Stalk-Applied Maleic Hydrazide: Can it Work?

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Introduction

- Continued emphasis on perfect sucker control
  - Reduce NTRM, hand suckering, and labor needs
- MH remains one of the keys to sustainable US production
  - $15.81/hour adverse wage rate in 2024
- 80 ppm CORESTA GRL
  - Difficulty with not exceeding GRL, in spite of GAP

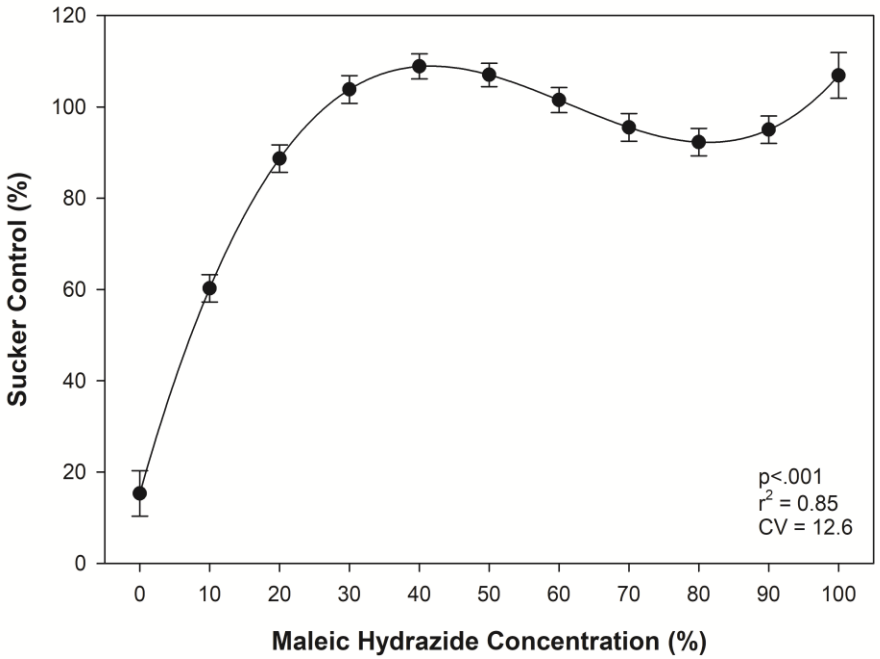
Introduction

- What has worked?
  - Coarse spray pattern
  - Low spray pressure
  - Reduced rate
  - Carrier Volume
  - Irrigation/rainfall 24 hr after application
  - Time of day
- What has NOT worked?
  - Conveyors
  - Soil applications
  - Alternative nozzles

What else??

- Could we just “wipe” MH onto plants?
  - Probably not, applicator wicks would become gummy
- What about a different spray technique?
  - Perhaps, somewhere on the plant that does not have leaves
- Maybe after first harvest?
  - Eliminate high MH residues on lugs
  - Still follows current recommendations

What else??



- Greenhouse trial in 2018
- MH was mixed appropriately
- MH solution applied to bare nodes at base of plant
  - After topping
- No other suckercides applied
- Some plants died at 100% MH concentration

Objectives

1. Determine how stalk applications compare to a traditional foliar application

2. Determine which stalk applications may be most impactful

Methods & Materials

- Trials conducted at three locations in 2020 and 2021
- RCBD w/factorial arrangement
- 13 treatments w/four reps
- 1 row plots
- MH applied <24 hr after first harvest
  - Preceded by contact and flumetralin
- Stalk applied treatments delivered with Guarany Universal liquid doser
  - Outfitted with TeeJet StreamJet nozzle
- Over the top treatment applied with 3-nozzle boom
- Super Sucker-Stuff (1.5 lbs MH/gal)

Methods & Materials

- Plots harvested for yield, quality, and value assessments
- 100 g tissue samples from 2nd, 3rd, and 4th harvest
- After final harvest:
  - Sucker number, sucker mass, and % control from 10 plants/plot
- Proc Mixed in SAS 9.4
- Analysis 1: comparison of each individual stalk applied treatment to foliar treatment
- Analysis 2: factorial analysis absent of foliar treatment

Guarany Universal Liquid Doser

Treatment List

Concentration	Solution Volume	Application Method	Application Rate[a]	
%	mL plant^{-1}		lb ai/ac	gal/ac
40	5	Stalk	4.75	3.16
40	10	Stalk	9.50	6.33
40	15	Stalk	14.25	9.50
40	20	Stalk	19.00	12.66
50	5	Stalk	5.94	3.96
50	10	Stalk	11.87	7.91
50	15	Stalk	17.82	11.88
50	20	Stalk	23.75	15.83
60	5	Stalk	7.12	4.75
60	10	Stalk	14.25	9.50
60	15	Stalk	21.38	14.25
60	20	Stalk	28.50	19.00
3	31.5	Foliar	2.25	1.50

[a] Application rates based upon MH formulation of 1.50 lbs ai/gallon (Super Sucker-Stuff, Drexel Chemical Company, Memphis, TN)

Comparison to Foliar Treatment

Table I. Tobacco sucker number per plant, sucker mass per plant, and percent control resulting from maleic hydrazide stalk applications compared to the conventional foliar treatment. Data are pooled across three locations.

