

# Maleic Hydrazide Residue Studies on Flue-Cured Tobacco

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# Maleic Hydrazide (MH)

MH remains an important compound for effective sucker control for U.S. tobacco growers

- Cured leaf residues of MH continue to be a concern for the U.S. industry
- Research trials and Extension recommendations have addressed management practices to lower residues
- U.S. growers can produce tobacco without MH

Systemic sucker control of MH is important in some circumstances



Pesticide exposure to workers must be minimized and the use of hand labor reduced as much as possible.



# Ongoing MH Studies

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1. Sequential sucker control with reduced rates of MH
2. Low volume MH wash-off
3. Plant factors impacting MH efficacy and residues
4. MH application methods
5. MH residues in a controlled environment (no rainfall)



# Low Volume MH Wash-off Study, 2012

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## Objective

Evaluate the use of a low volume wash-off spray application to reduce MH residues

# Low Volume MH Wash-off Study, 2012

## Treatment variables

### Spray volume

50 and 150 gal/ac

### Wash-off timing

2 and 6 hours after MH application

### Spray adjuvant

with and without fatty alcohol (2%)



# Low Volume MH Wash-off Study, 2012

## Treatment Protocol

1. Two (2) contact fatty alcohol applications (4 and 5%)
2. Flumetralin (2 qt/ac)
3. First harvest
4. MH application (1.5 gal/ac)
5. Wash-off treatments

