2020 VEGETABLE FUNDED RESEARCH

	TITLE	RESEARCHER	$ AMOUNT FUNDED
1	Weed Control Evaluations in Lima Beans	D. E. Robinson	$19,000
2	Weed Control Evaluations in Snap Beans	D. E. Robinson	
3	Weed Control Evaluations in Carrots	D. E. Robinson	
4	Weed Control Evaluations in Peas	D. E. Robinson	
5	NYS Processing Snap Bean and English Pea Evaluations	S. Reiners	$5,300 US
6	Cultivar evaluations of processing peas	Bonduelle	$5,000
7	Using Genetic Tests to Confirm Herbicide Resistant Weeds in Ontario Crops	K. Obeid	$5,000
8	Neonicotinoid alternatives for management of cucumber beetle in cucurbits	C. Trueman	$1,750*
		Total	**$36,050**

* This funding is split 50/50 between Vegetable Research and Cucumber Research Committees

Trial 1: Tolerance of Lima Bean to Preemergence Herbicides - I

Objective: Determine the tolerance of lima bean to PRE applications of new herbicide active ingredients – pethoxamid, Zidua, Shieldex, as well as Prowl H20.

Materials & Methods:

Crop: Lima bean

Variety: Improved Kingston	Planting date: June 3/20
Planting rate: 266667 seeds/ha	Depth: 3.5 cm
Row spacing: 75cm	Plant spacing: 5 cm

Design: Randomized Complete Block Design

Plot width: 1.5m	Plot length: 10m
Reps: 4	

Field Preparation: Field was fertilized on June 2 with 19-19-19 at 20 kg/ha of actual N, P and K.

Soil Description:

Sand: 82%	OM: 1.3%
Silt: 10%	pH: 6.0
Clay: 8%	CEC 6.2

Texture: Loamy Sand
Soil: Watford/Brady series

Application Information:

	A
Application Date:	June 4-2020
Time of Day:	8:00 AM
Application Method:	CO2 SPRAY
Application Timing:	PRE
Application Placement:	SOIL
Air Temperature, Unit:	24 C
% Relative Humidity:	60
Wind Velocity, Unit:	3 KPH
Wind Direction:	NE
Dew Presence (Y/N):	N
Soil Temperature, Unit:	21 C
Soil Moisture:	WET

Spray Equipment:

Application Method: CO2 Backpack	Pressure: 207 KPA (30 PSI)
Nozzle Type: Air Induction	Nozzle Size: ULD120-02
Nozzle Spacing: 50 cm (20")	Boom Width: 1.5 m (60")
Spray Volume: 200 L/ha (20 GAL/AC)	

Table 1.1. Effect of herbicide treatment on lima bean percent injury 7, 14 and 28 days after application, dry weight at 28 days and yield.

HERBICIDE	RATE	PERCENT INJURY 7D	14D	28D	DRY WT G	YIELD T/AC
1. Check (WEEDFREE)		0A	0B	0B	40A	3.0A
2. pethoxamid	1200 G/HA	1A	1B	0B	40A	3.2A
3. pethoxamid	2400 G/HA	2A	17A	28A	14C	1.1C
4. ZIDUA	47 G/AC	1A	5B	5B	29B	2.7A
5. ZIDUA	94 G/AC	1A	3B	3B	18C	2.0B
6. PROWL H20	0.96 L/AC	2A	2B	4B	38A	3.0A
7. PROWL H20	1.92 L/AC	2A	3B	4B	37A	3.3A
8. SHIELDEX	16.3 G/AC	0A	5B	5B	38A	3.0A
9. SHIELDEX	32.6 G/AC	1A	1B	1B	29B	2.6AB
LSD (P <0.05)		2	8	14	9	0.6

Note: Means followed by the same letter are not significantly different (P=0.05, LSD).

Conclusions:

Conclusions: This trial was kept weed-free to test for the effect of pethoxamid, a new preemergence herbicide under development for field crops. We also examined the tolerance of lima bean to Zidua, Prowl H20, and Shieldex (tolpyralate). We observed extensive injury in the pethoxamid treatments, which results in a reduction in plant size and yield loss. In addition, we observed injury in the Zidua treatments and a corresponding reduction in dry weight and yield at the 2X rate. This trial was conducted on a fairly sandy soil with low (1.3%) organic matter. The results of this trial contrasted with those of Trial 2, in which little injury and no yield loss were observed. Trial 2 (please see below) was conducted on a heavier soil type, and though some treatments injured lima bean, we did not measure any decreases in plant dry weight or yield.

Trial 2: Tolerance of Lima Bean to Preemergence Herbicides - II

Objective: Determine the tolerance of lima bean to PRE applications of new herbicide active ingredients – pethoxamid, Zidua, Shieldex, as well as Prowl H20.

Materials & Methods:

Crop: Lima bean
Variety: Improved Kingston   Planting date: June 3/20
Planting rate: 266667 seeds/ha   Depth: 3.5 cm
Row spacing: 75cm   Plant spacing: 5 cm

Design: Randomized Complete Block Design
Plot width: 1.5m   Plot length: 10m
Reps: 4

Field Preparation: Field was fertilized on June 2 with 19-19-19 at 40 kg/ha of actual N, P and K.

Soil Description:
Sand: 51%   OM: 3.8%
Silt: 22%   pH: 7.3
Clay: 26%   CEC 13.5

Texture: Sandy Clay Loam
Soil: Watford/Brady series

Application Information:

	A
Application Date:	June 4-2020
Time of Day:	10:00 AM
Application Method:	CO2 SPRAY
Application Timing:	PRE
Application Placement:	SOIL
Air Temperature, Unit:	26 C
% Relative Humidity:	30
Wind Velocity, Unit:	7 KPH
Wind Direction:	NE
Dew Presence (Y/N):	N
Soil Temperature, Unit:	22 C
Soil Moisture:	MOIST

Spray Equipment:

Application Method: CO2 Backpack   Pressure: 207 KPA (30 PSI)
Nozzle Type: Air Induction   Nozzle Size: ULD120-02
Nozzle Spacing: 50 cm (20")   Boom Width: 1.5 m (60")
Spray Volume: 200 L/ha (20 GAL/AC)

Table 2.1. Effect of herbicide treatment on lima bean percent injury 7, 14 and 28 days after application, dry weight at 28 days and yield.

HERBICIDE	RATE	PERCENT INJURY 7D	14D	28D	DRY WT G	YIELD T/AC
1. Check (WEEDFREE)		0A	0A	0A	42A	2.5A
2. pethoxamid	1200 G/HA	3A	5A	2A	40A	2.6A
3. pethoxamid	2400 G/HA	4A	9A	5A	46A	2.3A
4. ZIDUA	47 G/AC	1A	3A	2A	49A	2.7A
5. ZIDUA	94 G/AC	1A	5A	4A	48A	2.3A
6. PROWL H20	0.96 L/AC	1A	1A	0A	38A	2.5A
7. PROWL H20	1.92 L/AC	2A	2A	0A	47A	2.6A
8. SHIELDEX	16.3 G/AC	0A	3A	5A	38A	2.4A
9. SHIELDEX	32.6 G/AC	1A	6A	7A	39A	2.6A
LSD (P <0.05)		2	8	6	11	0.3

Note: Means followed by the same letter are not significantly different (P=0.05, LSD).

Conclusions:

Conclusions: This trial was kept weed-free to test for the effect of pethoxamid, a new preemergence herbicide under development for field crops. We also examined the tolerance of lima bean to Zidua, Prowl H20, and Shieldex (tolpyralate). Though plant height, dry weight and yield was not less than the untreated check in any of the treatments, some injury symptoms (leaf puckering and plant stunting) was observed early in the growing season. By crop maturity, lima bean had outgrown the injury.

Trial 3: Tolerance of Snap Bean to Preemergence Herbicides - I

Objective: Determine the tolerance of snap bean to PRE applications of new herbicide active ingredients – pethoxamid, Zidua, Shieldex, as well as Prowl H20.

Materials & Methods:

Crop: Snap bean
Variety: Matador
Planting date: June 9/20
Planting rate: 374532 seeds/ha
Depth: 2.5 cm
Row spacing: 75cm
Plant spacing: 3.6 cm

Design: Randomized Complete Block Design
Plot width: 1.5m
Plot length: 10m
Reps: 4

Field Preparation: Field was fertilized on June 8 with 19-19-19 at 20 kg/ha of actual N, P and K.

Soil Description:
Sand: 51%
OM: 3.8%
Silt: 22%
pH: 7.3
Clay: 26%
CEC 13.5

Texture: Sandy Clay Loam
Soil: Watford/Brady series

Application Information:

	A
Application Date:	June 10-2020
Time of Day:	8:00 AM
Application Method:	CO2 SPRAY
Application Timing:	PRE
Application Placement:	SOIL
Air Temperature, Unit:	19 C
% Relative Humidity:	75
Wind Velocity, Unit:	4 KPH
Wind Direction:	NE
Dew Presence (Y/N):	N
Soil Temperature, Unit:	26 C
Soil Moisture:	WET

Spray Equipment:

Application Method: CO2 Backpack
Pressure: 207 KPA (30 PSI)
Nozzle Type: Air Induction
Nozzle Size: ULD120-02
Nozzle Spacing: 50 cm (20")
Boom Width: 1.5 m (60")
Spray Volume: 200 L/ha (20 GAL/AC)

Table 3.1. Effect of herbicide treatment on snap bean percent injury 7, 14 and 28 days after application, dry weight at 28 days and yield.

HERBICIDE	RATE	PERCENT INJURY 7D	14D	28D	DRY WT G	YIELD T/AC
1. Check (WEEDFREE)		0C	0A	0C	40A	4.1A
2. pethoxamid	1200 G/HA	3B	1A	1BC	44A	4.2A
3. pethoxamid	2400 G/HA	3B	5A	4ABC	42A	4.5A
4. ZIDUA	47 G/AC	6A	3A	7A	42A	4.0A
5. ZIDUA	94 G/AC	6A	1A	1C	41A	4.4A
6. PROWL H20	0.96 L/AC	3B	1A	1C	43A	4.2A
7. PROWL H20	1.92 L/AC	5AB	3A	1C	45A	4.1A
8. SHIELDEX	16.3 G/AC	5AB	4A	1C	40A	3.3B
9. SHIELDEX	32.6 G/AC	7A	4A	1C	43A	3.0B
LSD (P <0.05)		2	5	4	12	0.8

Note: Means followed by the same letter are not significantly different (P=0.05, LSD).

Conclusions:

Conclusions: This trial was kept weed-free to test for the effect of pethoxamid, a new preemergence herbicide under development for field crops. We also examined the tolerance of snap bean to Zidua, Prowl H20, and Shieldex (tolpyralate). Though yield was not less than the untreated check in any of the pethoxamid treatments, some injury symptoms (leaf puckering and plant stunting) was observed early in the growing season. Snap bean yield was less than the untreated check in the Shieldex treatments, despite showing little visible injury (ie. 7% or less) and no reduction in plant height. These results confirm what we observed in 2019. After carefully examining the root systems of snap beans this year (we did not do this in 2020), we noted a reduction in secondary root growth in the Shieldex treatments.

Trial 4: Tolerance of Snap Bean to Preemergence Herbicides - II

Objective: Determine the tolerance of snap bean to PRE applications of new herbicide active ingredients – pethoxamid, Zidua, Shieldex, as well as Prowl H20.

Materials & Methods:

Crop: Snap bean

Variety: Matador	Planting date: May 29/20
Planting rate: 374532 seeds/ha	Depth: 2.5 cm
Row spacing: 75cm	Plant spacing: 3.6 cm

Design: Randomized Complete Block Design

Plot width: 1.5m	Plot length: 10m
Reps: 4	

Field Preparation: Field was fertilized on May 28 with 19-19-19 at 40 kg/ha of actual N, P and K.

Soil Description:

Sand: 82%	OM: 1.3%
Silt: 10%	pH: 6.0
Clay: 8%	CEC 6.2

Texture: Loamy Sand
Soil: Watford/Brady series

Application Information:

	A
Application Date:	May 29-2020
Time of Day:	8:00 AM
Application Method:	CO2 SPRAY
Application Timing:	PRE
Application Placement:	SOIL
Air Temperature, Unit:	24 C
% Relative Humidity:	60
Wind Velocity, Unit:	3 KPH
Wind Direction:	NE
Dew Presence (Y/N):	N
Soil Temperature, Unit:	28 C
Soil Moisture:	WET

Spray Equipment:

Application Method: CO2 Backpack	Pressure: 207 KPA (30 PSI)
Nozzle Type: Air Induction	Nozzle Size: ULD120-02
Nozzle Spacing: 50 cm (20")	Boom Width: 1.5 m (60")
Spray Volume: 200 L/ha (20 GAL/AC)	

Table 4.1. Effect of herbicide treatment on snap bean percent injury 7, 14 and 28 days after application, dry weight at 28 days and yield.

HERBICIDE	RATE	PERCENT INJURY 7D	14D	28D	DRY WT G	YIELD T/AC
1. Check (WEEDFREE)		0C	0C	0C	53A	5.1A
2. pethoxamid	1200 G/HA	3BC	1BC	1BC	44A	5.2A
3. pethoxamid	2400 G/HA	3BC	9A	17AB	32A	3.5B
4. ZIDUA	47 G/AC	5AB	3ABC	7A	46A	5.0A
5. ZIDUA	94 G/AC	6AB	11BC	21BC	31A	3.4B
6. PROWL H20	0.96 L/AC	3BC	1BC	1BC	53A	5.2A
7. PROWL H20	1.92 L/AC	5AB	3ABC	7BC	50A	4.5A
8. SHIELDEX	16.3 G/AC	5AB	4AB	1BC	50A	4.7A
9. SHIELDEX	32.6 G/AC	7A	4AB	1BC	50A	4.3A
LSD (P <0.05)		4	3	4	25	1.9

Note: Means followed by the same letter are not significantly different (P=0.05, LSD).

Conclusions:

Conclusions: This trials was kept weed-free to test for the effect of pethoxamid on snap bean. We also examined the tolerance of snap bean to Zidua, Prowl H20, and Shieldex (tolpyralate). In 2020, yield was less than the untreated check in the pethoxamid treatments, with some extensive injury symptoms (leaf puckering and plant stunting), particularly early in the growing season. Snap bean yield was slightly less than the untreated check in the Shieldex treatments (though not statistically significant, despite showing little visible injury (ie. 7% or less) and no reduction in plant height. As in Trial 3, we examined the root systems of the snap beans, and visually noted a decrease in secondary root growth in the Shieldex treatments. In 2019, we did not observe significant reductions in yield, but we did observe injury, though no observations on root growth were made last year.

