicated trials were conducted with each at the U of A Yuma Agriculture Center to evaluate crop safety and weed control.

Mesosulfuron (Osprey)

This sulfonylurea herbicide is used in Arizona for the control of grasses and some broadleaf weeds in wheat. It was first registered in 2004 by Bayer Crop science. Its use has been limited by a 10-month plant back restriction to many of the crops that it is grown in rotation with in Arizona. It is predominately used to control littleseed canarygrass and wildoat but will also control mustards and pigweeds. Our interest

in Osprey began when we tried it on a difficult to control species of canarygrass, Hood canary grass (*Phalaris paradoxa*), which first appeared in the Gila Valley, AZ. In 2016. We found that it controlled Hood canarygrass and stunted but did not kill the lettuce. Our trials have focused on finding a rate that is safe to the crop and will control broadleaf weeds in lettuce.

Pest Scientific Name		<i>Chenopodium murale</i>		<i>Phalaris paradoxa</i>		
Pest Name		Nettle-leaf go		Hood		
canarygrass		Head lettuce		Head lettuce		
Crop Name		14 DAT		14DAT		
Description		PHYGEN		control		
Rating Date		Mar-16-2018		Mar-16-2018		
Rating Type		PHYGEN		control		
Rating Unit		%		%		
Trt No.	Treatment Name	Rate	Unit	Plot 1	2	3
1	Osprey	1.0	oz/a	101	0.0	5.0
205	0.0	5.0	10.0			10.0
301	10.0	5.0	10.0			
405	10.0	5.0	10.0			
Mean =				5.0	5.0	10.0
2	Osprey	2.0	oz/a	102	10.0	20.0
204	20.0	60.0	80.0			10.0
303	25.0	80.0	80.0			
403	30.0	80.0	80.0			
Mean =				21.3	60.0	62.5
3	Osprey	3.0	oz/a	103	20.0	80.0
202	35.0	90.0	95.0			90.0
305	40.0	80.0	90.0			
402	30.0	80.0	90.0			
Mean =				31.3	82.5	91.3
4	Osprey	4.0	oz/a	104	35.0	95.0
201	40.0	95.0	95.0			95.0
302	20.0	90.0	90.0			
404	40.0	90.0	90.0			
Mean =				33.8	92.5	92.5
5	Untreated Check			105	0.0	0.0
203	0.0	0.0	0.0			0.0
304	0.0	0.0	0.0			
401	0.0	0.0	0.0			
Mean =				0.0	0.0	0.0

Table 1. Osprey phytotoxicity and Percent Control of *Chenopodium murale* and *Phalaris paradoxa*

Table1 above illustrate the results of a mesosulfuron trial that we conducted at the Yuma Agriculture Center in March 2018. 1.0, 2.0, 3.0 and 4.0 oz were applied when the lettuce was at the rosette stage of growth and Hood canarygrass and

Nettleleaf goosefoot were seedlings. Stunting to the head lettuce ranged from 5% at the 1.0 oz. rate to 33.8 % at the 5.0 oz. rate. Goosefoot control ranged from 5% at the 1.0 oz. rate up to 92.5 % at the 4.0 oz. rate. It was evident in this trial that when the rate of mesosulfuron was high enough to produce acceptable weed control that the lettuce injury became unacceptable. When the control of goosefoot went to above 80% at the 3.0 oz. rate the lettuce injury went about 90%. Although the lettuce did recover by 30% to 40% by harvest, it is unlikely that this will ever be a viable option for broadleaf weed control in lettuce.

Pelargonic Acid (Scythe)

Pelargonic acid is a non-selective postemergence contact herbicide that can be used for broadleaf and grass control in many crops. It is a naturally occurring acid in many plants and animals but is not certified as organic. It was first registered as a pesticide in 1992 and is currently marketed as Scythe by Gowan Company.

This focus of this project was to determine if Scythe could be applied over the top of lettuce and control broadleaf weeds while being safe to the crop. Pelargonic acid is a contact herbicide that works by destroying the waxy cuticle of the plant and causing cell disruption. Rate, spray volume and adjuvant are important. Trials were conducted to determine the effect of these variables on its safety to lettuce.

Fourteen treatments including rates of 5%, 7% and 9% of pelargonic acid with and without MSO or NIS and 2 pts of Paraquat were included in this trial. The results are presented in table 2. The 9% v/v rate with and without either MSO or NIS were the only treatments in this trial that produced commercially acceptable levels of weed control at 26 DAT and 58 DAT,(80% or better). The weeds in this trial were Sahara mustard, Perennial sowthistle and littleseed canarygrass. Grass control was poor for all treatments. Phytotoxicity to the lettuce (Table 3 and 4) ranged from 1.3 to 4 on a scale of 0 (no injury) to 10 (dead) at the 3% v/v rate and with different adjuvants. More than 2.0 is unacceptable with a short season fresh market crop like lettuce. It can be concluded from these trials that Pelargonic acid is too weak on the weeds and not safe enough on the crop to have potential as a useful broadleaf herbicide in lettuce.

Scythe Trial 2011
Yuma Valley Agricultural Center

No.	Hebicide	Rate	MSO	NIS
1	Untreated	-----	-----	-----
2	Gramoxone	2.0 pt	-----	0.5%
3	Scythe	5%	-----	-----
4	Scythe	7%	-----	-----
5	Scythe	9%	-----	-----
6	Scythe	5%	0.5%	-----
7	Scythe	7%	0.5%	-----
8	Scythe	9%	0.5%	-----
9	Scythe	5%	-----	0.5%
10	Scythe	7%	-----	0.5%
11	Scythe	9%	-----	0.5%
12	Scythe	5%	0.5%	0.5%
13	Scythe	7%	0.5%	0.5%
14	Scythe	9%	0.5%	0.5%

12-20-11 (26 DAT)

Trt	Nettleleaf Goosefoot	Mustard	Perenial Sowthistle	Grass
1	0	0	0	0
2	100	100	100	90
3	30	30	25	10
4	50	67.5	62.6	15
5	85	82.5	85	60
6	65	55	70	25
7	80	85	82.5	47.5
8	70	70	67.5	25
9	80	80	80	10
10	47.5	50	50	15
11	90	90	90	50
12	87.5	85	80	15
13	90	90	80	20
14	90	90	90	45

Table 3.