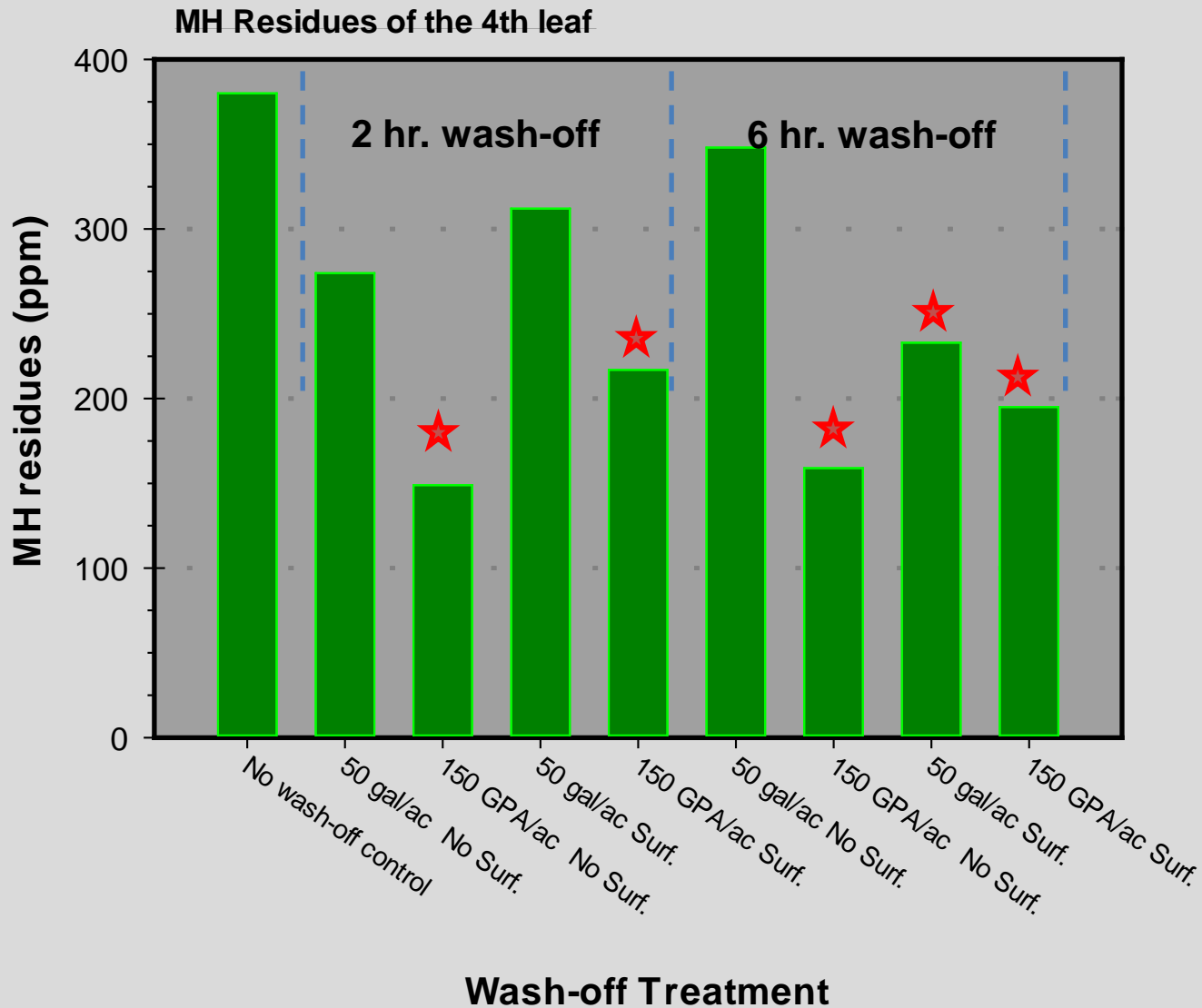
# Low Volume MH Wash-off Study, 2012

## Data Collected

1. Green leaf samples for MH 1 day after MH application (mid-stalk (C) and 4<sup>th</sup>-leaf)
2. Cured leaf MH residues