Trial 5: Tolerance of Carrot to Postemergence Applications of Pyroxasulfone

Objective: Determine carrot tolerance to POST applications of pyroxasulfone to support potential minor use submission.

Materials & Methods:

Crop: Carrot
Variety: Belgrado
Planting rate: 393750 seeds/ha
Row spacing: 38cm
Planting date: May 1/20
Depth: 1 cm

Design: Randomized Complete Block Design
Plot width: 1.5m
Plot length: 10m
Reps: 4

Field Preparation: Fertilized with 400 hg/ha of 27-0-0 on April 25. Entire trial was kept weed-free by hand.

Soil Description:
Sand: 78%
Silt: 15%
Clay: 7%
OM: 3.5%
pH: 6.2
CEC 6.6
Texture: loamy sand
Soil: Normandale

Application Information:

	A	B	C
APPLICATION DATE	May 18/20	May 28/20	June 21/20
TIME OF DAY	8:30AM	10:30AM	11:00AM
TIMING	POST1	POST2	POST3
AIR TEMP (c)	22	23	25
RH (%)	67	80	56
WIND SPEED (KPH)	5	2	2
SOIL TEMP (c)	20	26	24
CLOUD COVER (%)	100	0	0
CROP STAGE	2-3 LF	4-5 LF	6-7 LF

Spray Equipment:

Application Method: CO2 Backpack
Nozzle Type: AIR INDUCTION
Nozzle Spacing: 50 cm (20")
Spray Volume: 200 L/ha (20 GAL/AC)
Pressure: 207 KPA (30 PSI)
Nozzle Size: ULD120-02
Boom Width: 1.5 m (60")

Table 5.1. Effect of herbicide treatment on visual injury (7 and 28 days after treatment) and carrot yield.

HERBICIDE	RATE	TIMING	PERCENT INJURY 7D	28D	YIELD T/AC
1. UNTREATED					26A
2. PYROXASULFONE	89G/HA	2-3LF	1C	0C	25A
3. PYROXASULFONE	100G/HA	2-3LF	4C	0C	31A
4. PYROXASULFONE	125G/HA	2-3LF	4C	1C	27A
5. PYROXASULFONE	178G/HA	2-3LF	8BC	1C	30A
6. PYROXASULFONE	200G/HA	2-3LF	9B	1C	24A
7. PYROXASULFONE	250G/HA	2-3LF	12B	13B	21B
8. PYROXASULFONE	500G/HA	2-3LF	16A	46A	9C
9. PYROXASULFONE	89G/HA	4-5LF	3B	6C	25A
10. PYROXASULFONE	100G/HA	4-5LF	6B	5C	27A
11. PYROXASULFONE	125G/HA	4-5L	8B	8BC	25A
12. PYROXASULFONE	178G/HA	4-5LF	11B	9BC	26A
13. PYROXASULFONE	200G/HA	4-5LF	14B	9BC	28A
14. PYROXASULFONE	250G/HA	4-5LF	19B	8BC	27A
15. PYROXASULFONE	500G/HA	4-5LF	27A	19B	19B
15. PYROXASULFONE	500G/HA	6-7LF	15AB	18B	20B
LSD (P <0.05)			4	9	6

Note: Means followed by the same letter are not significantly different (P=0.05, LSD).

Conclusions: Pyroxasulfone (Zidua®) is an excellent candidate for control of linuron-resistant pigweed; therefore studies were established in mineral and muck soils to determine tolerance of carrot to postemergence applications of pyroxasulfone. As Zidua® rate increased from 105 to 588 g/ha at the early application timing (ie. 2-3 leaf), injury increased from 1-16%, and 0-46% at 7 and 28 days after herbicide treatment (DAT). Visible injury increased from 3-27% and 6-19% at 7 and 28 days after application at the 4-5 leaf stage of carrot. Despite the levels of injury that were apparent at either application timing, marketable yield was similar to the untreated check at most herbicide rates. Marketable yield was not reduced at a Zidua® rate of 100 g/ha. **A minor use was submitted, requesting a rate of 100 g/ha – additional data have been requested by PMRA on both tolerance and efficacy.**

Trial 6: PRE-POST Strategies for Weed Control in Carrot

Objective: Develop weed control strategies to control weeds in carrot without linuron.

Materials & Methods:

Crop: Carrot
Variety: Belgrado — Planting date: May 1/20
Planting rate: 393750 seeds/ha — Depth: 1 cm
Row spacing: 38cm

Design: Randomized Complete Block Design
Plot width: 1.5m — Plot length: 10m
Reps: 4

Field Preparation: Fertilized with 400 hg/ha of 27-0-0 on April 25. Entire trial was kept weed-free by hand.

Soil Description:

Sand: 78%	OM: 3.5%	Texture: loamy sand
Silt: 15%	pH: 6.2	Soil: Normandale
Clay: 7%	CEC 6.6	

Application Information:

	A	B	C	D
APPLICATION DATE	May 1/20	May 8/20	May 28/20	June 21/20
TIME OF DAY	8:00AM	9:00AM	11:00AM	8:30AM
TIMING	PRE	POST1	POST2	POST3
AIR TEMP (c)	10	29	25	25
RH (%)	53	56	54	70
WIND SPEED (KPH)	1	1	4	0
SOIL TEMP (c)	16	30	28	25
CLOUD COVER (%)	50	10	10	30
CROP STAGE	PRE	COT	2 LF	4-5LF
WEED STAGE	PRE	COT-2 LF	COT-2 LF	COT- 2LF

Spray Equipment:

Application Method: CO2 Backpack
Nozzle Type: AIR INDUCTION
Nozzle Spacing: 50 cm (20")
Spray Volume: 200 L/ha (20 GAL/AC)
Pressure: 207 KPA (30 PSI)
Nozzle Size: ULD120-02
Boom Width: 1.5 m (60")

Table 6.1. Effect of herbicide treatment on percent control of velvetleaf (ABUTH), pigweed (AMARE), and crabgrass (DIGSS) control 56 days after application.

HERBICIDE	RATE	TIMING	ABUTH %	AMARE %	DIGSS %
1. UNTREATED					
2. DUAL II MAGNUM	0.7 L/AC	PRE	50DE	79B	91A
3. PROWL H20	2.7 L/AC	PRE	45E	80B	86B
4. NORTRON	3.3 L/AC	PRE	90BC	85AB	85B
5. DUAL II MAGNUM	700 ML/AC	PRE	86BC	83B	94A
PROWL H20	3.3 L/AC	PRE			
6. DUAL II MAGNUM	700 ML/AC	PRE	76C	91AB	97A
NORTRON	3.3 L/AC	PRE			
7. DUAL II MAGNUM	700 ML/AC	PRE	96AB	98AB	98A
PROWL H20	2.7 L/AC	PRE			
NORTRON	3.3 L/AC	PRE			
8. GOAL	0.1 L/AC	POST1	99A	99A	61C
GOAL	0.1 L/AC	POST2			
GOAL	0.1 L/AC	POST3			
9. BLAZER	0.03 L/AC	POST1	95AB	94AB	0D
+ ASSIST	0.5% V/V				
BLAZER	0.03 L/AC	POST2			
+ ASSIST	0.5% V/V				
BLAZER	0.03 I/AC	POST3			
+ ASSIST	0.5% V/V				
10. DUAL II MAGNUM	700 ML/AC	PRE	99A	98AB	99A
PROWL H20	3.3 L/AC	PRE			
GOAL	0.1 L/AC	POST1			
GOAL	0.1 L/AC	POST2			
GOAL	0.1 L/AC	POST3			
11. DUAL II MAGNUM	700 ML/AC	PRE	96AB	99A	99A
PROWL H20	3.3 L/AC	PRE			
BLAZER	0.03 L/AC	POST1			
+ ASSIST	0.5% V/V				

BLAZER	0.03 L/AC	POST2			
+ ASSIST	0.5% V/V				
BLAZER	0.03 I/AC	POST3			
+ ASSIST	0.5% V/V				
12. DUAL II MAGNUM	700 ML/AC	PRE	99A	99A	99A
NORTRON	3.3 L/AC	PRE			
GOAL	0.1 L/AC	POST1			
GOAL	0.1 L/AC	POST2			
GOAL	0.1 L/AC	POST3			
13. DUAL II MAGNUM	700 ML/AC	PRE	98AB	99A	99A
NORTRON	3.3 L/AC	PRE			
BLAZER	0.03 L/AC	POST1			
+ ASSIST	0.5% V/V				
BLAZER	0.03 L/AC	POST2			
+ ASSIST	0.5% V/V				
BLAZER	0.03 I/AC	POST3			
+ ASSIST	0.5% V/V				
14. DUAL II MAGNUM	700 ML/AC	PRE	99A	99A	99A
PROWL H20	2.7 L/AC	PRE			
NORTRON	3.3 L/AC	PRE			
GOAL	0.1 L/AC	POST1			
GOAL	0.1 L/AC	POST2			
GOAL	0.1 L/AC	POST3			
15. DUAL II MAGNUM	700 ML/AC	PRE	96AB	99A	99A
PROWL H20	2.7 L/AC	PRE			
NORTRON	3.3 L/AC	PRE			
BLAZER	0.03 L/AC	POST1			
+ ASSIST	0.5% V/V				
BLAZER	0.03 L/AC	POST2			
+ ASSIST	0.5% V/V				
BLAZER	0.03 I/AC	POST3			
+ ASSIST	0.5% V/V				
LSD (P <0.05)			9	17	19

Note: Means followed by the same letter are not significantly different (P=0.05, LSD).

Table 6.2. Effect of herbicide treatment on visual injury (7 and 28 days after treatment) and carrot yield.

HERBICIDE	RATE	TIMING	PERCENT INJURY 7D	28D	YIELD T/AC
1. UNTREATED					54A
2. DUAL II MAGNUM	0.7 L/AC	PRE	0B	0B	54A
3. PROWL H20	2.7 L/AC	PRE	0B	0B	67A
4. NORTRON	3.3 L/AC	PRE	0B	0B	53A
5. DUAL II MAGNUM	700 ML/AC	PRE	0B	0B	52A
PROWL H20	3.3 L/AC	PRE			
6. DUAL II MAGNUM	700 ML/AC	PRE	5B	10A	42AB
NORTRON	3.3 L/AC	PRE			
7. DUAL II MAGNUM	700 ML/AC	PRE	18A	20A	38B
PROWL H20	2.7 L/AC	PRE			
NORTRON	3.3 L/AC	PRE			
8. GOAL	0.1 L/AC	POST1	0B	0B	55A
GOAL	0.1 L/AC	POST2			
GOAL	0.1 L/AC	POST3			
9. BLAZER	0.03 L/AC	POST1	1B	0B	58A
+ ASSIST	0.5% V/V				
BLAZER	0.03 L/AC	POST2			
+ ASSIST	0.5% V/V				
BLAZER	0.03 I/AC	POST3			
+ ASSIST	0.5% V/V				
10. DUAL II MAGNUM	700 ML/AC	PRE	0B	0B	38A-E
PROWL H20	3.3 L/AC	PRE			
GOAL	0.1 L/AC	POST1			
GOAL	0.1 L/AC	POST2			
GOAL	0.1 L/AC	POST3			
11. DUAL II MAGNUM	700 ML/AC	PRE	0B	0B	40B
PROWL H20	3.3 L/AC	PRE			
BLAZER	0.03 L/AC	POST1			
+ ASSIST	0.5% V/V				
BLAZER	0.03 L/AC	POST2			

+ ASSIST	0.5% V/V				
BLAZER	0.03 I/AC	POST3			
+ ASSIST	0.5% V/V				
12. DUAL II MAGNUM	700 ML/AC	PRE	3B	8B	49A
NORTRON	3.3 L/AC	PRE			
GOAL	0.1 L/AC	POST1			
GOAL	0.1 L/AC	POST2			
GOAL	0.1 L/AC	POST3			
13. DUAL II MAGNUM	700 ML/AC	PRE	8B	22A	36B
NORTRON	3.3 L/AC	PRE			
BLAZER	0.03 L/AC	POST1			
+ ASSIST	0.5% V/V				
BLAZER	0.03 L/AC	POST2			
+ ASSIST	0.5% V/V				
BLAZER	0.03 I/AC	POST3			
+ ASSIST	0.5% V/V				
14. DUAL II MAGNUM	700 ML/AC	PRE	10A	31A	33B
PROWL H20	2.7 L/AC	PRE			
NORTRON	3.3 L/AC	PRE			
GOAL	0.1 L/AC	POST1			
GOAL	0.1 L/AC	POST2			
GOAL	0.1 L/AC	POST3			
15. DUAL II MAGNUM	700 ML/AC	PRE	12B	30A	26A
PROWL H20	2.7 L/AC	PRE			
NORTRON	3.3 L/AC	PRE			
BLAZER	0.03 L/AC	POST1			
+ ASSIST	0.5% V/V				
BLAZER	0.03 L/AC	POST2			
+ ASSIST	0.5% V/V				
BLAZER	0.03 I/AC	POST3			
+ ASSIST	0.5% V/V				
LSD (P <0.05)			4	8	13

Note: Means followed by the same letter are not significantly different (P=0.05, LSD).

Conclusions: The results presented within are the final year of a long term study to develop an approach to managing linuron-resistant pigweed. The tank mixes of Dual II Magnum with Nortron or Prowl H20 (applied PRE) followed by micro-rates of Goal gave the best control of redroot pigweed, common lambsquarters and crabgrass. Visual injury was observed in those treatments where Nortron was included in the PRE application with either Goal or Blazer micro-rates at 7 and 28 days after treatment. Carrot yields were less than the untreated check in all treatments where Nortron was included in the PRE application. Carrot yield was greatest where the two-way tank mix of Dual II Magnum+Prowl H20 (PRE) were followed by Blazer micro-rates.

Trial 7: **Tolerance of Processing Peas to PRE Applications of Eragon LQ**

Objective: Determine weed control and tolerance of eight processing pea cultivars to PRE applications of Eragon LQ.

Materials & Methods:

Crop: Pea
Variety: various
Planting rate: 300 kg/ha
Row spacing: 18cm
Planting date: May 1/20
Depth: 5 cm

Design: Randomized Complete Block Design
Plot width: 1.5m
Plot length: 10m
Reps: 4

Field Preparation: Worked the field with S-tine cultivator prior to planting. Based on soil test recommendations, pea trials were fertilized with 6-24-24 N-P-K to provide 14 kg/ha actual N and 57 kg/ha of actual P and K.