Concentration	Solution Volume	Application Method	Sucker Number	Sucker Mass	Control
%	mL plant^{-1}		number plant^{-1}	g plant^{-1}	%
40	5	Stalk	0.21	10.1	98
40	10	Stalk	0.23	7.1	99
40	15	Stalk	0.06	4.7	99
40	20	Stalk	0.13	4.7	99
50	5	Stalk	0.19	7.1	99
50	10	Stalk	0.11	5.9	99
50	15	Stalk	0.18	7.5	99
50	20	Stalk	0.14	5.6	99
60	5	Stalk	0.19	8.7	99
60	10	Stalk	0.22	11.2	98
60	15	Stalk	0.15	8.1	98
60	20	Stalk	0.14	11.1	100
3	31.5	Foliar	0.18	20.4	98
	P>F		0.392	0.792	0.898

Comparison to Foliar Treatment

Table II. Tobacco yield, visual quality, and economic value resulting from maleic hydrazide stalk applications compared to the conventional foliar treatment. Data are pooled across three locations. [a]

Concentration	Solution Volume	Application Method	Yield	Quality	Value
%	mL plant^{-1}		Lb/ac		$US a^{-1}
40	5	Stalk	2,905	87	5,338
40	10	Stalk	2,948	85	5,308
40	15	Stalk	2,947	85	5,316
40	20	Stalk	2,928	86	5,367
50	5	Stalk	3,122	86	5,683
50	10	Stalk	3,143	87	5,821
50	15	Stalk	3,023	84	5,309
50	20	Stalk	3,126	84	5,572
60	5	Stalk	3,041	86	5,573
60	10	Stalk	2,838	86	5,196
60	15	Stalk	2,881	84	4,933
60	20	Stalk	2,869	84	4,932
3	31.5	Foliar	3,166	83	5,557
	P>F		0.202	0.301	0.067

Comparison to Foliar Treatment

Table III. Maleic hydrazide residues in cured cutter, leaf, and tip stalk positions resulting from maleic hydrazide stalk applications compared to the conventional foliar treatment. Data are pooled across three locations.

Concentration	Solution Volume	Application Method	Cutter	Leaf	Tip
%	mL plant^{-1}		mg kg^{-1}		
40	5	Stalk	29.47*	43.70*	62.99*
40	10	Stalk	28.95*	49.16*	75.83*
40	15	Stalk	31.23*	63.73*	88.43*
40	20	Stalk	34.45*	70.04*	103.61
50	5	Stalk	29.14*	56.11*	80.13*
50	10	Stalk	31.20*	63.02*	93.03*
50	15	Stalk	33.44*	72.41*	85.92*
50	20	Stalk	36.39*	82.73	127.45
60	5	Stalk	40.25*	67.35*	81.38*
60	10	Stalk	38.95*	73.11*	92.32*
60	15	Stalk	32.12*	77.62*	108.34
60	20	Stalk	40.38*	101.02	130.99
3	31.5	Foliar	122.32	97.20	130.12
	P>F		**<.001**	**<.001**	**<.001**

[a] "*" denotes treatment mean differences from the 3%, 31.5 mL, foliar maleic hydrazide application treatment at the α=0.05 level.

Absence of Foliar Treatment

Table IV: Analysis of variance for influence of stalk applications of MH in absence of a foliar treatment

Parameter	Concentration	Solution Volume	C x S
Sucker Number	0.940	0.535	0.163
Sucker Mass	0.448	0.509	0.833
Sucker Control	0.634	0.362	0.326
Total Yield	**0.023**	0.354	0.833
Lug Yield	0.878	0.366	0.925
Cutter Yield	0.675	0.885	0.684
Leaf Yield	0.056	0.275	0.653
Tip Yield	**0.001**	0.604	0.682
Quality	0.671	0.056	0.686
Total Value	**0.011**	0.163	0.534
Cutter Residue	**<.001**	**0.004**	0.181
Leaf Residue	**<.001**	**<.001**	0.552
Tip Residue	**<.001**	**<.001**	0.100