3. Sucker control  
(no. and wt. of suckers)
4. Daily rainfall at test site

# Low Volume MH Wash-off Study, 2012

## Southern Piedmont Center



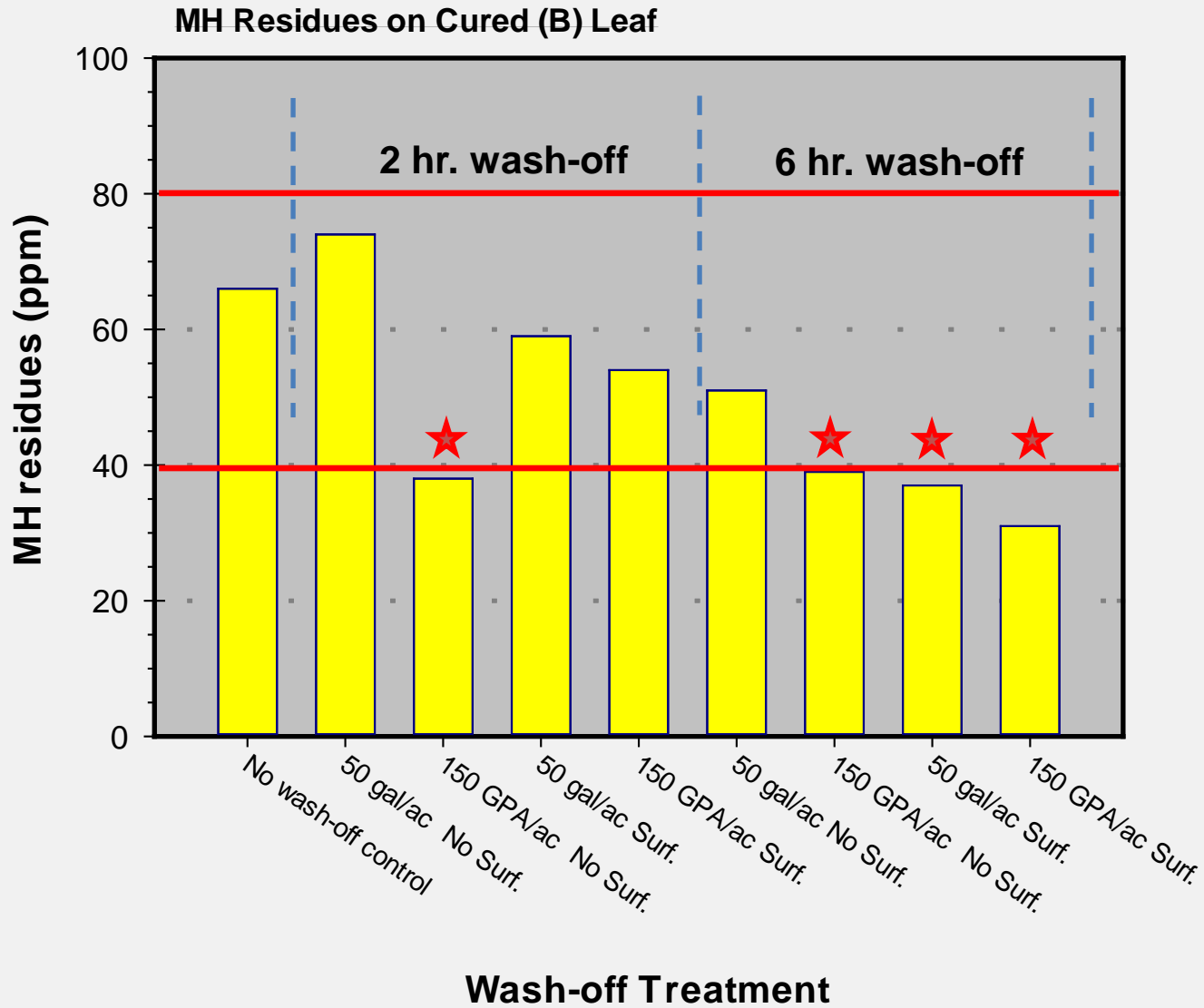
★ Dunnett's test vs. a control treatment