Soil Description:
Sand: 50%
Silt: 28%
Clay: 22%
OM: 4.1%
pH: 6.2
CEC: 12.4
Texture: Loam
Soil: WATFORD/BRADY

Application Information:

	A
APPLICATION DATE	May-3-2020
TIME OF DAY	6:30AM
TIMING	PRE
AIR TEMP (c)	8
RH (%)	88
WIND SPEED (KPH)	1
SOIL TEMP (c)	8
CROP STAGE	PRE

Spray Equipment:

Application Method: CO2 Backpack
Nozzle Type: AIR INDUCTION
Nozzle Spacing: 50 cm (20")
Spray Volume: 200 L/ha (20 GAL/AC)
Pressure: 207 KPA (30 PSI)
Nozzle Size: ULD120-02
Boom Width: 1.5 m (60")

Table 7.1. Effect of pea cultivar and Eragon rate on pea percent injury 7, 14 and 28 days after application.

CULTIVAR	ERAGON RATE (ML/AC)	VISUAL INJURY 7 DAT	14 DAT	28 DAT
1. RICCO	30	1A	1A	0A
	60	0A	1A	0A
2. PAO 826	30	0A	0A	0A
	60	0A	0A	3A
3. LIL MO	30	0A	0A	0A
	60	0A	0A	0A
4. CONCEPT	30	1A	0A	0A
	60	4A	4A	0A
5. TYNE	30	0A	1A	4A
	60	6A	4A	4A
6. SHERWOOD	30	1A	1A	3A
	60	3A	6A	1A
7. RELIANCE	30	0A	0A	2A
	60	2A	3A	4A
8. SWEET SAVOUR	30	1A	1A	3A
	60	2A	5A	4A
LSD (P <0.05)		6	6	4

Note: None of the means were significantly different from one another (P=0.05, LSD).

Table 7.2. Effect of pea cultivar and Eragon rate on pea tenderometer readings (PSI) and marketable yield (T/AC).

CULTIVAR	ERAGON RATE (L/AC)	TENDEROMETER PSI	YIELD (T/AC)
1. RICCO	0	98	5.6
	30	99	6.2
	60	98	5.7
2. PAO 826	0	103	2.0
	30	101	2.9
	60	105	2.8
3. LIL MO	0	117	2.5
	30	119	3.5
	60	118	3.2
4. CONCEPT	0	103	2.5
	30	108	2.9
	60	101	2.8
5. TYNE	0	104	2.2
	30	108	2.9
	60	98	3.0
6. SHERWOOD	0	102	1.6
	30	108	2.2
	60	105	2.2
7. RELIANCE	0	100	3.4
	30	101	3.7
	60	102	3.9
8. SWEET SAVOUR	0	97	3.4
	30	98	3.9
	60	96	3.7
LSD (P <0.05)		NS	NS

Note: Means followed by the same letter are not significantly different (P=0.05, LSD).

Conclusions:
This trial was established to test for tolerance of eight pea cultivars ('Ricco', 'PAO 826', 'Lil Mo', 'Concept', 'Tyne', Sherwood', 'Reliance', and 'Sweet Savour') to preemergence applications of Eragon at rates of 25 and 50 g/ac. Pea tenderness at harvest was rated using a tenderometer and final yield adjusted based on tenderometer readings. In addition, the level of weed control was rated in each treatment.

Visible injury was less than 10% in all pea cultivars at both rates of Eragon at all three rating intervals (7, 14 and 28 days after emergence). Injury symptoms were included slight leaf puckering. Pea tenderness ratings were all similar to the untreated check, an indication that pea maturity was not negatively affected. Finally, pea yield in all cultivars was similar to the untreated check. There was a tendency for pea yield to be slightly greater in the plots that had received herbicide treatment, associated with the presence of weeds competing for resources with the crop.

Trial 8: **Tolerance of Processing Peas to PRE Applications of Reflex**

Objective: Determine weed control and tolerance of eight processing pea cultivars to PRE applications of Reflex.

Materials & Methods:

Crop: Pea
Variety: various
Planting rate: 300 kg/ha
Row spacing: 18cm
Planting date: May 1/20
Depth: 5 cm

Design: Randomized Complete Block Design
Plot width: 1.5m
Plot length: 10m
Reps: 4

Field Preparation: Worked the field with S-tine cultivator prior to planting. Based on soil test recommendations, pea trials were fertilized with 6-24-24 N-P-K to provide 14 kg/ha actual N and 57 kg/ha of actual P and K.

Soil Description:
Sand: 50%
Silt: 28%
Clay: 22%
OM: 4.1%
pH: 6.2
CEC: 12.4
Texture: Loam
Soil: WATFORD/BRADY

Application Information:

	A
APPLICATION DATE	May-3-2020
TIME OF DAY	6:30AM
TIMING	PRE
AIR TEMP (c)	8
RH (%)	88
WIND SPEED (KPH)	1
SOIL TEMP (c)	8
CROP STAGE	PRE

Spray Equipment:

Application Method: CO2 Backpack
Nozzle Type: AIR INDUCTION
Nozzle Spacing: 50 cm (20")
Spray Volume: 200 L/ha (20 GAL/AC)
Pressure: 207 KPA (30 PSI)
Nozzle Size: ULD120-02
Boom Width: 1.5 m (60")

Table 8.1. Effect of pea cultivar and Reflex rate on pea percent injury 7, 14 and 28 days after application.

CULTIVAR	Reflex RATE (L/AC)	VISUAL INJURY 7 DAT	14 DAT	28 DAT
1. RICCO	0.4	1B	1B	0B
	0.8	0B	1B	0B
2. PAO 826	0.4	0B	0B	0B
	0.8	0B	0B	3B
3. LIL MO	0.4	0B	0B	0B
	0.8	0B	0B	0B
4. CONCEPT	0.4	1B	0B	0B
	0.8	4A	4A	0B
5. TYNE	0.4	0B	1B	4AB
	0.8	6A	10A	14A
6. SHERWOOD	0.4	1B	1B	6AB
	0.8	5A	6A	17A
7. RELIANCE	0.4	0B	0B	2B
	0.8	2AB	3AB	4AB
8. SWEET SAVOUR	0.4	1B	1B	11A
	0.8	2AB	5A	10A
LSD (P <0.05)		5	5	9

Note: None of the means were significantly different from one another (P=0.05, LSD).

Table 8.2. Effect of pea cultivar and Reflex rate on pea tenderometer readings (PSI) and marketable yield (T/AC).

CULTIVAR	REFLEX RATE (L/AC)	TENDEROMETER PSI	YIELD (T/AC)
1. RICCO	0	96	3.6A
	0.4	92	3.2A
	0.8	98	3.9A
2. PAO 826	0	104	2.4A
	0.4	104	2.5A
	0.8	107	2.8A
3. LIL MO	0	115	2.5A
	0.4	116	3.0A
	0.8	108	3.3A
4. CONCEPT	0	111	2.7A
	0.4	108	2.7A
	0.8	101	2.8A
5. TYNE	0	107A	3.2A
	0.4	105A	2.7AB
	0.8	98B	2.2B
6. SHERWOOD	0	111A	2.6A
	0.4	108A	2.0AB
	0.8	99B	1.7B
7. RELIANCE	0	100A	2.9A
	0.4	101A	3.7A
	0.8	100A	4.0A
8. SWEET SAVOUR	0	94A	3.7A
	0.4	94A	2.7B
	0.8	84B	2.0C
LSD (P <0.05)		3	0.7

Note: Means followed by the same letter are not significantly different (P=0.05, LSD).

Conclusions:
This trial was established to test for tolerance of eight pea cultivars ('Ricco', 'PAO 826', 'Lil Mo', 'Concept', 'Tyne', Sherwood', 'Reliance', and 'Sweet Savour') to preemergence applications of Reflex® at rates of 47 and 94 g/ac. Pea tenderness at harvest was rated using a tenderometer and final yield adjusted based on tenderometer readings. In addition, the level of weed control was rated in each treatment.

Visible injury was less than 10% in most pea cultivars at both rates of Reflex, except Tyne, Sherwood and Sweet Savour, which showed 14, 17 and 10% visual injury at 28 days after emergence (DAE), respectively. Injury symptoms included leaf puckering and shortened midribs (drawstringing). Corresponding to the injury in these three cultivars, pea tenderness ratings decreased relative to the untreated check, an indication that pea maturity was potentially slowed by the herbicide in these cultivars. Finally, pea yield decreased at the 0.8 L/ac rate of Reflex in Tyne, Sherwood and Sweet Savour. Additional work should be done to confirm these results, as it appears that Reflex may have the potential to injure some pea cultivars.

NEW YORK STATE 2020 PROCESSING PEA CULTIVAR TRIAL REPORT

Michael Rosato - Research Support Specialist, Horticulture Section
Cornell AgriTech (NYSAES) - Cornell University, Geneva, New York

Stephen Reiners – Professor and Chair, Horticulture Section
Cornell AgriTech (NYSAES) - Cornell University, Geneva, New York

We wish to thank the NYS Vegetable Research Council and Association and cooperating seed companies for their financial support of the project. We wish to thank Mr. Buzz Lowe of Farm Fresh First for his assistance in planning the trials. Also, a special thank you to our only two employees, Kim Day and Carla Yannotti, for their assistance in day to day operations during this challenging year

Table of Contents

*Contact information – Michael Rosato, email: mwr54@cornell.edu , office: (315) 787-2223

Procedure & Materials

Location: Cornell AgriTech Farm, Geneva - soil type – silt loam. **Tillage** – Conventional. **Fertilizer:** broadcast 400 lb/A of 8-14-21 and worked in. **Planter** – Modified Hege 80 (cone type). **Planting Date** – 5/15. Picking started on 6/30 and we finished on 7/16. **Herbicide** - Dual directly after planting. **Plot Size:** 7 rows by 30 ft. **Row Width:** 6 inches, Row length: 30 ft. **In-row Spacing:** All cultivars were adjusted (seed planted) to 100% germination. Our processor has asked us to shoot for 600,000 plants per acre for early, 570,000 for second early and 550,000 plants per acre for the rest. **Insecticide** – none. **Experimental Design** – Randomized split block design, 4 replications (3 replications were harvested, and another was left for demonstration). **Model TG4EI Integrating Texturegage** – measure for maturity.

The objective of this trial was to compare a number of normal leaf and afila type pea varieties for yield and other quality characteristics. This was accomplished in cooperation with the pea processor in New York in an attempt to find new, higher quality, and disease resistant varieties that are adapted to our climate and soil conditions. Evaluation of processed product was held on 11/19 for processing and seed company representatives.

Yield of seven rows by 5 feet per replication (35 Row feet) was obtained by pulling the plants and hand picking the pods. Two harvests were made if possible, to plot yield increase and also tenderometer reading increase. A target tenderometer value of 110 was used for the final harvest. A stationary sheller was used to remove berries from the harvested pods. Tenderometer readings were taken on each replication and averaged for the report. Pea berries were hand sieved with Seedburo hand testing screens. See following table for details.

Table 1. Sieve size diameters.

Sieve Size	Diameter of circular Opening in MM (inches) Will not pass through	Will pass through
1	6.35 (16/64)	7.1 (18/64)
2	7.1 (18/64)	7.9 (20/64)
3	7.9 (20/64)	8.7 (22/64)
4	8.7 (22/64)	9.5 (24/64)
5	9.5 (24/64)	10.3 (26/64)
6	10.3 (26/64)	11.1 (28/64)

Temperature and Moisture Conditions

Soil conditions were decent at planting. The day after planting, we received about 0.5 inches of rain in about 2 hours. The intense rain event, followed by dry hot weather, formed a shallow crust layer. Lack of moisture after planting, and a thin crust layer, delayed emergence and led to some spotty patches in plots. About a week and a half after planting we irrigated to help break up crust and irrigated again around widespread flower development. Drought and heat were the main elemental factors during the growing season. High heat and low moisture seemed to impact yield, especially with the early varieties and caused mid/late season varieties to have a short harvest window. See the weather insert at the end of the summary for a breakdown of temperatures and precipitation over the growing season.

Table 2 - Cultivar List and Maturity From Seed Source

Cultivar	GDD (40F)	Seed Source	Leaf Type	Seed Treatment	Seed Count/lb	Germ. %	Sieve index	Node to blossom
Spring	1050	Pureline	normal leaf	maxim, Apron, Cruiser	2013	93	3.9	8 to 9
Eldorado	1100	Pureline	normal leaf	Vibrance/LSV	1960	90	3.8	9 to 10
Sherwood	1160	Seminis	normal leaf	allegiance, captan, cruiser	2400	99	3.3	9 to 10
EXP461	1260	Brotherton	afila	maxim, ipoconazoleapron, cruiser	2400	95	3.3	10 to 11
GVS1703	1230	GV	n/a	n/a	n/a	99	n/a	10
CS-455AF	1355	Crites	afila	maxim, Apron, Cruiser	2100	99	3.7	10
Portage	1305	Crites	afila	Maxim/Apron XL	2032	99	3.8	8 to 11
BSC905	1370	Brotherton	normal leaf	maxim, ipoconazoleapron, cruiser	4700	97	1.3	12
GVS518	1350	GV	afila	maxim, Apron, Cruiser	2502	96	3.8	9 to 11
SV8112QH	1430	Seminis	Det afila	A, C, Cr	2270	99	3.1	10 to 13
Nitro	1370	Seminis	normal leaf	allegiance, captan, cruiser	4800	98	2	13 to 14
CS-494DAF	1470	Crites	afila	maxim, Apron, Cruiser	2800	97	3.1	12 to 13
DA 1470	1470	Seminis	Det afila	A, C, Cr	2895	100	3.2	12 to 15
BSC599	1620	Brotherton	afila	maxim, ipoconazoleapron, cruiser	2600	95	4.1	14 to 17
CS-464DAF	1565	Crites	afila	maxim, Apron, Cruiser	2400	99	3.7	15
Ricco	1530	GV	afila	maxim, Apron, Cruiser	2265	97	3.7	12 to 15
BSC712	1530	Brotherton	afila	Maxim/Apron XL	2300	96	4.4	13 to 15
98-326	1400	Pureline	afila	Vibrance/LSV	2873	95	2.9	16 to 18
SV0823QG	1525	Seminis	afila	allegiance, captan, cruiser	2600	95	3.3	17
PLS196	1580	Pureline	afila	maxim, Apron, Cruiser	2302	93	3.6	11 to 16
Dancer	1460	Pureline	afila	maxim, Apron, Cruiser	2592	95	3	10 to 13
SV5685QG	1750	Seminis	normal leaf	allegiance, captan, cruiser	2436	95	3.4	18 to 21