Absence of Foliar Treatment

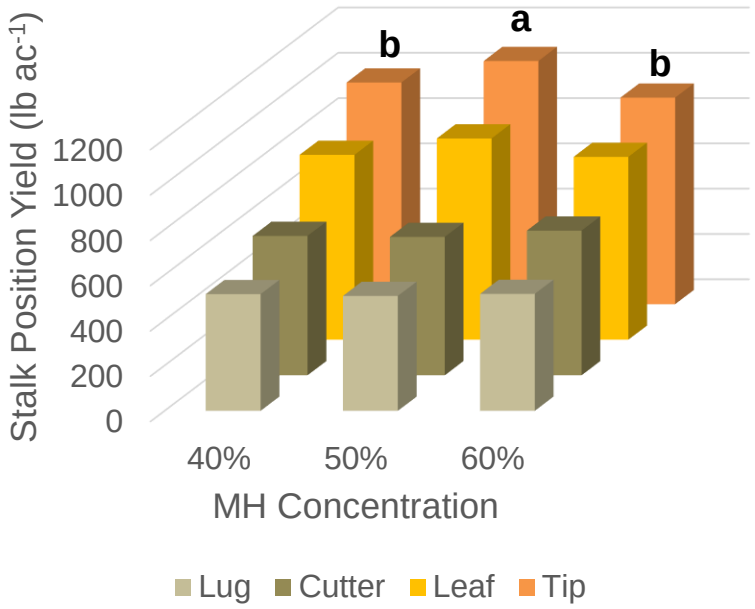
Table V. Sucker growth, treatment efficacy, and agronomic measurements as influenced by the main effects of maleic hydrazide concentration and solution volume per plant. Data are pooled across three locations. [a]

Main Effect	Sucker Number	Sucker Mass	Control	Total Yield	Quality	Total Value
Concentration	**number plant^{-1}**	**g plant^{-1}**	**%**	**lb ac^{-1}**		**$US ac^{-1}**
40%	0.14	6.64	99	2,955 ab	86	5,331 ab
50%	0.15	4.47	99	3,077 a	85	5,594 a
60%	0.15	4.92	99	2,853 b	85	5,157 b
Solution Volume						
5 mL plant^{-1}	0.17	6.06	99	3,052	86	5,529
10 mL plant^{-1}	0.15	6.72	99	2,978	86	5,442
15 mL plant^{-1}	0.14	3.77	99	2,908	84	5,184
20 mL plant^{-1}	0.13	4.82	99	2,908	84	5,288

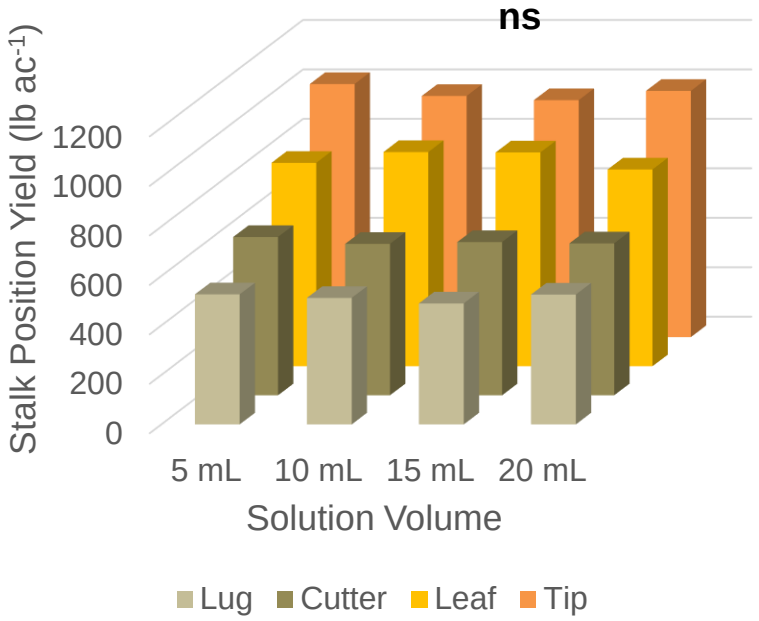
[a] Treatment means followed by the same lower or uppercase letter within the same column and main effect are not significantly different at the α=0.05 level.

Absence of Foliar Treatment

MH Concentration



Solution Volume



Absence of Foliar Treatment

Table VI. Cured leaf maleic hydrazide residues in the cutter, leaf, and tip stalk position groups as influenced by the main effects of maleic hydrazide concentration and solution volume per plant. Data are pooled across three growing environments.[a]

Main Effect	Cutter Residue	Leaf Residue	Tip Residue
Concentration		mg kg^{-1}	
40%	31.03 b	56.66 c	85.13 b
50%	32.54 b	68.57 b	97.79 a
60%	37.05 a	79.89 a	103.26 a
Solution Volume			
5 mL plant^{-1}	31.79 B	55.72 C	76.36 D
10 mL plant^{-1}	33.03 B	61.76 C	87.06 C
15 mL plant^{-1}	32.26 B	71.25 B	95.86 B
20 mL plant^{-1}	37.08 A	84.74 A	122.28 A

[a] Treatment means followed by the same lower or uppercase letter within the same column and main effect are not significantly different at α=0.05 level.

So…Can it Work?

- Yes, stalk applications are feasible!
  - 50% concentration @ 10 mL/plant appears to best balance yield, efficacy, and residues
  - MH should compliment applications of alcohol and flumetralin

What's Next??

- Large-scale research has been conducted and should continue
- Considerations for how close to harvest this can occur

Acknowledgements

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Questions??