# Three-factor ANOVA, 2012

## Green leaf MH residues on the 4<sup>th</sup>-leaf

Source	F-value	P > F
Rep	2.61	0.0786
Wash-off timing	0.04	0.8381
<b>Wash-off rate</b>	<b>24.35</b>	<b>0.0001</b>
Surfactant	0.09	0.7666
Timing X Rate	0.01	0.9370
<i>Timing X Surfactant</i>	<i>4.20</i>	<i>0.0531</i>
<i>Rate X Surfactant</i>	<i>3.98</i>	<i>0.0593</i>
Timing X Rate X Surfactant	1.80	0.1935

# Low Volume MH Wash-off Study, 2012 Southern Piedmont Center



# Three-factor ANOVA, 2012

## Cured leaf MH residues on B tobacco

Source	F-value	P > F
Rep	0.16	0.9215
<b>Wash-off timing</b>	<b>10.74</b>	<b>0.0036</b> ★
<b>Wash-off rate</b>	<b>8.59</b>	<b>0.0080</b> ★
Surfactant	1.10	0.3052
Timing X Rate	1.21	0.2836
Timing X Surfactant	1.27	0.2732
Rate X Surfactant	3.21	0.0874
Timing X Rate X Surfactant	1.82	0.1921

# Low Volume MH Wash-off Study, 2013

## Treatment variables

### Spray volume

50 and 150 gal/ac

### Wash-off timing

2 and 6 hours after MH application

### MH rate

1.0 and 1.5 gal/ac

# ANOVA for low volume MH wash-off study, 2013

MH residues (ppm) on green 4<sup>th</sup>-leaf and cured 4<sup>th</sup> harvest leaf

Wash-off		<u>1.0 gal/ac</u>		<u>1.5 gal/ac</u>	
Rate	Timing	Green	Cured	Green	Cured
<b>No wash-off</b>		132	44	289 a	74
<b>50 GPA</b>	<b>2 hrs</b>	123	40	191 b	74
<b>50 GPA</b>	<b>6 hrs</b>	99	34	154 b	73
<b>150 GPA</b>	<b>2 hrs</b>	80	34	153 b	60
<b>150 GPA</b>	<b>6 hrs</b>	80	36	140 b	62
<b>P-value</b>		<i>0.3033</i>	<i>0.2283</i>	<b><i>0.0052</i></b>	<i>0.3993</i>