Table 3. Plant Characteristics

Cultivar	Plant Stand Rating	GDD to full flower	Root Rot Rating	Plant Habit Rating (Harvest)	Yield Rating	Overall Rating
Spring	2.5	782	5.0	2.5	2.8	3.2
Eldorado	2.5	823	5.0	2.5	3.0	3.3
Sherwood	3.0	823	5.0	3.0	2.9	3.5
EXP461	3.0	883	5.0	3.5	4.3	4.0
GVS1703	3.0	883	5.0	2.5	3.2	3.4
CS-455AF	4.0	915	5.0	4.5	5.0	4.6
Portage	4.0	915	5.0	4.5	4.1	4.4
BSC905	2.5	1023	5.0	3.0	2.7	3.3
GVS518	4.0	1023	5.0	3.5	3.0	3.9
SV8112QH	3.5	1087	5.0	4.5	2.1	3.8
Nitro	2.5	1087	5.0	3.5	3.5	3.6
CS-494DAF	3.5	1114	5.0	4.0	2.2	3.7
DA 1470	3.5	1114	5.0	4.3	2.7	3.9
BSC599	3.5	1146	5.0	3.8	4.3	4.1
CS-464DAF	3.5	1146	5.0	3.0	4.0	3.9
Ricco	4.0	1146	5.0	2.5	4.5	4.0
BSC712	3.5	1175	5.0	2.5	4.2	3.8
98-326	3.5	1175	5.0	2.5	3.0	3.5
SV0823QG	3.5	1175	5.0	4.0	3.4	4.0
PLS196	4.0	1208	5.0	2.5	4.2	3.9
Dancer	3.5	1208	5.0	2.5	4.5	3.9
SV5685QG	3.5	1341	5.0	3.0	2.5	3.5

* Scale: 1 worst, 5 best

* Adjusted yield, from table 4, was used to calculate yield rating

*Overall rating is an average from plant stand, root rot rating, plant habit at harvest and yield rating

Table 4. Maturity Sieve Distribution and Yield - (in order of maturity)

Cultivar	Days to harv.	GDD	% Sieve >1	% Sieve 1	% Sieve 2	% Sieve 3	% Sieve 4	% Sieve 5	% Sieve 6	% 6> Sieve	Sieve size index	Ten.	Berry Yield (lbs/A)	Berry Yield (tons/A)	Adjusted Yield Based on 110 TU	Adjusted Tons/Acre (110 TU)	Plants per A (1000)	Plts. per foot
Spring	46	1270	0	1	1	5	21	39	30	1	4.9	118	4248	2.1	3993	1.9	416	4.8
Eldarado	46	1302	1	1	3	12	25	50	8	1	4.5	117	4456	2.2	4233	2.1	356	4.1
Eldarado	47	1341	0	1	2	7	20	58	12	1	4.7	126	4057	2.0	3651	1.8	310	3.6
Sherwood	46	1302	1	1	2	10	29	47	11	1	4.5	125	4547	2.3	4138	2.1	452	5.2
Sherwood	47	1341	0	0.5	1	5	23	51	18	1	4.8	149	4792	2.4	4025	2.0	445	5.1
EXP461	48	1341	3	8	14	30	39	5	1	0	3.2	94	3879	1.9	4965	2.5	489	5.6
EXP461	49	1378	7	10	14	27	28	10	5	0	3.3	104	5708	2.9	6050	3.0	511	5.9
GVS1703	47	1302	1	4	9	25	40	17	1	0	3.6	87	3410	1.7	5354	2.7	360	4.1
GVS1703	48	1341	1	3	6	16	43	26	3	1	3.9	100	3808	1.9	4303	2.2	334	3.8
GVS1703	49	1378	2	3	6	16	34	35	4	1	4.1	114	4734	2.4	4545	2.3	364	4.2
CS-455AF	48	1341	2	3	6	21	42	20	2	0	3.8	94	4787	2.4	6127	3.1	462	5.3
CS-455AF	49	1378	0	1	3	16	40	36	4	0	4.2	113	7327	3.7	7107	3.6	490	5.6
Portage	49	1378	7	8	11	19	26	20	7	0	3.7	95	7239	3.6	9049	4.5	461	5.3
Portage	50	1415	0.5	1	3	16	40	36	4	0	4.2	113	5928	3.0	5750	2.9	427	4.9
BSC905	49	1378	7	20	36	27	9	0.5	0	0	2.3	104	3568	1.8	3782	1.9	427	4.9
BSC905	50	1415	4	12	29	43	10	2	1	0	2.6	130	4070	2.0	3622	1.8	364	4.2
GVS518	50	1415	2	3	11	27	44	11	2	0	3.6	90	3277	1.6	4653	2.3	488	5.6
GVS518	51	1450	2	2	6	21	46	22	2	0	3.9	100	4319	2.2	4880	2.4	455	5.2
GVS518	52	1487	2	2	4	16	43	30	3	0.5	4.1	113	4397	2.2	4265	2.1	474	5.4
SV8112QH	52	1487	1	3	7	28	38	19	3	0	3.7	108	2867	1.4	2924	1.5	387	4.4

Table 4. Maturity Sieve Distribution and Yield - (in order of maturity) Continued

Cultivar	Days to harv.	GDD	% Sieve >1	% Sieve 1	% Sieve 2	% Sieve 3	% Sieve 4	% Sieve 5	% Sieve 6	% 6> Sieve	Sieve size index	Ten.	Berry Yield (lbs/A)	Berry Yield (tons/A)	Adjusted Yield Based on 110 TU	Adjusted Tons/Acre (110 TU)	Plants per A (1000)	Plts. per foot
Nitro	51	1450	9	30	37	17	2	1	0.5	0	2.0	87	2460	1.2	3862	1.9	368	4.2
Nitro	52	1487	3	15	38	31	5	1	0	0	2.3	97	2875	1.4	3421	1.7	329	3.7
Nitro	53	1526	3	9	26	52	7	0.5	0	0	2.6	108	4891	2.5	4989	2.5	351	4.0
CS-494DAF	53	1526	2	4	14	35	31	6	1	0	3.3	94	2692	1.4	3446	1.7	428	4.9
CS-494DAF	54	1563	6	3	11	37	38	12	2	0.5	3.5	113	3207	1.6	3111	1.6	442	5.1
DA 1470	53	1526	1	2	6	25	44	17	4	0	3.8	95	3414	1.7	4268	2.1	453	5.2
DA 1470	54	1563	2	2	5	16	41	32	7	1	4.1	107	3659	1.8	3769	1.9	415	4.8
BSC599	54	1563	2	2	6	9	20	51	15	2	4.5	129	6845	3.4	6092	3.0	565	6.5
CS-464DAF	55	1604	1	1	3	16	39	29	5	0.5	4.2	116	5912	3.0	5616	2.8	456	5.2
CS-464DAF	56	1645	1	1	3	13	40	34	6	0	4.2	141	6202	3.1	5272	2.6	421	4.8
Ricco	54	1563	1	2	6	17	38	32	2	0	4.0	102	5808	2.9	6331	3.2	519	6.0
Ricco	55	1604	2	2	5	15	33	41	6	1	4.2	110	6459	3.2	6459	3.2	511	5.9
BSC712	54	1563	2	3	6	16	37	36	5	1	4.1	107	5800	2.9	5974	3.0	510	5.9
BSC712	55	1604	0.5	0	1	10	32	44	6	1	4.5	139	6654	3.3	5722	2.9	511	5.9
98-326	55	1604	2	6	23	48	16	1	0.5	0	2.8	106	3962	2.0	4120	2.0	451	5.2
98-326	56	1645	2	7	18	51	21	1	0	0	2.9	122	4617	2.3	4248	2.1	490	5.6
SV0823QG	57	1682	1	2	6	19	43	26	3	1	3.9	127	5314	2.7	4783	2.4	461	5.3

Table 4. Maturity Sieve Distribution and Yield - (in order of maturity) Continued

Cultivar	Days to harv.	GDD	% Sieve >1	% Sieve 1	% Sieve 2	% Sieve 3	% Sieve 4	% Sieve 5	% Sieve 6	% 6> Sieve	Sieve size index	Ten.	Berry Yield (lbs/A)	Berry Yield (tons/A)	Adjusted Yield Based on 110 TU	Adjusted Tons/Acre (110 TU)	Plants per A (1000)	Plts. per foot
PLS196	55	1604	2	4	7	24	39	17	0.5	0	3.7	84	4858	2.4	8842	4.4	510	5.9
PLS196	56	1645	2	3	6	18	42	27	2	0	3.9	92	5796	2.9	7767	3.9	480	5.5
PLS196	57	1682	1	3	5	14	42	31	3	0	4.0	110	5932	3.0	5932	3.0	464	5.3
Dancer	55	1604	2	6	18	37	25	6	1	0	3.1	87	3862	1.9	6063	3.0	468	5.4
Dancer	56	1645	2	5	11	36	36	4	0.5	0	3.3	88	4734	2.4	7148	3.6	478	5.5
Dancer	58	1717	1	2	5	20	47	24	2	0	3.9	112	6505	3.3	6375	3.2	485	5.6
SV5685QG	61	1810	1	2	5	9	17	36	29	3	4.7	89	2995	1.5	4373	2.2	427	4.9
SV5685QG	62	1844	1	2	3	7	15	31	31	6	4.8	105	3410	1.7	3581	1.8	481	5.5

Explanation for Headings in Table 4:

Days to Harvest - Number of days from planting until day of harvest.

Growing Degree Days (GDD) - Accumulation of heat units (base 40 degree F.) from planting until harvest.

Average sieve percentage - Berries were hand sieved with Seedburo screens. The table on the title page describes the size of the various sieves.

Sieve Size index - Sieve size index reflects the mean sieve size of the variety at harvest.

Tenderometer measurement - A model TG4EI Integrating Texturegage was used to determine the tenderometer units of each harvested plot. The average of the three harvested plots per cultivar was listed.

Yield lbs/A - Pounds per acre was determined by extrapolating the total weight of the berries per plot to obtain lbs per acre. Harvest plot was 7 rows by 5 ft in length or 35 row feet. (43560 sq ft/A/.5 ft = 87,120 row ft per acre. 87120 row ft /A divided by 35 harvested row ft gives a factor of 2489. This factor was multiplied by total berry weight harvested per plot to obtain lbs per acre.

Yield - Tons per acre - The weight of the harvested berries was extrapolated to tons per acre.

Adjusted Yield lbs/acre - A corrigation factor was used to adjust yield based on a tenderometer reading of 110. For example, if a sample read 90 Tenderometer Units, we would then multiple the yield by a corrigation factor of 1.42. Please see corrigation factors in Table 7.

Plants/foot - Total number of plants harvested was divided by the 35 row feet harvested to arrive at plants per foot.

Plant population per acre - An extrapolation of the number of harvested plants to plants per acre.

Table 5. Plant and Pod Characteristics (in order of maturity)

Cultivar	Node to first flower	Vine length avg. (in)	Ht. at harvest (in)	Pods per plant (avg.)	Avg. # nodes w/ pods/plt.	# of Single pods/ node	# of Double pods/ node	# Triple pods/ node	% of Single pods/ node	% of Double pods/ node	% of Triple pods/ node	Berries per pod (avg.)	Pod length (in)
Spring	7-8	16.3	7 to 9	2.9	2.6	2.3	0.3	0.0	88	12	0	6.6	2.75 to 3
Eldarado	8-9	19.9	8 to 11	3.4	3.3	3.2	0.07	0.0	98	2	0	6.8	2.5 to 3
Sherwood	8-9	14.25	8 to 11	2.8	2.5	2.1	0.3	0.0	88	12	0	6	2 to 3
EXP461	8-10	14.3	8 to 10	3.6	2.4	1.3	1.1	0.0	53	47	0	7.1	2.5 to 3
GVS1703	7-8	11.2	8 to 10	3.7	2.6	1.4	1.2	0.0	55	45	0	7.3	2.5 to 3
CS-455AF	7-8	11.1	10 to 11	3.1	2.0	1.0	0.9	0.1	50	44	6	5.4	2.5 to 3
Portage	8-10	15	10 to 11	3.2	1.9	0.8	0.9	0.2	44	46	10	6.8	2.5 to 3
BSC905	7-9	11.4	7 to 10	3.3	2	0.9	1.1	0.1	43	52	5	8.4	2.75 to 3
GVS518	9-11	15	6 to 9	3.5	2.4	1.3	1.1	0	53	47	0	7.8	3.5 to 4
SV8112QH	10-13	14	9 to 12	2.7	1.8	1	0.8	0.1	54	42	4	7	3.25 to 3.75
Nitro	10-13	15.3	7 to 10	4.4	2.2	0.6	1.1	0.5	28	48	24	8.5	2.5 to 3
CS-494DAF	10-11	13.6	8 to 12	3.2	2.1	1.1	0.9	0.1	53	42	5	7.7	2.75 to 3
DA1470	10-12	16.1	11 to 14	3	2.1	1.2	0.8	0.1	58	39	3	6.8	3 to 3.5
BSC599	12-15	19.3	8 to 12	2.8	1.9	1.1	0.9	0	55	45	0	7.9	3 to 3.5
CS-464DAF	12-14	21.1	12 to 14	3.1	2	1.1	0.7	0.2	55	37	8	8.25	3 to 3.25
Ricco	10-13	16.1	7 to 9	3.1	2.1	1.1	1	0	52	48	0	7.3	3 to 3.5
BSC7120	10-13	21.1	10 to 12	2.7	1.9	1.1	0.6	0.1	61	34	5	7.3	2.5 to 3.5
98-326	12-13	19.5	10 to 14	5.2	2.7	0.8	1.4	0.6	28	51	21	8	2.25 to 2.75
SV0823QG	11-14	20.2	12 to 14	3.4	2.1	1.1	0.8	0.2	50	39	11	8	3
PLS196	12-13	18.7	8 to 10	3.1	2	0.9	1.1	0	43	57	0	8.4	3 to 3.5
Dancer	11-14	19.3	9 to 13	3.1	1.8	0.7	1	0.2	37	54	9	8.75	3 to 3.5
SV5685QF	17-20	21.5	10 to 12	3.5	2.2	1.1	0.9	0.2	50	39	11	8.5	3 to 4.5

Explanation for Headings in Table 5.

This data was derived from 30 plants harvested the same day as our yield harvest that was closest to our objective of 110 tenderometer unit reading. Example – Variety X was harvested twice at tenderometer readings of 99 and 116. The afternoon of the second harvest (116 units), 30 plants were harvested from the back of the plot, weighed and pods were hand stripped and berries were hand shelled.

Node to first flower - The average number of nodes on the stem until the first flower (included that one or two at the soil line or below).

Height at Harvest – Height was measured day of optimal harvest.

