Update on Crop Tolerance with Pyridate and Clethodim in Chickpea

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Postemergence (POST) broadleaf weed control is currently not an option for chickpea (*Cicer arietinum*) growers in the Pacific Northwest – there are no registered products. Preemergence (PRE) options exist but require spring precipitation for activation. As a consequence, broadleaf weed control in chickpea is difficult and often unacceptable.

Pyridate, previously labeled as Tough 5EC in peanuts and corn, is a photosystem II inhibitor. Chickpeas are tolerant due to metabolic detoxification of the herbicide, making pyridate a possible fit as a POST broadleaf herbicide in chickpeas (Gimenez-Espinosa and De Prado, 1997). The objective of the study was to evaluate chickpea crop tolerance to pyridate in a field setting with and without the addition of either nonionic surfactant (NIS) or clethodim and crop oil concentrate (COC) as tank mix partners.

The 2016 study and repeated study of 2017 were both established at the Central Ferry Research Farm near Pomeroy, WA. Treatments were applied post emergence (POST) at several different crop stages with and without the addition of a surfactant and clethodim (Select Max), detailed in Table 1, 2 and 3. Both studies were conducted in a randomized complete block with 4 replications. Plots were 10' by 30' long and were supplemented with irrigation. Studies were planted with chickpea variety Billy bean using a Monosem planter on 10" row spacing at a depth of 1.5" on May 11, 2016 and May 1, 2017. PRE herbicides, Lorox (2.5 lb A^{-1}) and Outlook (21 fl oz A^{-1}), were applied pre-emergence (PRE) immediately after each planting to establish weed free trials. The 2016 study was hand weeded July 5, 2016. Irrigation was shut-off three weeks before harvest. Glyphosate at 32 fl oz A^{-1} with ammonium sulfate at 3 lb/100 gal was applied 14 days before harvest as burn down applications.

For the 2016 trial, canopy cover was visually rated 21 days after treatment (DAT16) of application A. Crop injury was visually rated 6 and 44 DAT16 if application A. Crop canopy cover was also rated in 2016 at 21 DAT16 of application A. Percent pest pressure was visually rated 6 DAT16 of application A (Table 2). The repeated study in 2017 had visually crop injury ratings taken 8 and 21 days after treatment (DAT17) of application A. Crop stunting was visually assessed 46 DAT17 of application A. Plots were harvested using a 5' plot combine on September 26, 2016 and August 24, 2017. All data were subjected to an analysis of variance using the statistical package built into the Agricultural Research Manager software system (ARM 8.5.0, Gylling Data Management).

Fig 1. *2016 Paraquat Efficiency Study. Top: Nontreated Control. Middle: Paraquat (8 fl oz A^{-1}) applied 4 days after crop emergence. Bottom: Paraquat (8 fl oz A-1) applied 10 days after cracking.*

The 2016 study observed no significant crop injury compared to the nontreated at either 6 or 44 DAT after application A. Although not significant, minimal leaf burning was observed after each pyridate application (Table 3). No differences in pest pressure were observed 6 DAT16 after application A in any treatments. Percent crop canopy cover was not significantly from the nontreated control. There was no significant difference in yield observed for any of the treatments.

The repeated study in 2017 had similar results with no significant crop injury compared the nontreated at 8 and 21 DAT17, no significant crop stunting compared to the nontreated 46 DAT17, and no significant differences in yield for any of the treatments.

Results confirm chickpeas have a tolerance for pyridate with and without a nonionic surfactant (NIS) when compared to a nontreated control in a weed free environment. The addition of clethodim (Select Max) and COC with pyridate also did not effect the chickpea tolerance to pyridate.

Table 1. *2016 study treatment application details*

Study Application	**A**	**B**	**C**
Date	June 1, 2016	June 3, 2016	June 22, 2016
Application volume (GPA)	15	15	15
Crop stage	2-4”	6”	8-10”
Air temperature (˚F)	67	78	85
Soil temperature (˚F)	64	66	70
Wind velocity (mph, direction)	9, S	4, NW	4, S
Next rain occurred on	June 10, 2016	June 10, 2016	July 8, 2016

Table 2. *2017 study treatment application details*

Study Application	**A**	**B**	**C**
Date	May 22, 2017	May 25, 2017	May 30, 2017
Application volume (GPA)	15	15	15
Crop stage	3.5”	6”	8”
Air temperature (˚F)	85	58	85
Soil temperature (˚F)	72	68	75
Wind velocity (mph, direction)	3, NW	2, N	6, N
Cloud Cover	2%	100%	0%

Table 3. *Percent crop injury, pest pressure, crop canopy cover, and yield in chickpeas following applications of pyridate and clethodim at different application timings. Central Ferry, WA, 2016. DAT = days after treatment for the 2016 study. Means followed by the same letter are not statistically significantly different (α=0.05).*