# ANOVA for Low Volume MH Wash-off Study, 2013

Source	Green 4 <sup>th</sup> -leaf	Cured 4 <sup>th</sup> harvest (B)
Rep	0.8025	0.5610
MH Rate (1.0 v 1.5 GPA)	<b>&lt;0.0001</b>	<b>&lt;0.0001</b>
Wash-off volume	<b>0.0293</b>	0.1335
Wash-off timing	0.4331	0.9679
Wash-off rate X timing	0.0536	0.6021
MH rate X wash-off rate	0.7020	0.7580
MH rate X wash-off timing	0.8892	0.2404
MH rate X wash-off rate X timing	0.7717	0.7580

# Conclusions

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1. Low volume wash-off applications were effective in reducing MH residues
  - Application spray volume was the most important factor
  - Application timing had minimal impact

# Conclusions

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1. Low volume wash-off applications were effective in reducing MH residues
2. Wash-off treatments did not impact sucker control using MH rates of 1.0 and 1.5 gal/ac

# Conclusions

1. Low volume wash-off applications were effective in reducing MH residues
2. Wash-off treatments did not impact sucker control using MH rates of 1.0 and 1.5 gal/ac
3. The sampling of green leaves is a useful research tool to evaluate treatment effects on MH residues

# MH Plant Factors Study

## Objectives

1. Evaluate time of day for MH application as temperature, humidity, and plant condition change through the day.
2. Evaluate timing of MH application relative to first harvest.
3. Monitor the weathering of green leaf MH residues following application (timing of rainfall).

# MH Plant Factors Study

## Treatment Variables

### Application dates:

1. Before 1<sup>st</sup> harvest
2. After 1<sup>st</sup> harvest
3. Late after 1<sup>st</sup> harvest

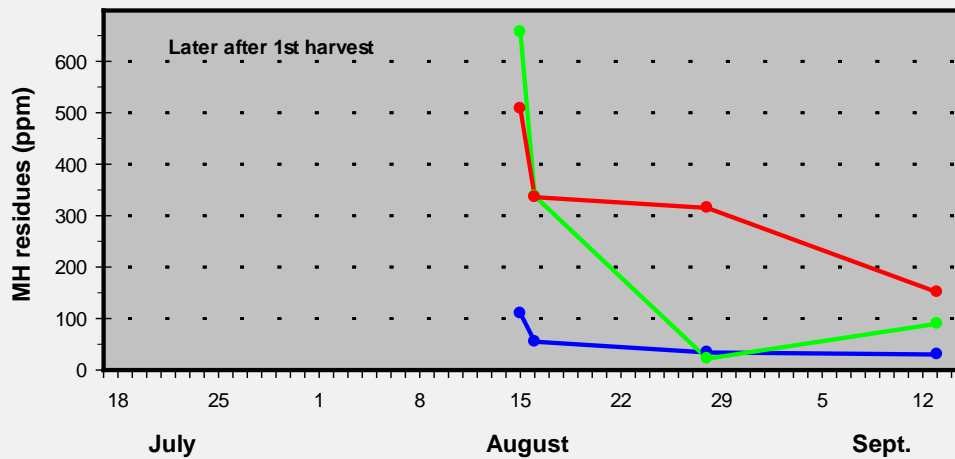
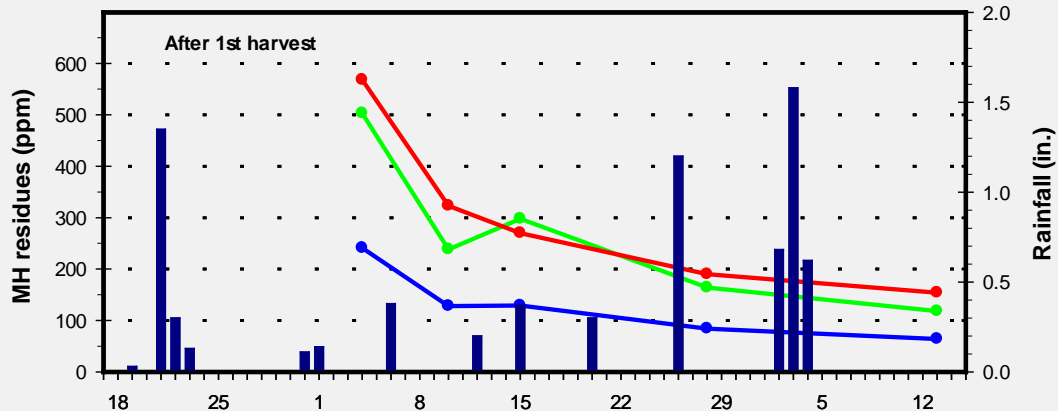
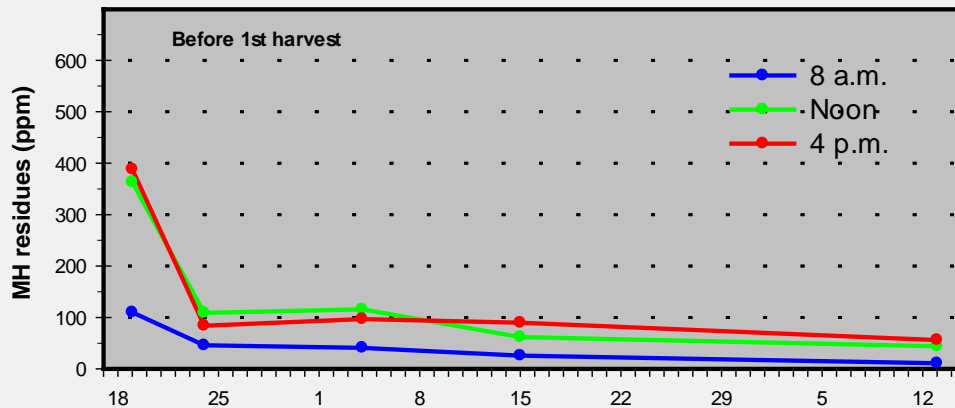
### Time of day:

