

2016 Waterhemp Control in Edible Lima Bean Production in SE Minnesota

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Introduction:

Effective broadleaf weed control especially *Amaranthus* spp. (*A. tuberculatus* and *A. rudis*), has become challenging in many broadleaf crops in MN. In the lima bean production areas in SE Minnesota *Amaranthus* resistance is documented for ALS herbicides (Group-2), glycine herbicides (Group-9), and recently (2016) PPO herbicides (Group-14). Multi-herbicide resistant *Amaranthus* has also become widespread across Minnesota and has complicated weed control efforts. Pendimethalin tank mixed with imazethapyr is currently utilized on the majority of southeastern Minnesota lima bean production acres. Inadequate *Amaranthus* control with this program has resulted in fewer acres in production and reduced grower profits.

Materials and Methods:

In 2016, a trial was conducted in edible lima beans to evaluate both labeled and unlabeled herbicides. Labeled products included bentazon (POST), imazamox (POST), imazethapyr, (PPI), pendimethalin (PPI), and s-metolachlor (PPI and PRE). Herbicides without current lima bean labels included fomesafen (PRE and POST), sulfentrazone (PRE), and POST applied s-metolachlor. Weed control, crop response, and plump pod weight were collected as measures of performance in this trial. Rates used were based on soil type and seasonal limits. The research site was a Lawler loam series with a pH of 6.9, O.M. 2.2% and soil test P and K levels of 49 ppm and 124 ppm, respectively. The field was fall chisel plowed, spring disked and field cultivated prior to planting. Improved Kinstons lima bean was planted on June 17, 2016 in 30-inch rows at 115,000 seeds per acre. A randomized complete block design was used with four replications. PPI and PRE treatments were applied with a tractor-mounted sprayer delivering 15 gpa at 40 psi using TTI 110015 spray tips immediately before and after planting. POST applications were made on July 15 at 15 gpa and 30 psi using TTIJ60 11002 nozzles for contact herbicides, and TTI 11002 nozzles for non-contact herbicides. Common waterhemp density on June 8 averaged 16 plants per square foot. Evaluations were taken on July 12 and July 19. On September 14, four feet of row from one of the two center rows were hand cut and plump pods were removed and weighed. Application dates, environmental conditions, and weed stages can be found in Table 1. Results are presented in Table 2.

Discussion:

Overall control of *Amaranthus* in this study was very good to excellent. Minor differences in *Amaranthus* control were observed (Table 2). The sequential application of s-metolachlor (PPI followed by POST) provided lower *Amaranthus* control than s-metolachlor applied PRE. Sulfentrazone, and the package mix of sulfentrazone and s-metolachlor provided excellent *Amaranthus* control. Fomesafen applied PRE or POST also provide excellent *Amaranthus* control. Crop response to both PRE applied and POST applied herbicides treatments were observed (Figure 1) and appeared to be the largest contributor to decreased plump pod weight other than zero weed control in the untreated check (Table 2). (University of Minnesota Extension Regional Office, Rochester).

Table 1. Application timing, plant stages, environmental conditions in 2016.

Date	6/17	6/17	7/15
Treatment	PPI (A)	PRE (B)	POST I (C)
Temperature (F)			
Air	82	81	62
Soil	56.3	71.3	69.5
Relative Humidity (%)	60	62	90
Wind (mph)	9	8	6
Soil Moisture	Normal	Normal	Normal
Lima bean			
Stage			V5
Height (inch)			12.0
Common Waterhemp			
Height (inch)			2.5
Common Lambsquarters			
Height (inch)			2.0
Grass			
Height (inch)			2.0
Rainfall after each application			
Week 1	0.41	0.41	2.00
Week 2	0.65	0.65	2.83
Week 3	1.66	1.66	1.28

Table 2. Waterhemp control, crop response and lima bean plum pod weight at Rochester, MN in 2016.

Treatment ^{1a}	Rate ^{2a}	Appl. ^{2b}	7/19/16 ^{3a}	6/10/16 ^{3b}	YIELD ^{3c}
Herbicide ^{4a}	Per-acre ^{4b}	Time ^{4c}	% Control ^{4d}	% Injury ^{4e}	Pod-wt ^{3d}
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	98-a ^{3a}	1...d ^{3b}	47...a ^{3c}
DUAL-MAGNUM ^{2a}	1.33-pt ^{2a}	B ^{2a}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	97-a ^{3a}	1...d ^{3b}	46...ab ^{3c}
SPARTAN ^{2a}	4.5-fl-oz ^{2a}	B ^{2a}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	99-a ^{3a}	11-bc ^{3b}	40-abc ^{3c}
DUAL-MAGNUM+REFLEX ^{2a}	1.33-pt+16-fl-oz ^{2a}	B ^{2a}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	99-a ^{3a}	13...b ^{3b}	38-bcd ^{3c}
AUTHORITY-ELITE ^{2a}	26-fl-oz ^{2a}	B ^{2a}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	98-a ^{3a}	6...c ^{3b}	36...cd ^{3c}
DUAL-MAGNUM ^{2a}	1.33-pt ^{2a}	B ^{2a}			
RAPTOR+BASAGRAN+NIS ^{2a}	4.0-fl-oz+8.0-fl-oz+0.25% ^{2a}	C ^{2a}			
PROWL+PURSUIT+DUAL-MAGNUM ^{1a}	2.3-pt+3-fl-oz+1.0-pt ^{1a}	A ^{1a}	90-b ^{3a}	7-bc ^{3b}	29...de ^{3c}
DUAL-MAGNUM ^{2a}	1.0-pt ^{2a}	C ^{2a}			
PROWL+PURSUIT ^{1a}	2.3-pt+3-fl-oz ^{1a}	A ^{1a}	99-a ^{3a}	40...a ^{3b}	26...e ^{3c}
DUAL-MAGNUM ^{2a}	1.33-pt ^{2a}	B ^{2a}			
REFLEX+BASAGRAN+NIS ^{2a}	12.0-fl-oz+8.0-fl-oz+0.25% ^{2a}	C ^{2a}			
LSD-P=0.10			2 ^{3a}	3.07-11.31 ^{3b}	9 ^{3c}

1. Prowl= pendimethalin-3.3-EC, Pursuit= imazethapyr-2-EC, Dual-Magnum= s-metolachlor-7.62-EC, Spartan= sulfentrazone-4-F,
 ...Authority-Elite= sulfentrazone+s-metolachlor-7-EC, Reflex= fomesafen-2-SL, Basagran= bentazon-4-SL
 2. Application date: A= PPI: 6/17/16, B= PRE: 6/17/16, C= POST: 7/15/16
 3. Plum-pod-weight= ounces per 4-foot-of-row
 4. Automatic-square-root-transformation-of-X+.05



Figure 1. Waterhemp control, and crop response, with various herbicides in lima bean on August 1, 2016 at Rochester, MN.

