PRELIMINARY EVALUATION OF DIMETHYL ANTHRANILATE AS A BIRD REPELLENT

by

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A MASTER'S REPORT

submitted in partial fulfillment of the

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MASTER OF SCIENCE

Crop Protection

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Approved by:

Edward W. Kellman

Major Professor

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Introduction

One of the most important problems concerning grape producers in the United States is damage to ripening grapes caused by birds. The present estimates for grape loss due to bird damage are approximately seven million dollars annually. (Himelrick, 1985).

Many types of birds are responsible for grape damage throughout the United States, primarily depending on the geographical location. However, on a nationwide basis, two species stand out as the most destructive; American robin (*Turdus migratorius*) and European starling (*Sturnus vulgaris*).

There are numerous bird control methods; chemical, physical and auditory, available or under study at the present time. The methods presently available, however, either have no significant effect in reduction of grape loss or they are extremely expensive and thus economically unfeasible.

Some of the physical bird control methods that are available includes scarecrows, streamers, and canopy netting. Scarecrows and streamers reportedly produced only poor to fair control (Himelrick, 1985). Netting produced excellent control, however, due to the high costs involved, this method proved uneconomical. Auditory controls, including propane exploders, alarm systems, firearm patrols and distress calls show only poor to fair control. It was also found that auditory control is affected by climatic conditions (Johnson, et al., 1985). Furthermore, effectiveness of auditory control is limited due to habitation by the birds resulting in loss of repellency (Thompson and Spencer, 1966).

At the present time there is only one chemical labelled by the Environmental Protection Agency (EPA) for use as a bird repellent on grapes. This chemical is called Sevana [composed of red pepper (Capsicum spp.) and ground garlic (Allium sativum)]. However, this chemical is registered for use in only five western states. A second chemical repellent which is registered for use on cherries and blueberries is Mesurol. While this chemical is not labelled for use on grapes at this time, it has been shown to be an effective bird repellent on grapes (Hothem, et al., 1981). The registration on Mesurol, however, is temporary (expires March 31, 1988), thus the future of this chemical is uncertain.

A third chemical which is under investigation as a bird repellent, but is not presently labelled for use, is dimethyl anthranilate (DMA). DMA closely resembles in chemical structure, methyl anthranilate which is a naturally occurring flavor component in many American grape varieties such as Concord, Fredonia and Van Buren (Pederson et al., 1971). DMA has been approved by the Food and Drug Administration (FDA) as a food flavoring for human consumption. DMA was first evaluated as a bird repellent livestock feed additive (Mason, et al., 1985). The following research is a preliminary evaluation of dimethyl anthranilate as a bird repellent on grapes.

Materials and Methods

This study was conducted at Manhattan, Kansas during September and October of 1987. European starlings were captured in a 4 x 6 foot live bird trap located near the Kansas State University Beef Research Unit in Manhattan. The birds were transported at night (to reduce stress) to an open-sided barn where they were individually housed in 4 x 2 x 4 foot wood-framed cages covered with 1 inch mesh chicken netting.

During the first three days of captivity, the starlings were maintained on a high protein diet consisting of Gerber baby food (apple-banana flavor), hyprotein baby cereal, cottage cheese, hard-boiled chicken eggs, and raisins in approximately a 6:4:1:3:2 ratio (Hazelton and Robel, 1984). Fresh water was available at all times. From days 4 to 7 the starlings were again offered the maintenance diet but in addition, five 'Thompson Seedless' grapes were placed on top of the maintenance diet to introduce the starlings to the fruit.

Three treatment spray mixtures were prepared; 0.01M DMA, 0.1M DMA, and a control containing no DMA. DMA in liquid form is insoluble in water thus Tween 80 was added to the mixtures to keep DMA in suspension. Tween 80 was added to the control mixture in an equal quantity as in the 0.1M DMA solution. Fresh 'Thompson Seedless' grapes were treated with each solution by means of a misting bottle such that all grapes were thoroughly covered. The grapes were treated the evening before they were offered to the birds.

The trial was started on the eighth day of the starlings' captivity and run for 10 consecutive days. Each of the treatments was randomly assigned to 10 birds for the duration of the experiment. Each morning at dawn, the remaining food of their maintenance diet was removed and the starlings were offered ten grapes, treated with their assigned solution, for a period of ninety minutes. At the end of the ninety minute period the grapes were removed and replaced with the maintenance diet. All food sources were offered in identical 5 x 10 inch aluminum foil pans that had been painted brown to reduce light reflection.

At the end of each ninety minute period, the number of grapes that were completely consumed by each bird, as well as the number of remaining grapes that had been damaged by each bird, was recorded.

A two-way repeated measures analysis of variance was used to determine the effect of DMA concentration and the effects of DMA over time on bird damage to grapes.

