

WEED CONTROL IN TOMATOES

RESEARCH RESULTS – 2009

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**FOR THE ONTARIO TOMATO
RESEARCH INSTITUTE**

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EXECUTIVE SUMMARY – WEED CONTROL IN TOMATOES (2009)

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Effect of Hail Damage on Tolerance of Tomato to Herbicides

This trial was established to assess tolerance of transplanted tomato to combinations of simulated hail damage and various postemergence herbicides (Pinnacle, Sencor and Prism), to determine whether these cumulative stresses reduce yield more than each stress individually. Though visual injury was initially higher and plant dry weight was lower in those treatments where hail damage had been simulated along with an application of Pinnacle, there were no differences in final yield.

Tolerance of Processing Tomato Varieties to Pinnacle

This trial was established to determine the tolerance of six processing tomato varieties to Pinnacle (thifensulfuron-methyl) applied 28 days after transplanting (DAT) at a rate of 6.4 g/ac. H2401, H7209, H4007, H4107 were injured by Pinnacle applied at 6.4 g/ac. Red yield was less in the Pinnacle treatment than the untreated control for both H7209 and H4007. Though red yield was not reduced by Pinnacle for H4107, green yields were higher at harvest and flowering was delayed by 3-5 days.

Hairy Nightshade Control with Prism

Four studies were established to compare control of hairy nightshade at 15, 25 and 35 gai/ha (24, 35 and 46 g/ac) of Prism in various growers' fields to meet requirements for the increased rate of Prism in tomato URMULE submission. Control was 75% or less at 24 g/ac, increased to 80% at 36 g/ac, and was best (86%) at the 48 g/ac rate of Prism.

Recropping After Prism Use in Tomato

A recropping study was established last year to determine the potential for carryover from Prism applied at 46 and 92 g/ac. Winter wheat was planted last fall, and seed corn, soybean, snap bean, edible beans, potatoes, peas, and sugar beet were planted in the spring. Prism reduced stand and yield of sugarbeet one year after Prism application, regardless of rate. The other crops were not injured.

Tolerance of Tomato to Kixor, Sulfentrazone, Valtera and Reflex

Kixor, sulfentrazone, Valtera or Reflex were applied PRE to tomatoes to determine tolerance at rates used in soybean. Kixor, sulfentrazone and Valtera caused significant injury, stand mortality and yield loss, while tomato was tolerant to Reflex applied prior to transplanting.

ACKNOWLEDGEMENTS

Purpose Of This Report

This report is provided as a guide to the 2009 tomato weed control research control plots. The experiments outlined in this booklet are located at Ridgetown College. We appreciate the funding, cooperation and assistance provided by the Ontario Tomato Research Institute (tomato growers and processing companies). As well, we would like to thank the chemical companies and their representatives, agextension personnel, and other research scientists for their ideas, plant material and herbicide samples that were used in these trials. Funding for the 2009 research program was provided by:

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We trust that the information provided by this research will further the science of weed control by assisting with the registration of herbicides through the minor use system. We also hope this information will be of use in the extension of proper herbicide recommendations, thereby enabling growers to achieve consistent, broad spectrum weed control with a minimum of crop damage.

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Trial 1: Effect of Hail Damage on Tolerance of Tomato to Herbicides

Objective: Determine the effect of cumulative stress caused by hail damage and a POST application of Pinnacle, Sencor or Prism, with and without an application of Bravo.

Materials & Methods:

Crop: *Tomato*

Variety: H9909

Planting rate: 14850 plants/ha

Row spacing: 1.5m

Planting date: May 22

Depth: 5 cm

Plant spacing: 45 cm

Design: Randomized Complete Block Design

Plot width: 1.5m

Plot length: 10m

Reps: 4

Field Preparation: Field was worked with an S-tine cultivator and fertilizer was applied at 190 kg N/ha on May 6.

Soil Description:

Sand: 49%

Silt: 30%

Clay: 21%

OM: 5.8%

pH: 5.8

CEC 14

Texture: Loam

Soil: Watford/Brady

Application Information:

APPLICATION DATE	A JUN 16
TIME OF DAY	6:30AM
TIMING	POST
AIR TEMP (c)	7
RH (%)	98
WIND SPEED (KPH)	8
SOIL TEMP (c)	9
CLOUD COVER (%)	100
CROP STAGE	7-9LF

HAIL INJURY WAS SIMULATED ON JUN 15.

