Sprout inhibition programs for export markets of fresh potatoes

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Synopsis

Introduction

The US exports fresh potatoes all around the world. To create an expansion of export markets, it takes years of negotiations and responses to phytosanitary concerns. Phytosanitary risk is when there is potential for the introduction, establishment, or spread of pests that could harm plant life, including agricultural crops, forests, and other plant resources. One way to mitigate this risk is to manage sprout behavior of the exported crop. This project focused on ensuring potatoes will not sprout and/or produce a plant by applying various sprout inhibitors to tubers and to create a consistent sprout control program for the fresh export market.

Our Objective

Evaluate various field and post-harvest sprout inhibition products and combination treatments on the impact of plant emergence and yield.

Materials and Methods

Russet Norkotah and Agata tubers were grown over two field and storage seasons.

1. Applied MH (1.33 gal/A @ a volume of 30 gal/A; Sprout Stop, Drexel) to growing potato plants approximately 4 weeks prior to vine kill
2. Harvested MH-treated and nontreated potatoes mid September and ultimately stored at 42F with additional sprout inhibitor treatments applied as outlined below:

Acronym key
MH = Maleic hydrazide
CIPC = Chlorpropham
DMN = 1,4 Dimethylnaphthalene

Dates of applications

MH:	Aug. 3, 2023 & Aug.1, 2024
Thermal CIPC:	Nov. 15, 2023 & Nov. 20, 2024
Spray CIPC:	Apr. 9, 2024 & Apr. 9, 2025
DMN:	Apr. 9, 2024 & Mar. 25, 2025
Planting:	Apr. 22, 2024 & Apr. 22, 2025

Treatment List
1: Nontreated control
2: MH + DMN (20 ppm)
3: Thermal CIPC (22 ppm)
4: MH + Thermal CIPC (22 ppm)
5: Thermal CIPC (22 ppm) + CIPC emulsifiable concentrate (EC) spray (10 ppm)
6: MH + Thermal CIPC (22 ppm) + CIPC spray (EC; 10 ppm)

Results

Sprout development in storage

By mid-January, the natural dormancy (nontreated control) and MH + DMN showed greater sprout development compared to CIPC based treatments. Regardless of variety, prior to planting in April, sprout development was retarded for all CIPC-based programs and slightly delayed for the MH + DMN program compared to the nontreated control (Figure 1).

Field Emergence

All treatments showed delay in emergence compared to the untreated control for both cultivars. Forty days after planting, all CIPC-based treatment programs had 0% emergence, whereas the nontreated control was fully emerged (>85%) at this time (Table 1). The treatment program with MH + Thermal CIPC + CIPC EC spray had the lowest percent emergence (2-8%) at 85 days after planting. MH + DMN was effective at reducing emergence to less than 40% of the untreated control but may not be as effective and consistent at suppressing emergence as CIPC based programs (Table 1). The thermal CIPC and EC spray combination program was very effective at minimizing plant emergence (0%) by 60 days after planting and 3-13% at 85 days after planting.

Harvest

At harvest, many seed pieces were intact in the Russet Norkotah harvested plots. Reduction in tuber number for a 50 ft plot was extreme for all sprout inhibitor treatments. The MH + DMN program reduced tuber number by 72% for Russet Norkotah and 61% for Agata; whereas, combining either a CIPC spray and/or MH to the thermal CIPC treatment was the most effective and reduced tuber number by 80 to 90% for Russet Norkotah and 92 to 96% for Agata (Figure 2). Total yield followed similar trends as seen in tuber number.

Conclusions

Sprout inhibitor programs should include CIPC to ensure no or minimal sprouting for export market regulations. Adding MH and CIPC spray to a thermal CIPC program provided greater protection against sprout, plant, and daughter tuber development. Timing and seasonal impact of MH needs to be further analyzed; however, this chemistry showed strong sprout control ability to be utilized in export market sprout inhibition programs that contain CIPC. Future research should evaluate the ideal cultivar candidates for export markets with respect to quality and sprouting aggressiveness. Other CIPC programs, such as two thermal CIPC applications + CIPC spray should also be examined in future research.