1. 8 a.m.
2. Noon
3. 4 p.m.

*1½ gal/ac RMH-30 (2.25 lbs a.i. per acre)*

# MH Plant Factors Study, 2012

## Green leaf MH residues (4th leaf)



# MH residues (ppm) of cured leaf (B) -- 2102

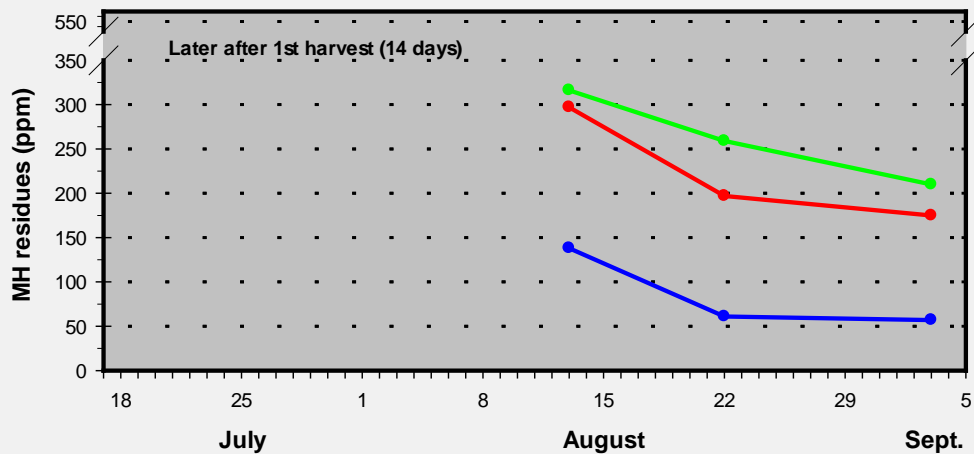
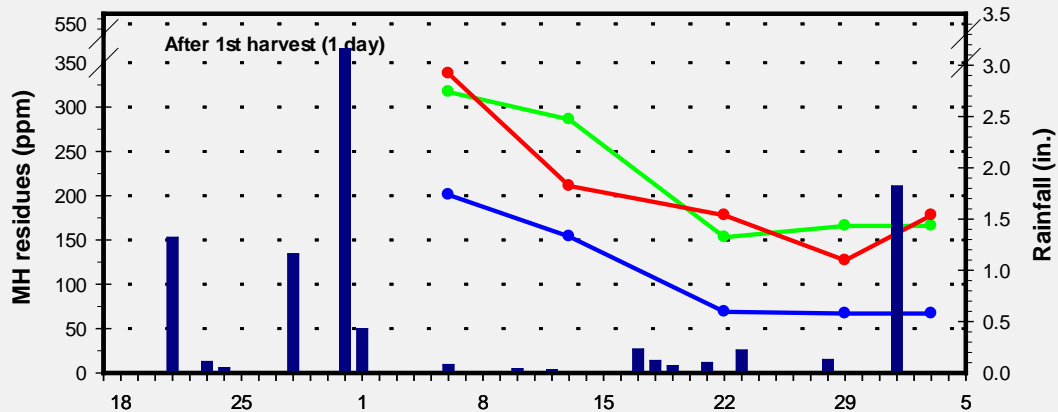
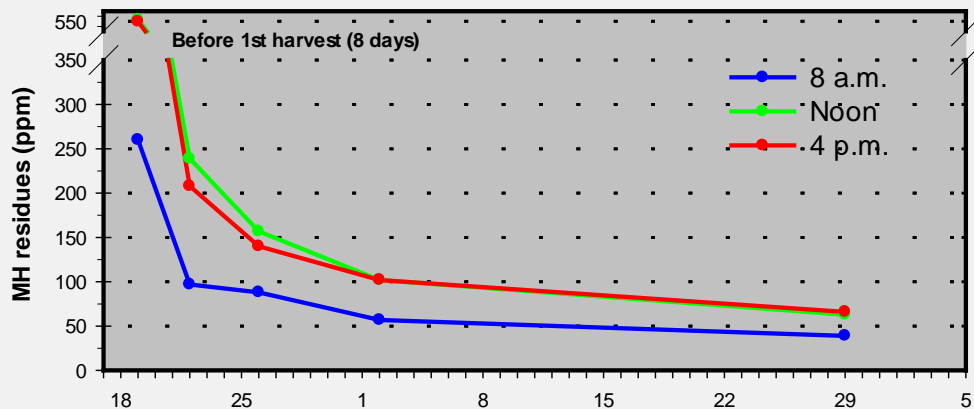
Date of application	8 a.m.	Noon	4 p.m.
Before first harvest	19	59	22
After 1 <sup>st</sup> harvest	33	92	87
Late (14 days later)	40	82	99

Royal MH-30 (1.5 gal/ac)



# MH Plant Factors Study, 2013

## Green leaf MH residues (4th leaf)



# ANOVA for MH plants factors study, 2013

## Significance levels

Source	Cured leaf MH residues	
	2 <sup>nd</sup> harvest (X)	4 <sup>th</sup> harvest (B)
Rep	0.2282	0.2102
Timing of application	<b>0.0012</b>	<b>&lt;0.0001</b>
Time of day	0.1503	<b>0.0023</b>
Timing X Time of day	<b>0.0439</b>	0.0778

# MH Plant Factors Study, 2013

## Cured leaf MH residues (ppm) of 4<sup>th</sup> harvest

Timing of application	Time of day for MH application		
	8 a.m.	Noon	4 p.m.
Before 1 <sup>st</sup> harvest	36	64	52
After 1 <sup>st</sup> harvest	62	<b>154</b>	<b>118</b>
Late after 1 <sup>st</sup> harvest	58	<b>159</b>	<b>133</b>

# MH Plant Factors Study, 2013

## Weight of suckers (lbs per 100 plants)

Timing of application	Time of day for MH application		
	8 a.m.	Noon	4 p.m.
Before 1 <sup>st</sup> harvest	19.9	10.6	27.4
After 1 <sup>st</sup> harvest	26.2	64.6	15.7
Late after 1 <sup>st</sup> harvest	34.7	28.8	60.1

*Significance levels: Time of day ( $P = 0.6414$ ), Timing of application ( $P = 0.0690$ ), and Timing X Time of day ( $P = 0.0179$ )*



# High Tunnel MH Wash-off Study



# MH High Tunnel Wash-off Study, 2013 Blackstone, Va.

