Evaluation of Methyl Anthranilate for Use as a Bird Repellent in Selected Crops

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Abstract

Methyl anthranilate (MA) did not provide effective repellent effects when applied to crops to prevent stand reduction by birds. When compared to crops protected by netting and to untreated plots, greater crop stand reduction was observed for MA treated crops. MA at 2.0 pt/A was more efficacious than a lower rate of 1.0 pt/A for certain crops. MA performance was not enhanced by the addition of an adjuvant. Greater activity with birds moving from plant to plant was observed in MA treated crops compared to untreated plants.

Introduction

Birds commonly cause damage to newly planted seeds, germinating seeds, or emerging seedlings of crops in many agronomic and horticultural crops in Arizona. Birds such as horned larks, sparrows, blackbirds, starlings, and mourning doves feed on newly seeded vegetable crops causing major crop damage resulting in significant economic loss by producers. Newly planted vegetable crops are often the only source of food in the desert and birds migrate to fields to nibble, chew, or destroy the emerging seedlings of lettuces, cole crops, onions, and melons. In Arizona, a variety of vegetables are grown throughout the year with planting occurring from the early fall (July to September for fall melons and early leafy vegetables) through the winter (October to December for early spring vegetables) and into early spring (February to March for late spring vegetables and spring melons). Hybrid vegetable crop seeds are often planted to a stand and when bird damage occurs, quality and yield of the harvestable crop are significantly reduced.

Methyl anthranilate (MA), is a naturally occurring GRAS (generally recognized as safe) listed compound used as a food flavoring and fragrance additive. MA is a natural component of concord grapes and other plant materials. Chemical formulations containing MA have been found to be effective bird aversion agents. Formulations of MA act as chemosensory repellents by irritating pain receptors associated with taste and smell. MA has been approved by the U.S. EPA as a bird repellent for use in cherries, blueberries, and table grapes, with anticipated registration on sunflowers and other crops. When applied as a formulated spray, MA has been found to be effective in repelling birds from feeding on crops. In field research conducted with MA applied to cherry orchards in the northwest U.S., it demonstrated a significant reduction in bird damage to harvestable fruit.

The experiments described in this report investigated the potential use of methyl anthranilate (MA) as a bird repellent for lettuce seedling protection. The experiments were conducted to evaluate and determine the efficacy of sprays of MA as a bird repellent in protecting seed and seedlings of lettuce, broccoli, cantaloupe, wheat, and sorghum during the period of stand establishment.

This is a part of the University of Arizona College of Agriculture 2001 Vegetable Report, index at: http://ag.arizona.edu/pubs/crops/az1252/

Materials and Methods

Eight field experiments were conducted between April 2000 and March 2001 at the University of Arizona Maricopa Agricultural Center, Maricopa, AZ (Table 1). Experiments were conducted to investigate the use of MA applied to lettuce during the fall and spring planting seasons. Sorghum, wheat, and barley were the grain crops evaluated in the studies in addition to broccoli, onion, and cantaloupe. Two fields, each up to approximately 1 acre in size, were located adjacent to a bird-infested fruit orchard for the majority of the experiments. One field was designated as a control that contained both netted (net-protected) and unnetted (untreated) lettuce or other crop plots. Crops were planted on raised beds, one or two beds of each crop per treatment and measuring more than 300 ft in length. The treated field contained treatment plots with rates of MA sprayed at 1.0 and/or 2.0 pt product/A.

Experiments I, V, and VI were sprayed using a backpack CO_2 sprayer equipped with a hand-boom with four nozzles delivering 20 to 30 gpa. The remaining Experiments II, III, IV, and VIII were sprayed using a small tractor-mounted sprayer with a 13-ft boom. Experiment VII was conducted on a commercial scale where 16 A were treated with a tractor-mounted sprayer with a 47-ft boom delivering 22 gpa.

Pre-treatment crop stand counts were conducted to record the number of undamaged plants within each plot in both fields from multiple subplots represented by 10 ft of row per bed. The treated fields were sprayed with MA using a backpack sprayer or a tractor-mounted sprayer. MA was applied after emergence and continued regularly at varying intervals until the 4-5 true leaf stage. All crop stand counts were taken regularly at varying intervals after applications to assess the degree of bird damage. Stand counts were collected in treated and untreated, netted and not netted plots to quantify stand reduction as an indicator of the bird repellence efficacy of MA. The average percent reduction of the individual crop stands were compared for the MA treated crops and untreated checks versus the netted crops.

Results and Discussion

In all field tests that were conducted to evaluate and compare the relative efficacy of MA against a netted crop, stand reductions were observed for all MA treated crops (Tables 2, 3, 4). In Experiment I, MA at 2.0 pt/A demonstrated greater efficacy against birds to protect lettuce, onion, and broccoli crops than the lower rate of MA at 1.0 pt/A (Table 2). However, all MA treated crops showed more crop stand reduction relative to the untreated check crops. In cases where the untreated checks were observed to have more plants than the netted crops, crop emergence occurred after the initial applications were made. The predominant birds that were observed in the initial experiment were mourning doves and grackles.