Acknowledgements

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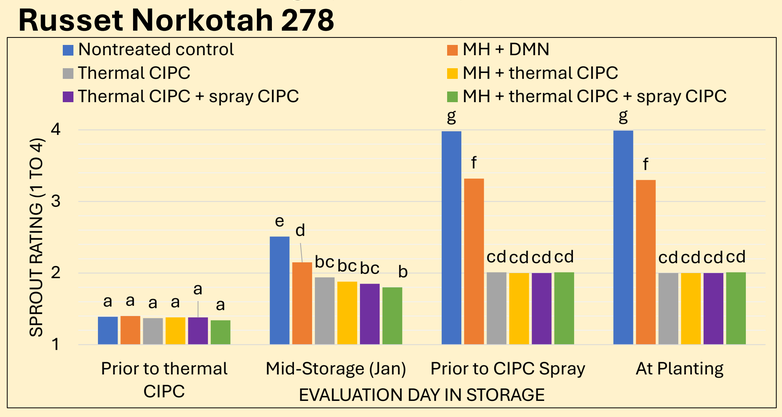
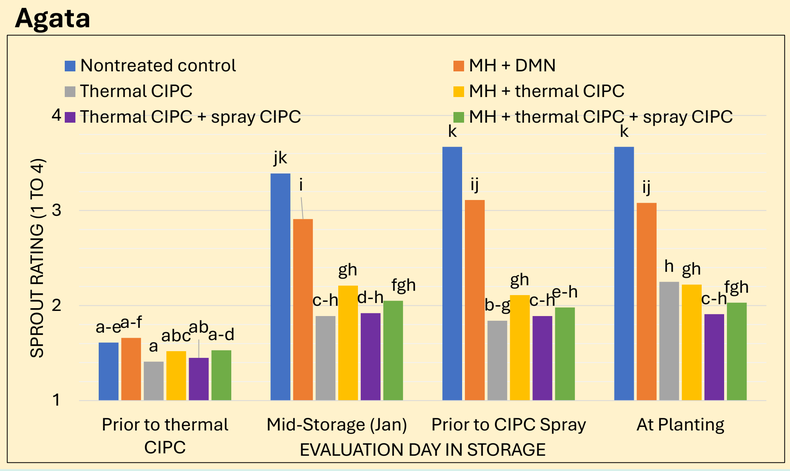
Sprout development in storage

Figure 1. Monthly sprout rating (1 to 4) for A) Russet Norkotah 278 and B) Agata potatoes stored at 42°F. Values are averaged between years. Sprout rating: 1 = no sprouting, 2 = peeping, 3 = pointed sprouts less than 0.2 inches in length, and 4 = sprouts are 0.2 inches or longer.

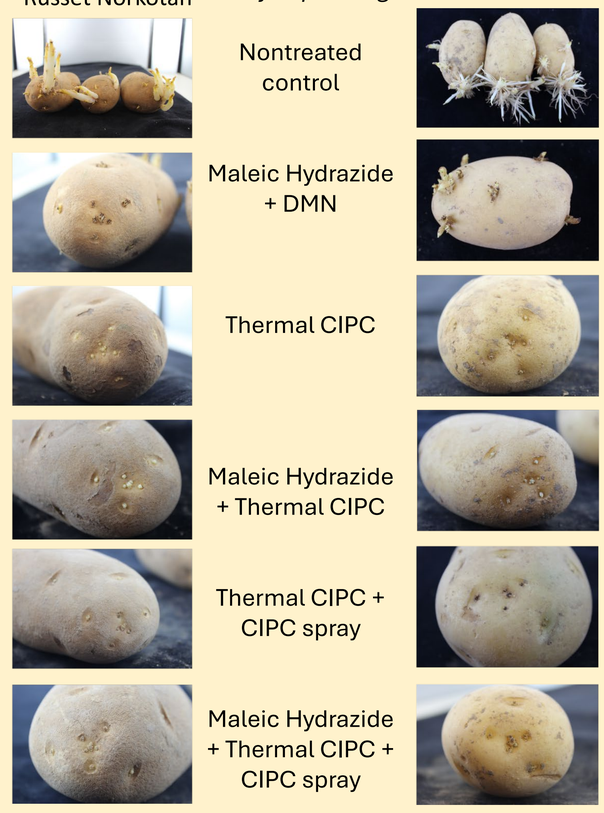
Russet Norkotah 278



Agata



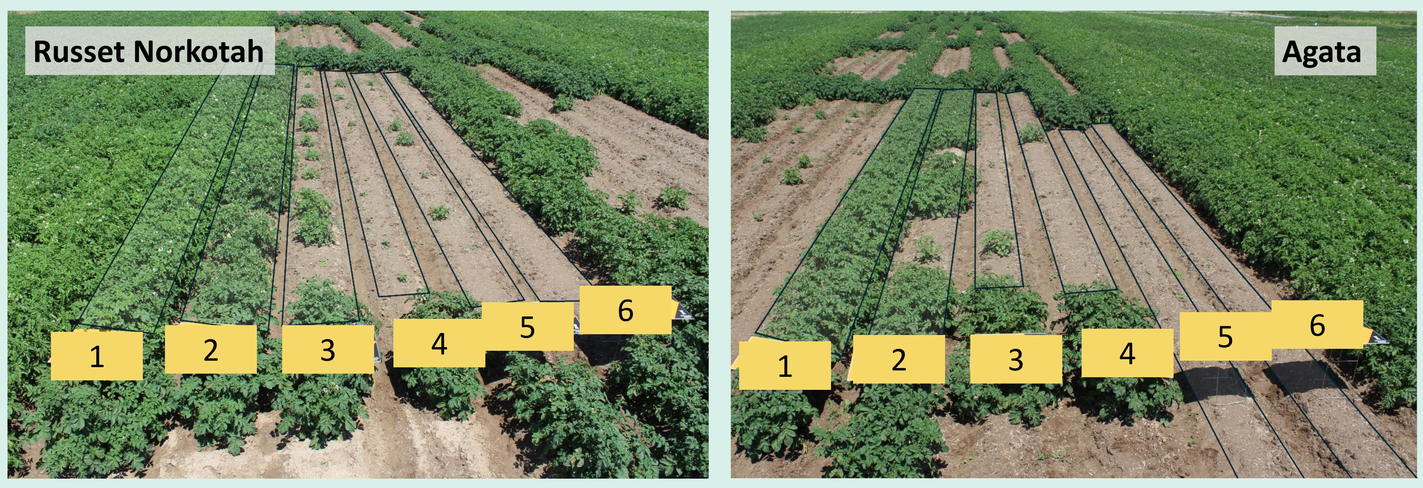
Visual of how tubers looked day of planting