				June 7, 2016 **6 DAT**	***June 7, 2016*** **6 DAT**	***June 22, 2016*** **21 DAT**	***July 14, 2016*** **44 DAT**	***September 26, 2016***
Treatment	**Application Code**	**Rate**		**Crop Injury**	**Pest Pressure**	**Canopy Cover**	**Crop Injury**	**Yield**
		field rate	**lb ai/A**	**%**	**%**	**%**	**%**	**lb/A**
Nontreated	-	-	-	-	-	100	-	1020
Pyridate	A	24 fl oz/A	0.940					
Clethodim	B	16.5 fl oz/A	0.125	0	2	76	8	1240
COC	B	0.25% v/v						
Pyridate	A	48 fl oz/A	1.880					
Clethodim	B	16.5 fl oz/A	0.125	3	5	73	6	1350
COC	B	0.25% v/v						
Pyridate	A	24 fl oz/A	0.940					
NIS	A	0.25% v/v		3	5	75	3	1250
Clethodim	B	16.5 fl oz/A	0.125					
COC	B	0.25% v/v						
Pyridate	A	48 fl oz/A	1.880					
NIS	A	0.25% v/v		0	3	76	10	1330
Clethodim	B	16.5 fl oz/A	0.125					
COC	B	0.25% v/v						
Pyridate	A	24 fl oz/A	0.940					
Clethodim	A	16.5 fl oz/A	0.125	0	1	78	11	1270
COC	A	0.25% v/v						
Pyridate	A	24 fl oz/A	1.880					
Clethodim	A	16.5 fl oz/A	0.125	0	0	79	3	1430
COC	A	0.25% v/v						
Pyridate	C	24 fl oz/A	0.940					
Clethodim	B	16.5 fl oz/A	0.125	1	1	75	1	1080
COC	B	0.25% v/v						
Pyridate	C	48 fl oz/A	1.880					
Clethodim	B	16.5 fl oz/A	0.125	1	1	84	8	1250
COC	B	0.25% v/v						
Pyridate	C	24 fl oz/A	0.940					
NIS	C	0.25% v/v		0	4	69	19	1040
Clethodim	B	16.5 fl oz/A	0.125					
COC	B	0.25% v/v						
Pyridate	C	48 fl oz/A	1.880					
NIS	C	0.25% v/v		3	3	76	14	1200
Clethodim	B	16.5 fl oz/A	0.125					
COC	B	0.25% v/v						
Pyridate	C	24 fl oz/A	0.940					
Clethodim	C	16.5 fl oz/A	0.125	0	0	71	6	1120
COC	C	0.25% v/v						
Pyridate	C	24 fl oz/A	1.880					
Clethodim	C	16.5 fl oz/A	0.125	2	1	71	16	1240
COC	C	0.25% v/v						
			LSD	*NS*	*NS*	*NS*	*NS*	*NS*

Table 4. *Percent crop injury, stunting, and yield in chickpeas following applications of pyridate and clethodim at different application timings. Central Ferry, WA, 2017. DAT = days after treatment for the 2017 study. Means followed by the same letter are not statistically significantly different (α=0.05).*

Treatment	Application Code	Rate		*May 30, 2017* 8 DAT	*June 12, 2017* 21 DAT	*July 7, 2017* 46 DAT	*August 24, 2017*
				Crop Injury	Crop Injury	Crop Stunting	Yield
		field rate	lb ai/A	%	%	%	lb/A
Nontreated	-	-	-	-	-	-	1746
Pyridate	A	24 fl oz/A	0.940				
Clethodim	B	16.5 fl oz/A	0.125	0	0	0	1518
COC	B	0.25% v/v					
Pyridate	A	48 fl oz/A	1.880				
Clethodim	B	16.5 fl oz/A	0.125	1	0	18	1495
COC	B	0.25% v/v					
Pyridate	A	24 fl oz/A	0.940				
NIS	A	0.25% v/v		1	0	5	1960
Clethodim	B	16.5 fl oz/A	0.125				
COC	B	0.25% v/v					
Pyridate	A	48 fl oz/A	1.880				
NIS	A	0.25% v/v		4	0	10	1554
Clethodim	B	16.5 fl oz/A	0.125				
COC	B	0.25% v/v					
Pyridate	A	24 fl oz/A	0.940				
Clethodim	A	16.5 fl oz/A	0.125	3	0	0	1970
COC	A	0.25% v/v					
Pyridate	A	24 fl oz/A	1.880				
Clethodim	A	16.5 fl oz/A	0.125	0	0	10	1911
COC	A	0.25% v/v					
Pyridate	C	24 fl oz/A	0.940				
Clethodim	B	16.5 fl oz/A	0.125	0	0	5	1782
COC	B	0.25% v/v					
Pyridate	C	48 fl oz/A	1.880				
Clethodim	B	16.5 fl oz/A	0.125	1	0	10	1428
COC	B	0.25% v/v					
Pyridate	C	24 fl oz/A	0.940				
NIS	C	0.25% v/v		1	0	0	1774
Clethodim	B	16.5 fl oz/A	0.125				
COC	B	0.25% v/v					
Pyridate	C	48 fl oz/A	1.880				
NIS	C	0.25% v/v		0	0	0	1613
Clethodim	B	16.5 fl oz/A	0.125				
COC	B	0.25% v/v					
Pyridate	C	24 fl oz/A	0.940				
Clethodim	C	16.5 fl oz/A	0.125	0	1	0	1595
COC	C	0.25% v/v					
Pyridate	C	24 fl oz/A	1.880				
Clethodim	C	16.5 fl oz/A	0.125	0	0	0	1507
COC	C	0.25% v/v					
			LSD	*NS*	*NS*	*NS*	*NS*

Disclaimer

Some of the pesticides discussed in this presentation were tested under an experimental use permit granted by WSDA. Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties up to $7,500. In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action by WSDA and/or the U.S. Food and Drug Administration. It is your responsibility to check the label before using the product to ensure lawful use and obtain all necessary permits in advance.