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 1.1. Effect of hail damage, herbicide treatment and fungicide (Bravo) on tomato visual injury caused by hail and herbicide 7 days after application.

HAIL Y/N	HERBICIDE	FUNGICIDE? Y/N	VISUAL INJURY	
			HAIL	HERBICIDE
N	UNTREATED	N	0B	0C
Y	UNTREATED	N	49A	0C
Y	PINNACLE	N	55A	19A
Y	PINNACLE	Y	50A	21A
Y	SENCOR	N	41A	6C
Y	SENCOR	Y	43A	5C
Y	PRISM	N	45A	16AB
Y	PRISM	Y	39A	10BC
N	PINNACLE	N	0B	11BC
N	PINNACLE	Y	0B	10BC
N	SENCOR	N	0B	2C
N	SENCOR	Y	0B	1C
N	PRISM	N	0B	6C
N	PRISM	Y	0B	0B
LSD (P <0.05)			13	6

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

Table 1.2. Effect of hail damage, herbicide treatment and fungicide (Bravo) on tomato plant dry weight and yield.

HAIL Y/N	HERBICIDE	FUNGICIDE? Y/N	DRY WT G/ 4PLANT	YIELD T/AC
N	UNTREATED	N	62AB	55A
Y	UNTREATED	N	31BC	39A
Y	PINNACLE	N	29BC	40A
Y	PINNACLE	Y	42ABC	40A
Y	SENCOR	N	30BC	41A
Y	SENCOR	Y	25C	37A
Y	PRISM	N	39BC	43A
Y	PRISM	Y	38BC	41A
N	PINNACLE	N	50ABC	58A
N	PINNACLE	Y	52ABC	60A
N	SENCOR	N	74A	52A
N	SENCOR	Y	55ABC	42A
N	PRISM	N	56ABC	45A
N	PRISM	Y	65AB	55A
LSD (P <0.05)			21	4

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

Conclusions:

This trial was established to assess tolerance of transplanted tomato to combinations of simulated hail damage and various postemergence herbicides (Pinnacle, Sencor and Prism), to determine whether these cumulative stresses reduce yield more than each stress individually.

Visual injury was initially higher and plant dry weight was lower in those treatments where hail damage had been simulated along with an application of Pinnacle, but yield was not reduced. We also observed a significant decrease in plant dry weight when Sencor had been applied along with Bravo. Though there were no significant differences in final yield. Yield tended to be lower when Sencor and Bravo were applied with one another. It should be noted that the Sencor rate used in this trial is the full label rate – 450 g/ac, which is much higher than rates typically used by growers (up to 200 g/ac).

Trial 2: Tolerance of Processing Tomato Varieties to Pinnacle

Objective: Determine the tolerance of several tomato varieties to Pinnacle.

Materials & Methods:

Crop: *Tomato*

Variety: various	Planting date: May 20
Planting rate: 14850 plants/ha	Depth: 5 cm
Row spacing: 1.5m	Plant spacing: 45 cm

Design: Randomized Complete Block Design

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

Field Preparation: Field was worked with an S-tine cultivator and fertilizer was applied at 190 kg N/ha on May 5.

Soil Description:

Sand: 49%	OM: 5.8%	Texture: sandy clay loam
Silt: 26%	pH: 5.8	Soil: Watford/Brady
Clay: 24%	CEC 14	

Application Information:

	A
APPLICATION DATE	JUN 16
TIME OF DAY	6:50PM
TIMING	28DAT
AIR TEMP (c)	20
RH (%)	75
WIND SPEED (KPH)	0
SOIL TEMP (c)	15
CLOUD COVER (%)	0
CROP STAGE	7-9 LF

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 tomato variety and time of Pinnacle (6.4 G/AC) application on visual injury in tomatoes 7, 14 and 28 days after treatment.