Pods per plant - The total number of pods was divided by 30 (number of plants) to determine average pods per plant.

Average Number of nodes with pods per plant - The number of nodes that had pods were counted and recorded.

Number and percentage of single pods, double pods or triple pods per node - The number of pods per node were hand counted and the number of single pods, double pods and triple pods were recorded. This was changed to a percentage.

Berries per pod – Ten uniform pods were selected and opened. The range of berries per pod in this group was listed.

Pod length - An average of 10 pods were lined up and measured in inches. If they were very uniform, a single number was listed, if not a range was listed.

Table 6. Maturity

Tenderometer unit measurement (Days after planting, gray area indicates prime harvest dates)

Cultivar	Day 46 1270 GDD 6/30	Day 47 1303 GDD 7/01	Day 48 1341 GDD 7/02	Day 49 1378 GDD 7/03	Day 50 1415 GDD 7/04	Day 51 1450 GDD 7/05	Day 52 1487 GDD 7/06	Day 53 1526 GDD 7/07	Day 54 1563 GDD 7/08	Day 55 1604 GDD 7/09	Day 56 1645 GDD 7/10	Day 57 1682 GDD 7/11	Day 58* 1717 GDD 7/12	Day 61* 1810 GDD 7/15	Day 62 1844 GDD 7/16
Spring	118														
Eldorado	117	126													
Sherwood	125	149													
EXP461			94	104											
GVS1703			101	114											
CS-455AF			95	113											
Portage				95	113										
BSC905						104	130								
GVS518						100	113								
SV8112QH							108								
Nitro							97	108							
CS-494DAF								94	113						
DA 1470								95	108						
BSC599									129						
CS-464DAF										116					
Ricco								102	110						
BSC712									108	139					
98-326										106	122				
SV0823QG												128			
PLS196											92	110			
Dancer											88		112		
SV5685QG														89	105

*Growing degree days (GDD) base 40F
*Note gap between day 58 and day 61

Table 7. Weather Summary and 110 Tenderometer Chart

Day	day	Max. Temp.	Min. Temp.	Mean Temp.	Precip.	Acc Precip.	Degree days base 40	acc dd units base 40	Ten. Units	Corrigation factor for Yield
5/14/18	1	64	37	50	0.04	0.04	10	10	80	2.33
5/15/18	2	79	53	63	0.56	0.6	26	36	81	2.18
5/16/18	3	62	46	55	0	0.6	15	51	82	2.05
5/17/18	4	69	42	56	0.05	0.65	16	67	83	1.93
5/18/18	5	58	55	56	0.19	0.84	16	83	84	1.82
5/19/18	6	69	54	61	0	0.84	22	105	85	1.72
5/20/18	7	70	49	60	0	0.84	20	125	86	1.64
5/21/18	8	74	44	60	0	0.84	19	144	87	1.57
5/22/18	9	75	54	66	0	0.84	24	168	88	1.51
5/23/18	10	77	60	68	0.15	0.99	29	197	89	1.46
5/24/18	11	78	59	67	0	0.99	28	225	90	1.42
5/25/18	12	83	63	72	0	0.99	33	258	91	1.38
5/26/18	13	88	63	77	0	0.99	36	294	92	1.34
5/27/18	14	83	66	75	0	0.99	35	329	93	1.31
5/28/18	15	79	66	72	0.01	1	32	361	94	1.28
5/29/18	16	84	59	71	0.06	1.06	35	396	95	1.25
5/30/18	17	68	50	60	0	1.06	20	416	96	1.22
5/31/18	18	58	42	51	0	1.06	9	425	97	1.19
Total Precipitation May				**---->**	**1.06 inches**		**425 GDD**	**425 GDD**		

Table 7. Weather Summary and 110 Tenderometer Chart Continued										
Day	day	Max. Temp.	Min. Temp.	Mean Temp.	Precip.	Acc Precip.	Degree days base 40	acc dd units base 40	Ten. Units	Corrigation factor for Yield
6/1/18	19	68	44	57	0	0	16	441	98	1.17
6/2/18	20	67	57	62	0.11	0.11	22	463	99	1.15
6/3/18	21	77	60	68	0.12	0.23	29	492	100	1.13
6/4/18	22	86	60	72	0	0.23	33	525	101	1.11
6/5/18	23	87	65	75	0.01	0.24	35	560	102	1.09
6/6/18	24	77	60	71	0	0.24	30	590	103	1.07
6/7/18	25	68	53	61	0	0.24	21	611	104	1.06
6/8/18	26	75	48	63	0	0.24	21	632	105	1.05
6/9/18	27	89	57	73	0	0.24	33	665	106	1.04
6/10/18	28	90	65	78	0	0.24	38	703	107	1.03
6/11/18	29	79	65	71	0.02	0.26	32	735	108	1.02
6/12/18	30	70	51	63	0	0.26	21	756	109	1.01
6/13/18	31	59	45	52	0	0.26	13	769	110	1.00
6/14/18	32	66	41	54	0	0.26	13	782	111	0.99
6/15/18	33	73	44	59	0	0.26	18	800	112	0.98
6/16/18	34	78	47	64	0	0.26	23	823	113	0.97
6/17/18	35	84	53	69	0	0.26	28	851	114	0.96
6/18/18	36	85	58	71	0	0.26	32	883	115	0.96
6/19/18	37	83	62	73	0	0.26	32	915	116	0.95
6/20/18	38	87	62	75	0	0.26	35	950	117	0.95
6/21/18	39	86	64	77	0	0.26	35	985	118	0.94
6/22/18	40	89	67	77	0.35	0.61	38	1023	119	0.94
6/23/18	41	86	66	74	0.03	0.64	36	1059	120	0.93
6/24/18	42	75	61	68	0	0.64	28	1087	121	0.93
6/25/18	43	77	59	67	0.22	0.86	27	1114	122	0.92
6/26/18	44	81	62	72	0	0.86	32	1146	123	0.92
6/27/18	45	78	61	70	0.3	1.16	29	1175	124	0.91
6/28/18	46	79	67	73	0.28	1.44	33	1208	125	0.91
6/29/18	47	82	65	73	0	1.44	33	1241	126	0.90
6/30/18	48	74	64	68	0	1.44	29	1270	127	0.90
Total Precipitation June				**---->**	**1.44 inches**		**845 GDD**	**1270 GDD**		

Table 7. Weather Summary and 110 Tenderometer Chart										
Day	day	Max. Temp.	Min. Temp.	Mean Temp.	Precip.	Acc Precip.	Degree days base 40	acc dd units base 40	Ten. Units	Corrigation factor for Yield
7/1/18	49	81	62	72	0	0	32	1302	128	0.89
7/2/18	50	91	67	80	0	0	39	1341	129	0.89
7/3/18	51	85	70	78	0	0	37	1378	130	0.89
7/4/18	52	86	67	76	0.01	0.01	37	1415	131	0.88
7/5/18	53	89	61	76	0	0.01	35	1450	132	0.88
7/6/18	54	90	64	78	0	0.01	37	1487	133	0.88
7/7/18	55	88	69	78	0	0.01	39	1526	134	0.87
7/8/18	56	85	69	76	0.12	0.13	37	1563	135	0.87
7/9/18	57	94	69	81	0	0.13	41	1604	136	0.87
7/10/18	58	89	72	79	0.03	0.16	41	1645	137	0.86
7/11/18	59	85	70	74	1.14	1.3	37	1682	138	0.86
7/12/18	60	82	68	74	0	1.3	35	1717	139	0.86
7/13/18	61	75	64	69	0.18	1.48	29	1746	140	0.86
7/14/18	62	80	63	70	0	1.48	31	1777	141	0.85
7/15/18	63	85	60	73	0	1.48	33	1810	142	0.85
7/16/18	64	79	69	72	0.99	2.47	34	1844	143	0.85
Total Precipitation July				**---->**	**2.47 inches**		**574 GDD**	**1844 GDD**		

Descriptions Provided by the Seed Source

Spring *– Seminis, normal leaf, 1050 heat units, 4.5 average sieve size, 9 nodes to flower, 1-2 pods per plant, 6-7 berries per pod, 16 inch plant height, resistance to Fusarium wilt race 1.*

Eldorado *– Pure Line, normal leaf type, 3.8 sieve size, -1 days to maturity relative to Spring, 1100 heat units, resistant to Fusarium race 1 and powdery mildew.*

Sherwood *– Seminis, normal leaf, 1160 heat units, 3.3 sieve size, IR: PV, HR: BYMV/FOP:1*

EXP 461 *– Brotherton, afila leaf type, 1260 heat units, 59 days to maturity, 3.5 average sieve size.*

GVS1703 *– Gallatin Valley, heat units 1230*

CS-455AF *– Crites, 1270 heat units to maturity, aflia leaf type, disease resistance: Fop 1, Pv+, 2 days earlier than Portage, good root system.*

Portage *– Crites, midseason maturity, 60 days to maturity or approximately 1325 heat units (+ 2 days relative to Tomahawk), afila leaf type, 18 inch plant height, 10 nodes to first bloom, 2-3 pods per node, 7-8 peas per pod, 3.7 sieve size index, resistant to fusarium wilt race 1.*

BSC905 *– Brotherton, normal leaf, 1370 Heat Units, 65 days to maturity, 1.3 sieve size*

GVS 518 *– Gallatin Valley, Mid-season Afila type, 67 days to maturity, 1350 heat units, 12-13 nodes to first flower, plant height 25", avg. 2 pods per node, avg. sieve size is 3.8, pointed pod shape.*

SV8112QH *– Seminis, Sweet Savor gene type, Determinate afila leaf type, Sweet Savor gene type, 1430 heat units, Similar maturity as Reliance but Reliance not sweet savor, 3.1 average sieve size, good disease package.*

Nitro *– Seminis, 1370 heat units, normal leaf, 2 sieve size, HR: BYMV/FOP*

494DAF *– Brotherton, afila leaf type, 1590 heat units, 71 days to maturity, 2.8 average sieve size, small sieve size class.*

DA 1470 (EX08540794) *– Seminis, 1470 heat units, determinate afila type, 3.2 average sieve size, 2-3 pods per node, 8-9 berries per pod, 18 inch plant height, HR for Fusarium R1 and bean yellow mosaic virus. Sweet savor gene which slows conversion of sugar to starch, true determinate plant type which allows for improved sieve distribution and less waste at harvest from immature fruit.*

BSC599 *– Brotherton, afila leaf type, 1630 heat units, 73 days to maturity, 4.1 average sieve size.*

CS-464AF *– Crites, 1475 heat units to maturity, disease resistance: Fop 1&2, Ep, PEMV, afila type leaf, triple pods, main-season, disease package.*

Ricco *– Gallatin Valley, Main season variety 1530 heat units, afila leaf type, 16 nodes to first flower, 26 inch plant height, 2 pods per node, 3.7 average sieve size, 8-9 berries per pod, pointed pod shape, HR for Fusarium wilt race 1 and IR for race 2, HR for Bean Leaf Roll Virus and Powdery Mildew race 1, dark green foliage, excellent disease package including root rot tolerance, superior yield, medium size berry, uniform berry color, widely adapted.*

BSC7120 *– Brotherton, 1500 heat units, afila leaf type, 68 days to maturity, 4.2 average sieve size.*

Descriptions provided by the seed source continued:

98-326 *– Pure Line, afila leaf type, 2.8 sieve size, +16 days to maturity relative to Spring, 1400 heat units, resistant to Fusarium wilt race 1, powdery mildew, and pea enation mosaic virus.*

SV0823QG *– Seminis, 1525 heat units, afila plant type, 3.3 average sieve size, 17 nodes to first flower, 2-3 pods per node, 8-9 berries per pod, 45 cm plant height, 2600 seeds per pound, Ir for Downy Mildew and HR for Powdery Mildew, Fusarium R1 and Pea Enation mosaic virus..*

PLS196 *– Pure Line, afila, +13 days to maturity relative to Spring, 1580 heat units, 4.0 sieve, resistance to FWr1,2, Fus.RR, PM, tolerant: Downy Mildew.*

Dancer *– Pure Line, afila leaf type, +14 days to maturity relative to Spring, 1460 heat units, 3.5 sieve size, resistance to FWr1, PM, and PEMV, tolerant to DM.*

SV5685QG *– Seminis, 1750 heat units, normal leaf.*

- 2020 Annual Cutting -

A socially distanced, vegetable "cutting", is planned for November 19th, where frozen peas, snap beans, and sweet corn will be put on display for processors and seed companies to evaluate. Large and 3-4 sieve snap beans were canned and will also be put on display. Our vegetable cutting is the final step of our program's evaluation. We evaluate the horticultural characteristics in the field and in raw products, but our vegetable cutting takes us all the way to quality evaluation on the plate.


Bonduelle
PEA VARIETY TRIAL 2020

In collaboration with:

Ontario Processing Vegetable Growers

Brotherton Seed

PureLine Seeds, Inc

Storm Seeds
passion for Leguminose

Seminis

Gallatin Valley Seed Company

Vilmorin
SEED GENERATION

Summary

The plot was located just South of London, Ontario and west of Littlewood.

Twenty-one unique varieties were planted on May 7, 2020.
Forty-four unique varieties were planted on June 1, 2020;
twenty-eight of which for the first time.

The plot was visited weekly prior to bloom, twice or three times weekly post-bloom and pre-podset, and daily from podset to harvest.

Early May was quite cold and it snowed on varieties planted May 7.
Mid-June to Mid-July was very hot and very dry, which overlapped with podfill of the May 7 planting and flowering of the June 1 planting.

Varieties planted May 7 experienced compaction stress along the tractor tire tracks created at planting.

Varieties planted June 1 experienced bird damage, where the pods were shredded and gassing and young peas were eaten.

Reported yields are in tons per acre and adjusted to 110 TD.