Field emergence

Table 1. Effect on emergence of sprout-inhibitor-treated Russet Norkotah 278 and Agata tubers 40, 60, and 85 days after planting (DAP) among 2024 and 2025 field seasons. Values followed by the same letter in each column are not significantly different ($\alpha < 0.05$).

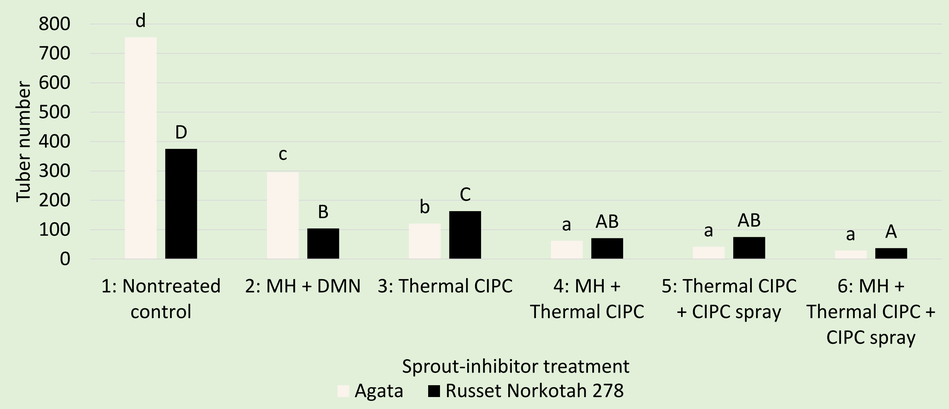
		Russet Norkotah Emergence (%)			Agata Emergence (%)		
Treatment	**Year**	**40 DAP**	**60 DAP**	**85 DAP**	**40 DAP**	**60 DAP**	**85 DAP**
Nontreated control	2024	91 c	93 c	93 d	86 d	90 e	90 g
MH + DMN		20 b	27 b	37 c	22 c	36 d	42 f
Thermal CIPC		0 a	3 a	37 c	0 a	2 ab	14 bcd
MH + Thermal CIPC		0 a	0 a	16 b	0 a	1 a	7 abc
Thermal CIPC + CIPC spray		0 a	0 a	13 b	0 a	0 a	3 ab
MH + Thermal CIPC + CIPC spray		0 a	0 a	3 a	0 a	0 a	2 a
Nontreated control	2025	95 c	95 c	95 d	98 e	98 f	98 g
MH + DMN		1 a	3 a	3 a	13 b	22 c	24 de
Thermal CIPC		0 a	0 a	29 c	0 a	7 b	32 ef
MH + Thermal CIPC		0 a	0 a	2 a	0 a	4 ab	16 cd
Thermal CIPC + CIPC spray		0 a	0 a	6 ab	0 a	0 a	3 a
MH + Thermal CIPC + CIPC spray		0 a	0 a	2 a	0 a	1 ab	8 abc
	P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001



Storage treatments in the field 49 days after planting for Russet Norkotah 278 and Agata plants. From left to right in each photo, rows include 1) nontreated control, 2) MH + DMN, 3) Thermal CIPC, 4) MH + Thermal CIPC, 5) Thermal CIPC + CIPC Spray, 6) MH + Thermal CIPC + CIPC spray.

Harvest

Average number of tubers harvested per 50 ft plot



Results are averaged between years. Values followed by the same letter (uppercase = Agata; lowercase = Russet Norkotah) in each column are not significantly different ($\alpha < 0.05$).

Tuber number reduction (%) relative to the nontreated control plots.

Sprout inhibitor treatment	Russet Norkotah 278	Agata
2: MH + DMN	72%	61%
3: Thermal CIPC	57%	84%
4: MH + Thermal CIPC	81%	92%
5: Thermal CIPC + CIPC spray	80%	94%
6: MH + Thermal CIPC + CIPC spray	90%	96%

Sprout inhibitor programs should include thermal CIPC with either CIPC spray and/or MH to ensure no or minimal sprouting for export

Visual representation of the sustained inhibited growth of CIPC-treated seed pieces in harvested plots in year 1.