In Experiments IV, VI, and VIII, lettuce stand reduction progressively increased as compared to the untreated fields when MA was applied three to six times during stand establishment at 2.0 pt/A (Table 3). Broccoli in Experiment V was treated as many as five times with MA at 2.0 pt/A and also showed greater stand reduction than the untreated field. Sparrows were the predominant species of birds observed in the broccoli.

In Experiments III and VII, MA demonstrated greater efficacy when used on grain crops, sorghum and wheat. A single application during the summer on sorghum showed that MA at 2.0 pt/A had only slightly less stand reduction than the untreated check (Table 4). Mourning doves, grackles, and sparrows were the predominant birds observed in this experiment.

In Experiment VII, MA at 2.0 pt/A was applied using a commercial sprayer on seedling wheat on a larger scale acreage and showed a 37% improved stand compared to the untreated wheat stand. More wheat plants counted after the application may also indicate emergence of more seedlings after the application. The predominant birds observed were horned larks, meadow larks, sparrows, black birds, and killdeers. In this large scale application on the wheat, birds were monitored immediately after the application and most appeared to be very active and moving rapidly from plant to plant in the treated area. Those birds in the untreated wheat appeared to be less active and tended to stay in one location to feed on wheat seedlings. In Experiment IV, barley and romaine lettuce were planted and the barley was reduced 50% compared to the untreated check. The crops were attacked primarily by black birds and sparrows.

The addition of Tactic, a synthetic latex and organosilicone adjuvant, to the formulated MA did not enhance the performance of 1.0 pt/A applied on sorghum. Greater stand reduction was observed when an adjuvant was added to the MA. Mourning doves, grackles, and sparrows were the predominant birds observed in this experiment.

In summary, MA did not provide efficacious bird repellent effects when applied on these crops to prevent stand reduction caused by bird depredation. More crop stand reduction was observed for MA treated crops than untreated and netted crops. MA at 2.0 pt/A was more efficacious than a lower rate of 1.0 pt/A in lettuce, onion, and broccoli. The repellent efficacy of MA was not enhanced by the addition of an adjuvant. MA was observed to cause greater bird activity with birds moving from plant to plant within treated areas. The efficacy of single and multiple applications of MA could not be differentiated against any birds. The length of efficacy provided by any single or multiple application could not be conclusively determined.

Acknowledgments

These experiments were supported in part with funding provided by the Arizona Iceberg Lettuce Research Council. Appreciation is expressed to the personnel of the University of Arizona Maricopa Agricultural Center for assisting in conducting the field experiments. Technical assistance in conducting the experiments was gratefully appreciated by N.Lund, D. Roberts, and D. MacNeil.

Table 1. Field tests conducted during 2000-01 to evaluate MA efficacy on crops.

Experiment*	Date	Crop(s)	Application date(s)
I	April - May 2000	lettuce, onion, broccoli, wheat, cantaloupe	Apr 20, 27, May 4
II	June - July 2000	sorghum	Jun 28
III	July - August 2000	sorghum	Aug 2
IV	October - November 2000	head lettuce	Oct 18, 24, 30
V	November - December 2000	broccoli	Nov 29, Dec 1, 4, 8, 13
VI	December 2000 - January 2001	romaine lettuce, barley	Dec 8, 13, 20, Jan 2, 8, 11
VII	January 2001	wheat	Jan 4
VIII	February - March 2001	red leaf lettuce, wheat	Feb 22, 27, Mar 2, 12, 20

*Experiment number as reference for summary of results in following tables.

Table 2. Comparison of efficacy of MA rates against birds versus various net-protected crops.

MA Treatment	Average Crop Stand Reduction (%)				
	Lettuce	Onion	Broccoli	Wheat	Cantaloupe
Untreated check	1	7	+12	+43	14
1.0 pt/A	61	14	38	+4	19
2.0 pt/A	45	12	6	6	21

Experiment I initiated April 2000.

Table 3. Efficacy of MA against birds compared to various net-protected crops.

MA Treatment	Average Crop Stand Reduction (%)			
	Lettuce (IV)	Lettuce (VI)	Lettuce (VIII)	Broccoli (V)
Untreated check	+3	+13	+2	30
2.0 pt/A	1	21	53	42

Summary of Experiments IV, V, VI, and VIII, conducted October 2000 to March 2001.

Table 4. Efficacy of MA against birds in grain crops.

MA Treatment	Average Crop Stand Reduction (%)				
	Wheat (VII)	Wheat (VIII)	Barley (VI)	Sorghum (II)	Sorghum (III)
Untreated check	-	11	50	8	21
1.0 pt/A				13	
1.0 pt/A + adjuvant				29	
2.0 pt/A	+37	71	50		20

Sorghum Experiments II and III conducted June to August 2000.
Wheat and barley Experiments VI, VII, and VIII conducted December 2000 to March 2001.