WEATHER

APR	Low	High	Daily HU	Daily Rain	MAY	Low	High	Daily HU	Daily Rain	JUN	Low	High	Daily HU	Daily Rain	JUL	Low	High	Daily HU	Daily Rain	AUG	Low	High	Daily HU	Daily Rain
1	0.0	11.0	2	0	1	4.0	13.0	7	0.3	1	7.0	23.0	19	0.8	1	16.0	30.0	33	0	1	17	28	33	24.8
2	0.0	12.0	3	0	2	4.0	18.0	12	0	2	12.0	30.0	30	5.1	2	17.0	31.0	35	0	2	17	25	30	20.6
3	0.0	11.0	2	0	3	5.0	21.0	15	0	3	14.0	28.0	30	0.5	3	18.0	32.0	37	0	3	16	26	30	20.8
4	0.0	13.0	4	0	4	0.0	9.0	0	0	4	13.0	28.0	29	0	4	18.0	31.0	36	0	4	15	25	28	0.5
5	-2.0	9.0	0	0	5	-2.0	11.0	0	0	5	15.0	28.0	31	1	5	15.0	33.0	35	0	5	12	22	23	0
6	-3.0	14.0	2	0	6	0.0	14.0	5	0	6	12.0	25.0	25	0	6	16.0	34.0	37	0					
7	3.0	14.0	7	21.3	7	-1.0	16.0	6	0	7	9.0	22.0	20	0	7	19.0	35.0	41	0.5					
8	7.0	16.0	13	7.4	8	-2.0	5.0	0	0	8	9.0	25.0	23	0	8	20.0	33.0	40	0					
9	0.0	8.0	0	3	9	-4.0	8.0	0	0	9	13.0	31.0	32	0.3	9	19.0	34.0	40	0					
10	-1.0	6.0	0	1.5	10	3.0	14.0	7	4.1	10	18.0	29.0	34	12.4	10	21.0	34.0	42	12.2					
11	-1.0	9.0	0	0	11	-1.0	6.0	0	4.3	11	15.0	25.0	28	0	11	18.0	27.0	33	34.3					
12	4.0	15.0	9	2.3	12	-3.0	11.0	0	0	12	7.0	17.0	14	0	12	15.0	24.0	27	0					
13	1.0	13.0	5	2.8	13	-3.0	12.0	0	0	13	6.0	19.0	15	0	13	14.0	23.0	25	0					
14	-2.0	6.0	0	0	14	5.0	15.0	10	3.6	14	8.0	19.0	16	0	14	13.0	28.0	29	0					
15	-5.0	3.0	0	0.3	15	9.0	22.0	20	12.2	15	10.0	23.0	22	0	15	17.0	29.0	33	0					
16	-5.0	4.0	0	0	16	8.0	19.0	16	0	16	11.0	26.0	25	0	16	18.0	26.0	32	11.9					
17	-3.0	4.0	0	1	17	9.0	15.0	14	16.5	17	12.0	29.0	29	0	17	18.0	30.0	35	0					
18	-4.0	9.0	0	0	18	11.0	14.0	15	13.2	18	14.0	29.0	31	0	18	17.0	31.0	35	0					
19	-3.0	14.0	2	0.8	19	10.0	19.0	18	0	19	15.0	29.0	32	1.5	19	20.0	29.0	36	9.9					
20	-5.0	9.0	0	0	20	8.0	21.0	18	0	20	31.0	16.0	34	0	20	18.0	28.0	33	0.3					
21	-2.0	9.0	0	1.3	21	7.0	22.0	18	0	21	16.0	31.0	34	0	21	17.0	27.0	32	0.5					
22	-4.0	6.0	0	0	22	10.0	23.0	22	3	22	18.0	26.0	32	0	22	19.0	28.0	34	3.8					
23	0.0	3.0	0	5.3	23	14.0	24.0	26	0	23	15.0	26.0	29	1.3	23	17.0	28.0	33	0					
24	3.0	13.0	6	0	24	14.0	27.0	29	0	24	12.0	23.0	24	0	24	17.0	28.0	33	0					
25	1.0	15.0	6	0	25	17.0	29.0	33	0	25	10.0	27.0	25	0	25	16.0	30.0	33	0					
26	3.0	11.0	5	5.3	26	17.0	30.0	34	0	26	13.0	29.0	30	11.9	26	17.0	32.0	36	0					
27	1.0	15.0	6	0	27	18.0	27.0	33	0	27	18.0	29.0	34	2	27	20.0	31.0	38	30.5					
28	8.0	16.0	14	0.8	28	18.0	22.0	28	4.3	28	16.0	28.0	32	0	28	18.0	29.0	34	0.3					
29	9.0	15.0	14	10.9	29	10.0	25.0	24	3	29	16.0	30.0	33	0	29	18.0	28.0	33	2.5					
30	5.0	14.0	9	5.6	30	7.0	17.0	14	0	30	17.0	29.0	33	0	30	16.0	26.0	30	0					
					31	4.0	15.0	9	0						31	16.0	18.0	23	0					

DATA SUMMARY - MINI VARIETIES

Variety	1st Planting - May 7, 2020					2nd Planting - June 1, 2020				
	Standard	Maturity	Yield	Sieve	TD	Standard	Maturity	Yield	Sieve	TD
LIL' MO	n/a	1392	1.38	2.74	115	n/a	1412	2.46	3.08	107
BSC 905	n/a	1429	0.50	2.02	102	n/a	1412	1.04	1.91	103
BAGHERA	BSC 905	+1 day	1.38	2.05	107	LIL' MO	-1 day	1.32	2.65	108
SV 0371	LIL' MO	+3 days	1.91	2.83	104	LIL' MO	+1 day	2.47	2.91	130
NITRO	n/a	1429	1.58	2.06	107	n/a	1517	1.98	2.14	121
EXP 064	NITRO	+/-0 days	1.22	2.30	112	NITRO	+/- 0 days	2.61	2.18	105
489 (EXP 097)	NITRO	+1 day	1.81	2.31	111	NITRO	+/- 0 days	1.89	2.07	111
FIRENZA	NITRO	+3 days	0.94	1.98	126	NITRO	+2 days	3.31	1.89	104
PANAMA	NITRO	+4 days	1.67	2.08	118	NITRO	+3 days	1.98	1.91	110
389						LIL' MO	+3 days	1.93	2.79	117
ANTALIA						NITRO	+3 days	1.78	1.53	104
602						SV 7441 QC	-4 days	2.47	2.78	120
560						SV 7441 QC	-3 days	2.48	2.51	113
EXP 496						SV 7441 QC	-3 days	2.13	2.07	103
CS 439						SV 7441 QC	-3 days	2.32	2.31	93
EXP 568						SV 7441 QC	-3 days	2.14	1.98	102
PL 001						SV 7441 QC	-2 days	2.10	2.32	97
322						SV 7441 QC	-1 day	1.99	2.55	116
EXP 410						SV 7441 QC	-1 day	1.41	2.21	114
RHIANNA						SV 7441 QC	-1 day	1.58	1.73	110
WAV 202						SV 7441 QC	+/-0 days	2.07	2.84	120
SV 7441 QC						n/a	1790	1.15	2.27	122

GROWTH STAGES & WEATHER - MINI VARIETIES - 1st PLANTING

Variety	Date	05/25	06/01	06/08	06/15	06/19	06/23	06/25	06/27	06/29	07/01	07/04	07/06	07/07	07/08	07/09	0/.10	07/11
	Days	18	25	32	39	43	47	49	51	53	55	58	60	61	62	63	64	65
	HU	218	392	576	737	843	975	1027	1082	1148	1215	1321	1392	1429	1470	1509	1549	1591
	Rain	56.9	64.2	71.6	84.3	84.3	85.8	87.1	99.0	101.0	101.0	101.0	101.0	101.0	101.5	101.5	101.5	113.7
LIL' MO		2 nodes	4 nodes	7 nodes	bud	70% bloom	podset	podset	flatpod	gas	gas	96	115 (H)					
BAGHERA		3 nodes	4 nodes	6 nodes	5% bloom	90% bloom	podset	podset	flatpod	gas	young	88	107 (H)					
EXP 064		1 node	4 nodes	7 nodes	bud	bud	podset	podset	flatpod	flatpod	gas	young	88	112 (H)	140			
NITRO		2 nodes	4 nodes	7 nodes	bud	10% bloom	podset	podset	flatpod	gas	gas	young	young	107 (H)	136			
BSC 905		3 nodes	4 nodes	6 nodes	bud	5% bloom	80% bloom	90% bloom	podset	flatpod	gas	young	young	102 (H)				
489 (EXP 097)		3 nodes	5 nodes	7 nodes	bud	5% bloom	90% bloom	podset	flatpod	flatpod	gas	young	85	96	111 (H)			
SV 0371 QF		2 nodes	4 nodes	7 nodes	10 nodes	12 nodes	20% bloom	70% bloom	podset	flatpod	flatpod	gas	young	81		104 (H)	136	
FIRENZA		1 node	4 nodes	6 nodes	8 nodes	11 nodes	bud	20% bloom	flatpod	flatpod	flatpod	gas	young	young	92	94	126 (H)	
PANAMA		1 node	4 nodes	7 nodes	8 nodes	bud	5% bloom	20% bloom	60% bloom	60% bloom	flatpod	gas	gas	young	79		98	118 (H)

GROWTH STAGES & WEATHER - MINI VARIETIES - 2nd PLANTING

Variety	Date	06/08	06/15	06/22	06/29	07/07	07/13	07/15	07/16	07/17	07/18	07/19	07/20	07/21	07/22	07/23	07/24	07/25	07/26	07/27	07/28
	Days	7	14	21	28	36	42	44	45	46	47	48	49	50	51	52	53	54	55	56	57
	HU	183	344	551	756	1037	1258	1312	1346	1377	1412	1448	1484	1517	1549	1583	1615	1648	1681	1717	1755
	Rain	7.4	20.1	21.6	36.8	36.8	83.8	83.8	83.8	95.7	95.7	95.7	105.6	105.9	106.4	110.2	110.2	110.2	110.2	110.2	104.7
BAGHERA		emerge	3 node	7 node	5% bloom	podset	young	90		108 (H)	127										
LIL' MO		emerge	3 node	7 node	bud	podset	young	79		97	107 (H)										
BSC 905		emerge	3 node	7 node	8 node	podset	young	young	83		103 (H)	132									
NITRO		emerge	3 node	7 node	10 node	90% bloom	flatpod	young	young	young	80		97	121 (H)							
389		emerge	4 node	6 node	9 nods	70% bloom	gas	gas	young	young	76		103	117 (H)							
489 (EXP 097)		emerge	3 node	6 node	9 node	80% bloom	flatpod	gas	young	young	young	84	95	111 (H)							
EXP 064		emerge	3 node	6 node	9 node	60% bloom	flatpod	gas	young	young	young	85	93	105 (H)							
SV 0371 QF		emerge	4 node	7 node	10 node	10% bloom	flatpod	gas	gas	young	young	young	86		130 (H)						
FIRENZA		emerge	3 node	6 node	10 node	bud	flatpod	flatpod	gas	gas	young	young	young	83	95	104 (H)					
PANAMA		emerge	3 node	7 node	9 node	bud	flatpod	flatpod	gas	gas	gas	young	young	77		102	110 (H)				
ANTALIA		emerge	3 node	6 node	8 node	bud	flatpod	flatpod	flatpod	flatpod	gas	young	young	young	81	97	104 (H)				
602		emerge	4 node	7 node	9 node	5% bloom	flatpod	flatpod	flatpod	flatpod	gas	gas	young	young	88	100	120 (H)				
560		emerge	4 node	7 node	10 node	bud	podset	flatpod	flatpod	flatpod	gas	young	young	young	80		107	113 (H)			
EXP 496		emerge	3 node	7 node	10 node	bud	podset	podset	flatpod	flatpod	gas	gas	gas	young	young	77		103 (H)		142	
EXP 568		emerge	3 node	7 node	10 node	bud	podset	flatpod	flatpod	flatpod	flatpod	gas	gas	young	young	80		102 (H)		145	
CS 439		emerge	4 node	7 node	10 node	bud	flatpod	flatpod	flatpod	flatpod	gas	gas	young	young	79	79		93 (H)			
PL 001		emerge	3 node	7 node	9 node	bud	podset	flatpod	flatpod	flatpod	flatpod	gas	gas	young	young	young	79		97 (H)	148	
322		emerge	3 node	7 node	10 node	bud	80% bloom	podset	flatpod	flatpod	flatpod	flatpod	flatpod	young	young	young	young	young	90	116 (H)	
EXP 410		emerge	3 node	6 node	10 node	bud	100% bloom	flatpod	flatpod	flatpod	flatpod	flatpod	flatpod	gas	young	young	young	young	98	114 (H)	
RHIANNA		emerge	2 node	5 node	8 node	bud	podset	podset	flatpod	flatpod	flatpod	flatpod	gas	gas	gas	gas	young	young	young	110 (H)	125
SV 7441 QC		emerge	3 node	6 node	9 node	bud	podset	podset	podset	flatpod	flatpod	flatpod	gas	gas	young	young	young	young	84	105 (H)	122
WAV 202		emerge	3 node	7 node	10 node	bud	90% bloom	podset	flatpod	flatpod	flatpod	gas	gas	young	young	young	young	young	82		120 (H)

TENDEROMETER PROGRESSIONS - MINI VARIETIES - 1st PLANTING

Variety	Standard	July 4	July 5	July 6	July 7	July 8	July 9	July 10	July 11
Accumulated Air Heat Units		1321	1357	1392	1429	1470	1509	1549	1591
LIL' MO	n/a	96	102	115					
BAGHERA	BSC 905	88	97	107					
EXP 064	NITRO			88	112	140			
NITRO	n/a		85		107	136			
BSC 905	n/a		85		102				
489 (EXP 097)	NITRO			85	96	111			
SV 0371 QF	LIL' MO				80		104	136	
FIRENZA	NITRO					92	94	126	
PANAMA	NITRO					79		98	118

TENDEROMETER PROGRESSIONS - MINI VARIETIES - 2nd PLANTING

Variety	Standard	July 15	July 16	July 17	July 18	July 19	July 20	July 21	July 22	July 23	July 24	July 25	July 26	July 27	July 28
Accumulated Air Heat Units		1312	1346	1377	1412	1448	1484	1517	1549	1583	1615	1681	1717	1755	1790
BAGHERA	LIL' MO	90		108	127										
LIL' MO	n/a	79		97	107										
BSC 905	n/a		83		103	132									
NITRO	n/a				80		97	121							
389	LIL' MO				76		103	117							
489 (EXP 097)	NITRO					84	95	111							
EXP 064	NITRO					85	93	105							
SV 0371 QF	LIL' MO						86		130						
FIRENZA	NITRO							83	95	104					
PANAMA	NITRO							77		102	110				
ANTALIA	NITRO								81	97	104				
602	SV 7441 QC								89	100	120				
560	SV 7441 QC								80		107	113			
EXP 496	SV 7441 QC									77		103		142	
EXP 568	SV 7441 QC									80		102		145	
CS 439	SV 7441 QC								79	79		93			
PL 001	SV 7441 QC										79		97	148	
322	SV 7441 QC												90	116	
EXP 410	SV 7441 QC												98	114	
RHIANNA	SV 7441 QC													110	125
SV 7441 QC	n/a												84	105	122
WAV 202	SV 7441 QC												82		120