Variety	VISUAL INJURY (D AFTER TREATMENT)		
	7D	14D	28D
H9553	0B	0B	0B
H2401	16A	15A	11A
H7209	13A	18A	12A
H4007	8AB	16A	10A
H4107	11A	11A	9A
H9909	2B	0B	0B
LSD (P <0.05)	8	10	7

Table 2.2. Effect of tomato variety and time of Pinnacle (6.4 G/AC) application on red and green yield.

Variety	PINNACLE RATE (G/AC)	YIELD (T/AC)	
		RED	GREEN
H9553	0	36A	12A
	6.4	36A	13A
H2401	0	32A	7A
	6.4	30A	9A
H7209	0	26A	7A
	6.4	15B	8A
H4007	0	42A	8A
	6.4	32B	8A
H4107	0	48A	7B
	6.4	42A	13A
H9909	0	34A	6A
	6.4	33A	5A
LSD (P <0.05)		8	4

Conclusions:

This trial was established to determine the tolerance of six processing tomato varieties to Pinnacle (thifensulfuron-methyl) applied 28 days after transplanting (DAT) at a rate of 6.4 g/ac.

H2401, H7209, H4007, H4107 were injured by Pinnacle applied at 6.4 g/ac. Red yield was less in the Pinnacle treatment than the untreated control for both H7209 and H4007. Though red yield was not reduced by Pinnacle for H4107, green yields were higher at harvest and flowering was delayed by 3-5 days.

Visual injury was not observed in either H9553 or H9909. Red yields were not reduced, and maturity was not delayed by Pinnacle applications in H9553, H9909 and H2401.

Trial 3A-D: Control of Hairy Nightshade with Increased Rates of Prism

Objective: Determine hairy nightshade control when Prism rate is increased to 24, 35 and 46 g/ac in 4 growers' fields in Ontario

Materials & Methods:

Crop: *Tomato*

Variety: H4707, H8204, H5208, JEM9 Planting date: May 21, 21, 21, 26

Planting rate: 14850 plants/ha Depth: 5 cm

Row spacing: 1.5m Plant spacing: 45 cm

Design: Randomized Complete Block Design

Plot width: 1.5m Plot length: 10m

Reps: 4

Application Information:

	A
APPLICATION DATE	JUN 24,24,24, 26
TIME OF DAY	8:15, 9:00, 9:45, 8:30 AM
TIMING	21 DAYS POST-T
AIR TEMP (c)	27, 27, 27, 30C
RH (%)	79, 79, 79, 87%
WIND SPEED (KPH)	3, 3, 3, 5
SOIL TEMP (c)	26, 26, 26, 26
CLOUD COVER (%)	5, 5, 10, 35
CROP STAGE	10-14, 10-14, 9-13, 9-12 LF
WEED STAGE	2-4, 2-4, 2-4, 3-4 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 3.1. Effect of herbicide application on tomato visual injury at 7 days after treatment (DAT) at each of the 4 locations tested.

TREATMENT	VISUAL INJURY			
	loc1	loc2	loc3	loc4
1. UNTREATED	0A	0A	0A	0B
2. PRISM 24G/AC	1A	1A	1A	1B
3. PRISM 35 G/AC	2A	2A	5A	4A
4. PRISM 46 G/AC	3A	2A	5A	6A
LSD (P <0.05)	NS	NS	NS	2

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

Table 3.2. Effect of herbicide application on hairy nightshade control at 56 days after treatment (DAT) at each of the 4 locations tested.

TREATMENT	HAIRY NIGHTSHADE CONTROL			
	loc1	loc2	loc3	loc4
1. UNTREATED	0C	0C	0C	0C
2. PRISM 24G/AC	65B	75B	68B	74B
3. PRISM 35 G/AC	74B	80B	74B	76B
4. PRISM 46 G/AC	89A	94A	86A	93A
LSD (P <0.05)	10	6	7	5

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

Conclusions:

Four studies were established to compare control of hairy nightshade at 15, 25 and 35 gai/ha (24, 35 and 46 g/ac) of Prism in various growers' fields to meet requirements for the increased rate of Prism in tomato URMULE submission. Control was 65-75% at 24 g/ac, increased to 74-80% at 36 g/ac, and was acceptable (86-94%) at the 48 g/ac rate of Prism.

Trial 4: Recropping After Prism Use in Tomato

Objective: Determine the tolerance of several crops to residues of Prism applied to tomato the previous year.