1-27-12 (58 DAT)

<u>Trt</u>	Nettleleaf Goosefoot	Mustard	Perenial Sowthistle	Grass
1	0	0	0	0
2	90	90	83	90
3	20	45	40	10
4	40	55	30	15
5	80	80	50	60
6	58	75	10	25
7	85	70	50	47.5
8	65	65	35	25
9	75	75	20	10
10	0	60	0	15
11	90	90	50	50
12	85	75	55	15
13	90	90	60	20
14	90	85	55	45

Scythe Bard 8-2

	Pigweed		Purslane		Grass	
	3dat	11dat	3dat	11dat	3dat	11dat
1	2e	0.7de	2cd	0.6d	2f	0.6c
2	4.6d	0.7cde	2.6bc	2.7d	2.3ef	1c
3	10a	9.3a	10a	10a	9a	7b
4	6.3c	8.7ab	9a	9a	5.3cd	8.7ab
5	7.6bc	10a	9.3a	10a	6.3bc	10c
6	3.3de	2.7cd	6b	3.7bc	3ef	1c
7	7.3bc	2.7c	9.3a	4.7b	4de	2c
8	4.3d	1.3de	3.3c	1.7cd	3.3ef	1c
9	7.3bc	7b	9a	8.5a	7.3ef	6.5c
10	8b	2cde	9.6a	3.7bc	6f	1.7c
11	0f	0e	0d	0d	0g	0c

Table 4.

Scythe Adjuvant Trial
Yuma Valley Agricultural Center
2012

Herbicide	Rate	Adjuvant	Phyto (6DAT)
Scythe	3%	None	1.3d
Scythe	3%	NIS (0.05%)	3.6bc
Scythe	3%	MSO (0.05%)	2.6c
Scythe	3%	Blend (0.375%)	4b
Scythe	3%	Organosilicone (0.125%)	1.3d
Gramoxone	2pts.	NIS (0.05%)	10a
UTC	-----	-----	0e

LSD = 1.01

0=No crop reponse

10=Dead

Evaluated: 4-2-12(6DAT)

Imazethapyr (Pursuit) and Imazamox (Raptor)

Imazethapyr is widely used in Arizona on alfalfa for broadleaf weed control. It is effective pre and postemergence on most broadleaf weeds but is weak on the composites. Lettuce is a composite and it this herbicide has been used in Florida on lettuce for broadleaf weed control. The soils there are high in organic matter and we were uncertain how safe and effective imazethapyr would be on lettuce in Arizona.

Chart shows the results of trial that was conducted at the Yuma Agriculture Center.

Raptor 1oz		Raptor 2oz		Pursuit 3oz		Pursuit 4oz	
Head lettuce	Leaf Lettuce	Head lettuce	Leaf Lettuce	Head lettuce	Leaf Lettuce	Head lettuce	Leaf Lettuce
25	40	25	50	15	35	25	45
20	40	30	45	15	30	15	45
15	35	35	55	15	35	25	45

September 28, 2013, treated at rosette stage, evaluated 21DAT.

Injury to head lettuce ranged from 15% at the 2 oz. rate to 25% at the 4 oz. rate. The normal use rates in alfalfa are 4 to 6 ounces. The lettuce head lettuce did recover by harvest time in most of the plots. This much injury would be acceptable in some leafy vegetables but would likely be marginally acceptable in lettuce.

Injury to leaf lettuce (romaine) was higher. It ranged from 30% at the 2 oz. rate to 45% at the 4 oz rate. It did not recover in most plots and would be an unacceptable treatment.

Imazamox is an isomer of imazethapyr that was developed to have shorter soil persistence for use in areas where double cropping was common. Imazethapyr has soil residual activity for as long as 5 years to some crops. Imazamox was included in this same trial at 1.0 oz and 2.0 oz. injury was more severe and ranged from 35 % at the low rate to 55% at the high rate. This injury would be commercially unacceptable.

Pronamide (Kerb) postemergence

Pronamide has been a standard treatment for grass and broadleaf weed control in lettuce for more than 50 years. It is a mitotic inhibitor that stops seedling weeds from developing normal root systems. Unlike the other preemergence herbicides used in lettuce, it is systemic and translocates to the entire plant. It can control some very small weeds before they have developed a root system that is adequate to sustain growth. We do not have one trial to include in this report that quantifies which weeds are controlled postemergence and which are not. We did, however, go back through several years of lettuce trials to find which weed were controlled by early postemergence applications of Pronamide. The results are listed in table 6.

Postemergence weed control with pronamide(Kerb)

• **Controlled**

- Wild mustard
- Annual bluegrass
- Wild oat
- Volunteer wheat

• **Not controlled**

- Goosefoot
- Malva
- Purslane
- Shepardspurse
- Knotweed

Conclusion

There have never been chemical options for the postemergence control of broadleaf weeds in lettuce. This project was conducted to evaluate five potential options. These included Mesosulfuron, Pelargonic acid, Imazethapyr, Imazamox and Pronamide. Both crop safety and weed control were considered. Only early postemergence applications of Pronamide resulted in adequate weed control with acceptable crop safety although this was on limited broadleaf weeds.

Aknowlegement

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