DATA SUMMARY - REGULAR VARIETIES

Variety	1st Planting - May 7, 2020					2nd Planting - June 1, 2020				
	Standard	Maturity	Yield	Sieve	TD	Standard	Maturity	Yield	Sieve	TD
SHERWOOD	n/a	1182	1.27	3.71	123					
AUSTIN	SHERWOOD	+4 days	2.11	4.54	134					
CS 455	PORTAGE	-1 day	2.36	4.03	110					
PORTAGE	n/a	1429	2.05	3.97	114					
SALTINGO	RELIANCE	-1 day	2.14	3.83	113					
SV 7401 QH	n/a	1470	2.12	2.95	110	n/a	1484	2.96	3.54	112
SC 0935 QF	PORTAGE	+1 day	1.99	3.29	117	SV 7401 QH	+0 days	2.11	3.67	116
518	PORTAGE	+1 day	1.48	3.66	112	SV 7401 QH	+1 day	2.33	4.05	119
SV 0969 QH	RELIANCE	+0 days	2.19	3.35	127	RELIANCE	-1 day	2.19	3.10	121
RELIANCE	n/a	1549	1.70	3.63	117	n/a	1549	2.68	3.32	104
DA 1470	n/a	1549	1.85	3.86	130	n/a	1549	2.56	3.98	132
828	SV 7401 QH					SV 7401 QH	+1 day	1.64	3.62	119
ASR 40.0221	RELIANCE					RELIANCE	+0 days	2.00	3.45	123
ASR 40.0051	RELIANCE					RELIANCE	+0 days	2.59	3.42	103
712	DA 1470					DA 1470	+1 day	3.35	4.61	125
CS 464	DA 1470					DA 1470	+1 day	2.67	3.90	121
SV 7688 QG	DA 1470					DA 1470	+1 day	1.99	3.59	115
CS 494	TYNE					TYNE	-2 days	2.36	3.46	110
691	TYNE					TYNE	-1 day	1.95	4.07	109
TYNE	n/a					n/a	1717	2.71	3.82	107
TRINITY	TYNE					TYNE	+0 days	2.97	3.79	101
914	TYNE					TYNE	+0 days	1.93	4.06	114
CONCEPT	n/a					n/a	1717	2.48	3.93	108
ASR 2143	CONCEPT					CONCEPT	+1 day	1.15	3.29	112
BALLADA	CONCEPT					CONCEPT	+8 days	Data unavailable		
SV 5685 QG	CONCEPT					CONCEPT	+10 days	Data unavailable		

GROWTH STAGES & WEATHER - REGULAR VARIETIES - 1st PLANTING

Variety	Date	05/25	06/01	06/08	06/15	06/18	06/22	06/25	06/28	06/30	07/01	07/02	07/03	07/04	07/05	07/06	07/07	07/08	07/09	07/10
	Days	18	25	32	39	42	46	49	52	54	55	56	57	59	60	61	62	63	64	65
	HU	218	382	576	737	812	943	1027	1117	1182	1215	1249	1284	1321	1357	1392	1429	1470	1509	1549
	Rain	56.9	64.2	71.6	84.3	84.3	85.8	87.1	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.5	101.5	101.5
SHERWOOD		2 nodes	5 nodes	bud	80% bloom	flatpod	gas	young	93	123 (H)										
AUSTIN		2 nodes	5 nodes	8 nodes	70% bloom	80% bloom	gas	gas	young	80		94		134 (H)						
CS 455		3 nodes	5 nodes	8 nodes	5% bloom	80% bloom	flatpod	flatpod	gas	gas	young	young	young	young	103	110 (H)	136			
PORTAGE		3 nodes	4 nodes	7 nodes	bud	40% bloom	100% bloom	podset	flatpod	gas	gas	gas	young	young	young	young	114 (H)	130		
SC 0935 QF		1 node	4 nodes	7 nodes	9 nodes	bud	80% bloom	podset	flatpod	flatpod	flatpod	gas	gas	young	young	young	young	117 (H)	153	
518		1 node	4 nodes	6 nodes	bud	bud	50% bloom	podset	flatpod	gas	gas	gas	young	young	young	86	110	112 (H)		
SV 7401 QH		2 nodes	3 nodes	6 nodes	bud	bud	50% bloom	podset	flatpod	flatpod	flatpod	gas	gas	young	young	young	103	110 (H)	125	
389		1 node	4 nodes	7 nodes	8 nodes	bud	60% bloom	podset	podset	flatpod	flatpod	flatpod	gas	gas	young	young	young	98	118	134
SALTINGO		2 nodes	5 nodes	7 nodes	bud	5% bloom	70% bloom	flatpod	flatpod	gas	gas	gas	young	young	young	young	96	104	113 (H)	
SV 0371 QF		2 nodes	4 nodes	7 nodes	10 nodes	11 nodes	bud	70% bloom	podset	flatpod	flatpod	gas	gas	young	young	young	81		104 (H)	136
DA 1470		2 nodes	4 nodes	7 nodes	9 nodes	10 nodes	30% bloom	70% bloom	podset	flatpod	flatpod	flatpod	gas	gas	young	young	young	83		130 (H)
SV 0969 QH		1 node	3 nodes	6 nodes	9 nodes	bud	20% bloom	70% bloom	podset	flatpod	flatpod	flatpod	gas	gas	gas	young	young	young	100	127 (H)
RELIANCE		2 nodes	4 nodes	7 nodes	9 nodes	12 nodes	30% bloom	80% bloom	flatpod	flatpod	flatpod	flatpod	gas	young	young	young	young	95	94	117 (H)

GROWTH STAGES & WEATHER - REGULAR VARIETIES - 2nd PLANTING

Variety	Date	06/10	06/18	06/25	07/02	07/09	07/16	07/18	07/19	07/20	07/21	07/22	07/23	07/24	07/25	07/26	07/27	07/28		08/03	08/05
	Days	9	17	24	31	38	45	47	48	49	50	51	52	53	54	55	56	57		63	65
	HU	238	420	635	856	1117	1346	1412	1448	1484	1517	1549	1583	1615	1648	1681	1717	1755		1938	1996
	Rain	7.7	20.1	22.9	36.8	37.3	83.8	95.7	95.7	105.6	105.9	106.4	110.2	110.2	110.2	110.2	110.2	140.7		188.7	210.0
SC 0935 QF		3 nodes	5 nodes	8 nodes	bud	flatpod	gas	young	91	116 (H)											
SV 7401 QH		3 nodes	5 nodes	8 nodes	bud	flatpod	young	young	97	112 (H)											
SV 0969 QH		2 nodes	5 nodes	7 nodes	12 nodes	flatpod	young	young	89	101	121 (H)										
828		3 nodes	5 nodes	7 nodes	12 nodes	podset	young	young	young	101	119 (H)										
518		3 nodes	5 nodes	8 nodes	bud	flatpod	young	young	young	100	119 (H)										
ASR 40.0221		3 nodes	5 nodes	8 nodes	bud	80% bloom	gas	young	young	95	97	123 (H)									
DA 1470		3 nodes	5 nodes	7 nodes	bud	podset	gas	young	young	82		109 (H)	132								
RELIANCE		3 nodes	5 nodes	8 nodes	bud	80% bloom	gas	young	young	young	93	104 (H)	131								
ASR 40.0051		3 nodes	5 nodes	8 nodes	11 nodes	80% bloom	gas	young	young	young	99	103 (H)	133								
712		3 nodes	5 nodes	8 nodes	11 nodes	80% bloom	gas	young	young	young	young	98	125 (H)								
CS 464		3 nodes	5 nodes	8 nodes	bud	80% bloom	gas	young	young	young	89	95	121 (H)								
SV 7688 QG		3 nodes	5 nodes	7 nodes	bud	70% bloom	flatpod	gas	young	young	young	90	115 (H)								
CS 494		3 nodes	5 nodes	8 nodes	11 nodes	80% bloom	flatpod	gas	gas	young	young	84		110 (H)	128						
691		2 nodes	4 nodes	7 nodes	11 nodes	10% bloom	flatpod	flatpod	gas	gas	gas	young	86	102	109 (H)						
914		3 nodes	5 nodes	8 nodes	11 nodes	20% bloom	flatpod	flatpod	flatpod	flatpod	gas	young	young	young	young	114 (H)	129				
CONCEPT		3 nodes	4 nodes	7 nodes	10 nodes	40% bloom	flatpod	flatpod	flatpod	gas	young	young	young	young	young	108 (H)	127				
TYNE		3 nodes	5 nodes	7 nodes	12 nodes	30% bloom	flatpod	flatpod	flatpod	gas	gas	young	young	young	young	107 (H)	158				
TRINITY		3 nodes	5 nodes	8 nodes	11 nodes	10% bloom	flatpod	flatpod	flatpod	gas	gas	young	young	young	95	101 (H)	148				
ASR 2143		3 nodes	5 nodes	7 nodes	11 nodes	bud	podset	flatpod	flatpod	flatpod	gas	gas	gas	young	young	young	114 (H)	120			
BALLADA		3 nodes	5 nodes	8 nodes	14 nodes	17 nodes	bud	bud	bud	10% bloom	30% bloom	40% bloom	50% bloom	podset	podset	podset	flatpod	flatpod		(H)	
SV 5685 QG		2 nodes	4 nodes	7 nodes	11 nodes	16 nodes	bud	bud	bud	bud	bud	10% bloom	10% bloom	podset	podset	podset	podset	flatpod			(H)

TENDEROMETER PROGRESSIONS - REGULAR VARIETIES - 1st PLANTING

Variety	Standard	June 28	June 29	June 30	July 1	July 2	July 3	July 4	July 5	July 6	July 7	July 8	July 9	July 10
Accumulated Air Heat Units		1117	1148	1182	1215	1249	1284	1321	1357	1392	1429	1470	1509	1549
SHERWOOD	n/a	93		123										
AUSTIN	SHERWOOD			80		94		134						
CS 455	PORTAGE								103	110	136			
PORTAGE	n/a										114	130		
SC 0935 QF	PORTAGE											117	153	
518	PORTAGE									86	110	112		
SV 7401 QH	n/a										103	110	125	
389	RELIANCE											98	118	134
SALTINGO	RELIANCE										96	104	113	
SV 0371 QF	LIL' MO										81		104	136
DA 1470	n/a											83		130
SV 0969 QH	RELIANCE												100	127
RELIANCE	n/a											95	94	117

TENDEROMETER PROGRESSIONS - REGULAR VARIETIES - 2nd PLANTING

Variety	Standard	July 19	July 20	July 21	July 22	July 23	July 24	July 25	July 26	July 27	July 28		August 3	August 5
Accumulated Air Heat Units		1448	1484	1517	1549	1583	1615	1681	1717	1755	1790		1968	2018
SC 0935 QF	SV 7401 QH	91	116											
SV 7401 QH	n/a	97	112											
SV 0969 QH	RELIANCE	89	101	121										
828	SV 7401 QH		101	119										
518	SV 7401 QH		100	119										
ASR 40.0221	RELIANCE		95	97	123									
DA 1470	n/a		82		109	132								
RELIANCE	n/a			93	104	131								
ASR 40.0051	RELIANCE			99	103	133								
712	DA 1470				98	125								
CS 464	DA 1470			89	95	121								
SV 7688 QG	DA 1470				90	115								
CS 494	TYNE				84		110	128						
691	TYNE					86	102	109						
914	TYNE								114	129				
CONCEPT	n/a								108	127				
TYNE	n/a								107	158				
TRINITY	TYNE							95	101	148				
ASR 2143	CONCEPT									114	120			
BALLADA	CONCEPT												H	
SV 5685 QG	CONCEPT													H

2020 Project Summary: Using Genetic Tests to Confirm Herbicide Resistant Weeds in Ontario Horticulture Crops

Kristen Obeid, OMAFRA Weed Management Specialist - Horticulture

Since 2016, this project has created 16 genetic quick tests (5 more in progress) to assist in identifying herbicide resistance in 12 weed species and confirmed 94 new cases of herbicide resistance in horticulture crops. These tests deliver a diagnostic and a recommendation to the grower within the same growing season. Traditional resistance testing in the greenhouse can take from three months to a year to get results back to growers. Now, leaf tissue instead of seed is collected. DNA is extracted from the leaf tissue to determine if there is a change in the sequencing resulting in a mutation making the plant resistant.

Tests have also been developed to differentiate between Brassica and Amaranthus (pigweed) species. Tests differentiating pigweed species have been instrumental in confirming new cases of waterhemp in Ontario, Manitoba and Quebec. Once confirmed, the waterhemp was tested for Groups 2, 5, 9 and 14 resistances.

Table 1. Genetic Tests Currently Utilized by the Labs

Weed Species	Herbicide Group	Resistance & Tests
Large crabgrass	1	Metabolic: ACCase gene amplification
Common chickweed	2	Target-site (P197Q & unpublished)
Common ragweed	2	Target-site (W574L)
Eastern black nightshade	2	Target-site (A205V)
Green pigweed	2	Target-site (S653N & W574L)
Giant foxtail	2	Target-site (unpublished)
Redroot pigweed	2	Target-site (S653N & W574L)
Waterhemp	2	Target-site (S653N & W574L)
Common ragweed	5&7	Target-site (V219I)
Green pigweed	5&7	Target-site (A251V, S264G*, V219I & F274L)
Lamb's-quarters	5	Target-site (S264G)
Redroot pigweed	5&7	Target-site (A251V, S264G*, V219I & F274L)
Waterhemp	5&7	Target-site (A251V, S264G*, V219I & F274L)
Brassica spp.	9	Presence of transgene
Canada fleabane	9	Target-site (P106S)
Waterhemp	9	Metabolic: EPSPS gene amplification
Waterhemp	14	Target-site (ΔG210 in PPX2L)
Amaranthus spp.	-	Species identification
Brassica spp.	-	Species identification

*S264G mutation only induces resistance to Group 5 herbicides, not Group 7

In 2018, the protocols for these tests were shared with the Pest Diagnostic Lab of the Quebec Ministry of Agriculture, Fisheries and Food (MAPAQ) and the weeds lab of AAFC's Harrow Research and Development Centre as a pilot project and made available to extension personal in Ontario and Quebec to submit samples, providing the diagnostic service to growers.

In 2019, all samples were sent from Ontario to the Pest Diagnostic Lab of the Quebec Ministry of Agriculture, Fisheries and Food (MAPAQ), whom provided the testing for free. In 2020, MAPAQ could no longer accept samples form out of province.