Materials & Methods:

Crop: *Tomato*

Variety: H9909

Planting date: May 23

Planting rate: 14850 plants/ha

Depth: 5 cm

Row spacing: 1.5m

Plant spacing: 45 cm

Design: Randomized Complete Block Design

Plot width: 1.5m

Plot length: 10m

Reps: 4

Field Preparation: Field was worked with an S-tine cultivator and fertilizer was applied at 190 kg N/ha on May 5.

Soil Description:

Sand: 33%

OM: 5.9%

Texture: clay

Silt: 33%

pH: 7.1

Soil: Watford/Brady

Clay: 34%

CEC 20

Application Information:

APPLICATION DATE	A JUN 12
TIME OF DAY	8:15PM
TIMING	21DAT
AIR TEMP (c)	22
RH (%)	50
WIND SPEED (KPH)	3
SOIL TEMP (c)	28
CLOUD COVER (%)	0
CROP STAGE	6-8 LF

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 Prism residues on injury, plant dry weight and yield of winter wheat, grown in the fall following application of Prism.

TREATMENT	INJURY			DRY WT	YIELD
	7D	28D	179D	G	BU/AC
1. UNTREATED	0B	0A	0B	29A	100A
2. PRISM 46G/AC	2AB	2A	4AB	25A	97A
3. PRISM 92G/AC	4A	3A	12A	32A	98A
LSD (P <0.05)	4	4	10	14	20

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

Table 4.2. Effect of Prism residues on injury, plant dry weight and yield of potato, grown in the year following application of Prism.

TREATMENT	INJURY			DRY WT	YIELD
	7D	14D	28D	G	T/AC
1. UNTREATED	0A	0B	0B	111A	13A
2. PRISM 46G/AC	0A	1B	0B	116A	12A
3. PRISM 92G/AC	0A	3A	2A	84B	13A
LSD (P <0.05)	0	2	2	8	4

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

Table 4.3. Effect of Prism residues on injury, plant dry weight and yield of pea, grown in the year following application of Prism.

TREATMENT	INJURY			DRY WT	YIELD
	7D	14D	28D	G	T/AC
1. UNTREATED	0A	0A	0A	22A	2.4A
2. PRISM 46G/AC	0A	0A	0A	27A	2.4A
3. PRISM 92G/AC	0A	1A	1A	22A	2.4A
LSD (P <0.05)	NS	NS	NS	10	0.3

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

Table 4.4. Effect of Prism residues on injury, plant dry weight and yield of seed corn, grown in the year following application of Prism.

TREATMENT	INJURY			DRY WT	YIELD
	7D	14D	28D	G	T/AC
1. UNTREATED	0A	0A	0A	33A	7.3A
2. PRISM 46G/AC	0A	0A	1A	31A	7.7A
3. PRISM 92G/AC	0A	0A	0A	34A	7.9A
LSD (P <0.05)	NS	NS	NS	12	1.2

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

Table 4.5. Effect of Prism residues on injury, plant dry weight and yield of sweet corn, grown in the year following application of Prism.

TREATMENT	INJURY			DRY WT	YIELD
	7D	14D	28D	G	T/AC
1. UNTREATED	0A	0A	0A	46A	14.2A
2. PRISM 46G/AC	2A	2A	1A	59A	14.3A
3. PRISM 92G/AC	2A	2A	1A	45A	14.7A
LSD (P <0.05)	NS	NS	NS	12	1.6

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

Table 4.6. Effect of Prism residues on injury, plant dry weight and yield of soybean, grown in the year following application of Prism.

TREATMENT	INJURY			DRY WT	YIELD
	7D	14D	28D	G	T/AC
1. UNTREATED	0A	0A	0B	36A	8.8A
2. PRISM 46G/AC	0A	0A	1B	40A	8.7A
3. PRISM 92G/AC	1A	2A	5A	32A	9.0A
LSD (P <0.05)	NS	NS	4	28	1.0

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

Table 4.7. Effect of Prism residues on injury, plant dry weight and yield of sugar beet, grown in the year following application of Prism.