In 2020, Harvest Genomics www.harvestgenomics.ca signed an agreement with AAFC to obtain the protocols and started to provide the service to Ontario growers for a fee. The funding obtained from the project sponsors has been utilized to pay for this service. Due to COVID-19 there was a decrease in field sampling. Funds that were not utilized in 2020 will be carried forward to provide the same service to Ontario growers in 2021. No funding will be invoiced or requested for 2021. For the organizations that committed to funding for 2021, we request that the project be extended to 2022.

Results

Table 2. 2020 Results to Date in Ontario (15 fields are still being analyzed)

Crop	Weed	Herbicide Group	Total Fields	Positive Tests	%
Carrots	Lamb's-quarters	5	1	0	0
Carrots	Green pigweed	2, 5, 7**	1	1	100
Carrots	Pigweed species	5, 7	1	1	100
Corn	Pigweed species	5	1	1	100
Kidney Beans	Pigweed species	2, 5, 7	1	0	0
Onion	Green pigweed	2, 5, 7	1	0	0
Peas	Pigweed species	2*, 5, 7	6	6	100
Potatoes	Lamb's-quarters	5	1	1	100
Potatoes	Pigweed species	2, 5, 7**	4	4	100
Seed Corn	Pigweed species	2, 5***,7	2	2	100
Soybeans	Canada fleabane	9	1	1	100
Soybeans	Common ragweed	2, 5, 7	1	1	100
Soybeans	Eastern black nightshade	2, 5, 7	1	0	0
Soybeans	Lamb's-quarters	5	1	0	0
Soybeans	Waterhemp	2	7	6	86
		5, 7		0	0
		9		3	43
		14		7	100
Sweet Corn	Pigweed species	5	1	1	100
Tomato	Pigweed species	2, 5***, 7	1	1	100
Total			32	27	84

*Resistant to Group 2 only

**Resistant to Groups 5&7 only

***Resistant to Group 5 only

Note: Pigweed species includes redroot pigweed and green pigweed

Since 2016, the most significant trend is the increase in the number of fields with multiple resistant species:

- Common ragweed resistant to herbicide Groups 2 and 5 in pumpkins and 2, 5 and 7 in soybeans
- Redroot and green pigweed resistant to herbicide groups 2 and 5 in tomatoes
- Redroot and green pigweed resistant to herbicide Groups 5 and 7 in carrots and potatoes
- Waterhemp resistant to herbicide Groups 2, 5, 9 and 14 in asparagus, peppers, soybeans and corn

Another significant trend is the increased documentation of Canada fleabane resistant to glyphosate (Group 9) in apples, grapes, carrots, onions and pumpkins.

This testing has been instrumental in documenting new cases of herbicide resistant weeds. 80% of submitted weed samples tested positive. Once confirmed producers were provided the resistance profile enabling a change in management to mitigate spread. Producers, agri-business and consultants that participated in the project were pleased with the timely results and welcomed the in-season management recommendations.

There are many more undocumented cases of herbicide resistant weeds in Canada. The resistance mechanism is unknown for most of them. The major concern is their distribution and economic impact for producers. Knowing where resistant biotypes are located will improve management and maintain the longevity of our crop protection tools.

Project partners include: AAFC, AAFC-PMC, Bayer CropScience Inc., FMC Corporation, FVGO, MAPAQ, OAG, OFVGA, OPVG and Syngenta Canada Inc.

2020 Research Report

Neonicotinoid alternatives for management of cucumber beetle

Prepared for the Ontario Processing Vegetable Growers (OPVG) and the Ontario Cucumber Research Committee (OCRC)
October 14, 2020

Research Team:

- Cheryl Trueman, Ph.D., Assistant Professor, Dept of Plant Ag, University of Guelph – Ridgetown Campus
- Phyllis May, Research Technician
- Andrew Wylie (OMAFRA) was unable to assist with the trial due to restrictions for on-campus visitors related to COVID-19. Elain Roddy (OMAFRA, on leave) assisted with proposal development Fall 2019.

Highlights/Summary:

- The objective was to obtain efficacy data on neonicotinoid alternatives for cucumber beetle using in-furrow and foliar insecticides. In consultation with crop protection companies, the Group 28 diamide insecticides Coragen (chlorantraniliprole), Exirel (cyantraniliprole, foliar formulation), and Verimark (cyantraniliprole, soil formulation) were identified as potential solutions. Untreated seed of the cucumber beetle attractive buttercup squash 'Burgess' was used in both trials.
- *Foliar insecticides:* None of the insecticide treatments reduced cucumber beetle populations or feeding injury compared to the nontreated control.
- *In-furrow insecticides:* Treatments were applied in-furrow at the time of planting. Striped and spotted cucumber beetles were present in the trial, but populations remained relatively low and there was very little feeding damage observed in all treatments.
- Our strategy to plant late and expose seedlings to second generation beetles, in the hopes of a more intense and consistent population compared to trials in 2018 and 2019 seeded in late June or early July was unsuccessful. Our efforts to collect data on the efficacy of Verimark from 2018-2020 have not been successful due to low or inconsistent cucumber beetle populations. It is recommended that this research be completed elsewhere, where there are consistently high populations of cucumber beetles. For now, we will not pursue further research in this area.

Funding: Ontario Cucumber Research Committee, Ontario Processing Vegetable Growers, Ontario Ministry of Agriculture, Food, and Rural Affairs

TITLE: Foliar insecticides for the control of cucumber beetles in squash

PEST(S): Striped cucumber beetle (*Acalymma vittatum*), spotted cucumber beetle (*Diabrotica undecimpunctata howardi*)

MATERIALS: Matador 120 EC (lambda-cyhalothrin 120 g/L), Coragen (chlorantraniliprole 200 g/L), Exirel (cyantraniliprole 100 g/L)

METHODS: One trial was completed at Ridgetown Campus, University of Guelph. Buttercup squash 'Burgess', which is highly attractive to cucumber beetle, was seeded with a cone seeder on July 24 at a rate of 4 seeds per meter. A late July planting date was chosen to improve the likelihood that peak beetle populations would be present during crop establishment. Seed was not treated with any insecticides. Rows were spaced 3 m apart. Each treatment plot was 7 m long. Trials were setup as a randomized complete block design with four replications per treatment. The insecticide treatment was applied using a hand-held CO_2 2.0 m. Water volume of 300 L Ha^{-1} was used to apply the treatments.

Whole plots were monitored for cucumber beetles every 3-5 days at 7:00 am, to align with peak beetle activity, except for ratings on August 31, which began at 8:30 am. Insect counts and foliar feeding damage (% leaf area affected on 5% incremental scale) were evaluated in the whole plots on August 11, 14, 18, 21, 25, 28, 31, Sept 4 and 10. The foliar insecticide treatment was applied on August 17. The spray threshold of 0.5-1 beetles per plant was not yet met, but we anticipated it would reach threshold before the next assessment date based on experience from running similar trials in 2018 and 2019. On August 14, populations per plant ranged from 0.1 to 0.2.

Harvest was not completed because squash was underdeveloped due to the late planting date. Late planting was done on purpose to try and expose seedlings to the second generation of cucumber beetles.

Statistical analysis was conducted using ARM (Gylling Data Management, Brookings, SD). Data were tested for normality using Bartlett's homogeneity of variance test. Data which were not normal ($P \leq 0.05$) were transformed using an arsine, log, or square root transformation as appropriate. Analysis of variance was conducted using Tukey's HSD and means comparisons were performed when $P \leq 0.05$.

RESULTS & CONCLUSIONS: Cucumber beetle populations were generally low throughout the season. None of the insecticide treatments reduced cucumber beetle populations or feeding injury compared to the nontreated control (Table 1, Table 2). There were also no differences among treatments for the number of dead beetles (*data not shown*). No symptoms of bacterial wilt were observed. Our strategy to plant late and expose seedlings to second generation beetles, in the hopes of a more intense and consistent population compared to trials in 2018 and 2019 seeded in late June or early July were unsuccessful.

Table 1. Number of striped cucumber beetles on foliage in butternut squash 'Burgess' treated with foliar insecticides, Ridgetown, ON, 2020.

Treatment (rate per Ha) [a]	Population (number of live beetles per plot) [b]								
	Aug 11	Aug 14	Aug 18	Aug 21	Aug 25	Aug 28	Aug 31	Sept 4	Sept 10
Control	0.5 ns	2.3 ns	0.5 ns	1.0 ns	1.0 ns	5.5 ns	6.0 ns	0.5 ns	1.3 ns
Matador @ 210 mL	0.3	2.8	0.0	0.0	2.0	2.5	3.5	1.5	0.5
Coragen @ 375 mL	1.8	1.8	0.0	0.8	2.5	4.3	4.3	0.5	0.0
Exirel @ 1000 mL	0.5	2.5	0.5	0.8	2.0	4.3	2.8	0.5	1.0

[a] Foliar insecticide applied on August 17.

[b] Striped cucumber beetles were the dominant type observed.

[c] Numbers in a column followed by the same letter are not significantly different at $P \leq 0.05$, Tukey's HSD. ns = not significant.

Table 2. Leaf area with cucumber beetle feeding damage on foliage and flowers in butternut squash 'Burgess' treated with foliar insecticides, Ridgetown, ON, 2020.

Treatment (rate per Ha) [a]	% Foliar Feeding Damage								
	Aug 11	Aug 14	Aug 18	Aug 21	Aug 25	Aug 28	Aug 31	Sept 4	Sept 10
Control		1.5 ns	3.0 ns	1.0 a	0.5 ns	0.0 ns	0.0 ns	0.3 ns	0.0 ns
Matador @ 210 mL		1.8	1.0	0.3 ab	0.3	0.0	0.0	0.3	0.0
Coragen @ 375 mL		2.0	1.0	0.0 b	0.0	0.3	0.0	0.0	0.0
Exirel @ 1000 mL		1.3	1.0	0.3 ab	0.0	0.0	0.0	0.3	0.0

[a] Foliar insecticide applied on August 17.

[b] Striped cucumber beetles were the dominant type observed.

[c] Numbers in a column followed by the same letter are not significantly different at $P \leq 0.05$, Tukey's HSD. ns = not significant.

TITLE: In-furrow insecticides for the control of cucumber beetles in squash

PEST(S): striped cucumber beetle (*Acalymma albidovittata*), spotted cucumber beetle (*Diabrotica undecimpunctata howardi*)

MATERIALS: Admire (imidacloprid 240 g/L), Verimark (cyantraniliprole 200 g/L)

METHODS: One trial was completed at Ridgetown Campus, University of Guelph. Buttercup squash 'Burgess', which is highly attractive to cucumber beetle, was seeded with a cone seeder on July 24 at a rate of 4 seeds per meter. Seed was not treated with any insecticides. Rows were spaced 3 m apart. Each treatment plot was 7 m long. Trials were setup as a randomized complete block design with four replications per treatment. Treatments were applied in-furrow behind the shoe. A spray nozzle was placed through the spring for the press wheels and secured using cable ties. It was connected with tubing to the CO_2 sprayer. The insecticide solution was allowed to fill the tube leading to the shoe before starting to plant. The system was flushed with clean water after treatment application and before a new treatment was applied. Applications were made using pressure of 30 psi with Lurmark 015-F110 nozzles. The band width was 7 cm and application volume 40.8 L/Ha.

Squash were monitored for the presence of cucumber beetle and feeding damage twice a week beginning at emergence. Insect assessments were completed at 7:00 am to align with the daily period of peak beetle activity, except for ratings on August 31, which began at 8:30 am. There was no presence of insects for the first evaluation on August 5. Insect counts and foliar feeding damage (% leaf area affected on 5% incremental scale) were evaluated in the whole plots on August 11, 14, 18, 21, 25, 28, 31, and Sept 4. Harvest was not completed because squash was underdeveloped due to the late planting date. Late planting was done on purpose to try and expose seedlings to the second generation of cucumber beetles.

Statistical analysis was conducted using ARM (Gylling Data Management, Brookings, SD). Data were tested for normality using Bartlett's homogeneity of variance test. Data from the control plot in replication four were not included because half the row was missing. Data which were not normal ($P \leq 0.05$) were transformed using an arsine, log, or square root transformation as appropriate. Analysis of variance was conducted using Tukey's HSD and means comparisons were performed when $P \leq 0.05$.

RESULTS & CONCLUSIONS: Striped and spotted cucumber beetles were present in the trial, but populations remained relatively low and there was very little feeding damage observed. None of the treatments reduced cucumber beetle populations or feeding damage compared to the nontreated control (Table 1, Table 2). There were also no differences among treatments for the number of dead beetles (*data not shown*). Our strategy to plant late and expose seedlings to second generation beetles, in the hopes of a more intense and consistent population compared to trials in 2018 and 2019 seeded in late June or early July were unsuccessful.

Table 1. Number of striped and spotted cucumber beetles on foliage and flowers in squash treated with insecticides in-furrow, Ridgetown, ON, 2020.

Treatment (mL per 100 m of row) [a]	Population (number of live beetles per plot) [b]							
	Aug 11	Aug 14	Aug 18	Aug 21	Aug 25	Aug 28	Aug 31	Sept 4
Control	0.5 ns	1.8 ns	0.8 ns	0.7 ab	2.3 ns	7.8 ns	3.0 ns	4.3 ns
Admire @ 18 mL	1.5	3.3	1.8	0.4 b	2.8	8.0	3.5	2.5
Verimark @ 30 mL	0.5	1.8	2.5	0.9 ab	1.8	6.5	4.0	2.3
Verimark @ 40 mL	0.5	2.8	2.8	2.7 a	0.8	7.5	2.5	2.8

[a] In-furrow treatments were applied July 24.

[b] Striped cucumber beetles were the dominate type observed.

[c] Numbers in a column followed by the same letter are not significantly different at $P \leq 0.05$, Tukey's HSD. ns = not significant.

Table 2. Leaf area (%) with cucumber beetle feeding damage in squash treated with insecticides in-furrow, Ridgetown, ON, 2020.

Treatment (mL per 100 m of row) [a]	% Foliar Feeding Damage							
	Aug 11	Aug 14	Aug 18	Aug 21	Aug 25	Aug 28	Aug 31	Sept 4
Control	0.5 ns	0.5 ns	0.5 ns	0.8 ns	0.3 ns	0.3 ns	0.0 ns	0.0 ns
Admire @ 18 mL	0.0	0.3	0.5	0.5	0.3	0.5	0.0	0.0
Verimark @ 30 mL	0.5	0.8	0.8	0.3	0.0	0.3	0.0	0.0
Verimark @ 40 mL	0.3	0.3	0.3	0.5	0.3	0.3	0.0	0.0

[a] In-furrow treatments were applied July 24.

[b] Striped cucumber beetles were the dominate type observed.

[c] Numbers in a column followed by the same letter are not significantly different at $P \leq 0.05$, Tukey's HSD. ns = not significant.