TREATMENT	INJURY			DRY WT	YIELD
	7D	14D	28D	G	T/AC
1. UNTREATED	0B	0A	0A	856A	31A
2. PRISM 46G/AC	2AB	2A	2A	831A	26AB
3. PRISM 92G/AC	3A	2A	2A	744B	22B
LSD (P <0.05)	2	NS	NS	25	6

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

Table 4.8. Effect of Prism residues on injury, plant dry weight and yield of snap bean, grown in the year following application of Prism.

TREATMENT	INJURY			DRY WT	YIELD
	7D	14D	28D	G	T/AC
1. UNTREATED	0A	0A	0A	83A	5.0A
2. PRISM 46G/AC	1A	0A	0A	76A	5.2A
3. PRISM 92G/AC	1A	0A	1A	71A	5.6A
LSD (P <0.05)	1	NS	1	32	0.8

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

Table 4.9. Effect of Prism residues on injury, plant dry weight and yield of white bean, grown in the year following application of Prism.

TREATMENT	INJURY			DRY WT	YIELD
	7D	14D	28D	G	T/AC
1. UNTREATED	0B	0A	0A	65A	2.7A
2. PRISM 46G/AC	2A	1A	0A	59A	3.3A
3. PRISM 92G/AC	2A	0A	1A	66A	2.6A
LSD (P <0.05)	1	NS	NS	17	1.6

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

A recropping study was established this year to determine the potential for carryover from Prism applied at 46 and 92 g/ac. Winter wheat was planted last fall, and seed corn, soybean, and sugar beet were planted in the spring. Prism reduced stand and yield of sugarbeet one year after Prism application, regardless of rate. The other crops were not injured.

Trial 5: Tolerance of Tomatoes to Preemergence Herbicides

Objectives:

1. Determine the efficacy and tolerance of tomato to Reflex, Kixor, Valtera and sulfentrazone applied PRE-T.

Materials & Methods:

Crop: *Tomato*

Variety: H9909

Planting rate: 14850 plants/ha

Row spacing: 1.5m

Planting date: May 22

Depth: 5 cm

Plant spacing: 45 cm

Design: Randomized Complete Block Design

Plot width: 1.5m

Plot length: 10m

Reps: 4

Field Preparation: Field was worked with an S-tine cultivator and fertilizer was applied at 190 kg N/ha on May 6.

Soil Description:

Sand: 49%

Silt: 30%

Clay: 21%

OM: 5.8%

pH: 5.8

CEC 14

Texture: Loam

Soil: Watford/Brady

Application Information:

APPLICATION DATE	A
	MAY 22
TIME OF DAY	6:30AM
TIMING	PRE-T
AIR TEMP (c)	7
RH (%)	98
WIND SPEED (KPH)	8
SOIL TEMP (c)	9
CLOUD COVER (%)	100
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 5.1. Effect of herbicide treatment on tomato visual injury 7, 14 and 28 days after planting, plant dry weight 28 days after planting, and yield.

HERBICIDE	RATE	VISUAL INJURY			DRY WT	YIELD
		7D	14D	28D	G	T/AC
1. Check (WEEDFREE)		0B	0B	0B	35A	23.9A
2. REFLEX	400 ML/AC	0B	2B	1B	43A	23.0A
3. REFLEX	800 ML/AC	0B	2B	2B	39A	23.0A
4. KIXOR	25 gai/ha	5AB	5B	6B	37A	22.6AB
5. KIXOR	50 GA/HA	8A	18A	23A	22B	17.2BC
6. VALTERA	42 G/AC	0B	0B	30A	20B	18.1BC
7. VALTERA	84 G/AC	0B	0B	44A	16B	16.8C
8. SULFENTRAZONE	67 G/AC	2B	4B	8B	35A	16.4C
9. SULFENTRAZONE	135 G/AC	3B	11AB	28A	20B	15.1C
LSD (P <0.05)		2	3	6	9	4.3

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

Conclusions:

This trial was established to determine tolerance of transplanted tomato to pre-transplant applications of Kixor, sulfentrazone, Valtera or Reflex to determine tolerance at rates used in soybean. Kixor, sulfentrazone and Valtera caused significant injury, stand mortality and yield loss, while tomato was tolerant to Reflex applied prior to transplanting.