Results and Discussion

A significant reduction of grape loss was achieved with both concentrations of DMA (Table 1.). Mean damage to grapes (consumed grapes plus damaged grapes) was reduced from 4.6 to 2.8 for both DMA concentrations. No significant difference was detected between the two DMA concentrations. The reduction of total damage by DMA treatments was apparently due to a reduction in the number of berries consumed, (Figure 1.) because there was no difference among treatments in number of damaged berries (Figure 2.).

Consumption and damage of grapes varied daily throughout the experiment, but followed similar patterns for treated and untreated grapes (Figure 3.). Total damage to treated grapes did not decrease over the timespan of this experiment, suggesting that the birds had not developed a learned aversion to grapes.

As previously mentioned, DMA is approved by the FDA as a food flavoring for human consumption. Because DMA is considered a relatively safe chemical and achieves it's repellency by means of an unpalatable taste to birds while being readily accepted by humans (Mason et al., 1985), it is felt that DMA could readily qualify for registration by the EPA as a bird repellent with labelling for use on grapes.

Although there are many questions yet to be answered on the use of DMA as a bird repellent on fruit, the results of this preliminary study are promising and warrant further investigation.

Some of the questions that remain to be answered are: 1) How will birds (including species other than starlings) react to DMA treated grapes in a noncaptive setting. 2) What is the effectiveness of DMA as a repellent when alternative food sources are available? Sturkie (1965) reported that a ten fold increase in DMA concentration was needed to achieve a comparable reduction of food consumption of young chicks when fed only DMA treated rations versus a choice between treated and untreated rations. 3)What are the effects of treating the grapes with DMA prior to the acclimation of grapes as a food source versus applying DMA after the birds have become accustomed to grapes as a food source? The Sevana Company reports that Sevana is more effective if applied prior to the birds feeding on the grapes. Thus it is possible that the effectiveness of DMA would also be inhanced if it were applied prior to the birds feeding on the grapes.

Table 1. Consumption and damage to DMA treated and untreated grapes by European starlings.

Treatment	Mean No. Berries Consumed[z]	Mean No. Berries Damaged	Mean Total Damage[y]
Control	3.9a	0.7n.s.	4.6a
0.01M DMA	2.2 b	0.6	2.8 b
0.1M DMA	1.9 b	1.0	2.8 b

[z]Means within columns separated by LSD test, P = 1%.
[y]Consumed berries plus damaged berries.

Figure 1. Consumption of DMA treated and untreated grapes by European starlings.

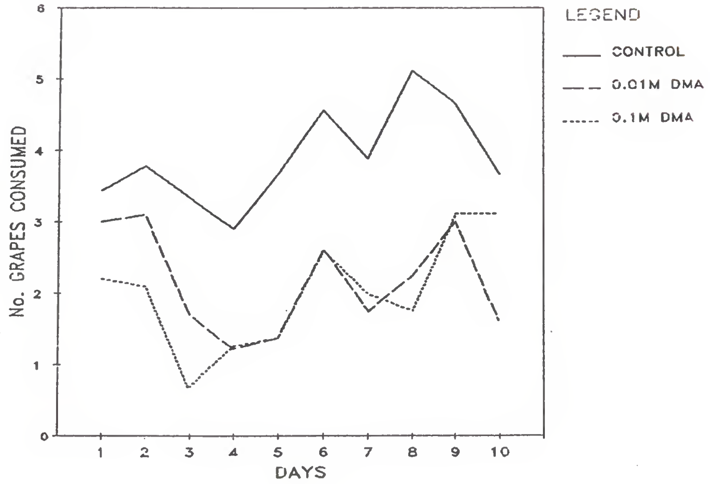


Figure 2. Number of DMA treated and untreated grapes damaged by European starlings.

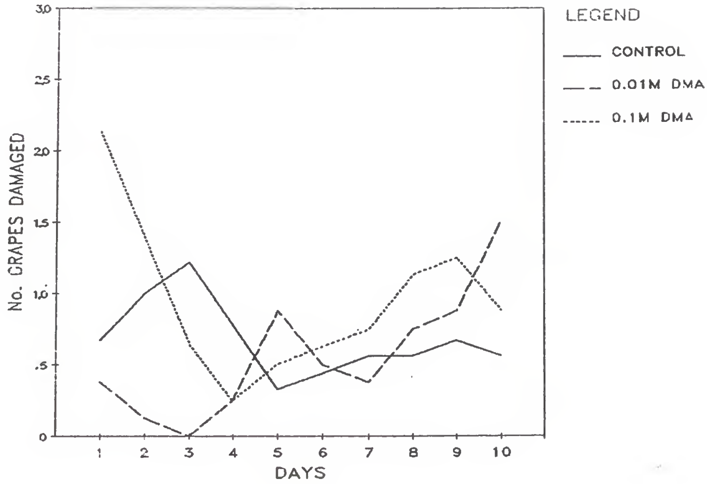
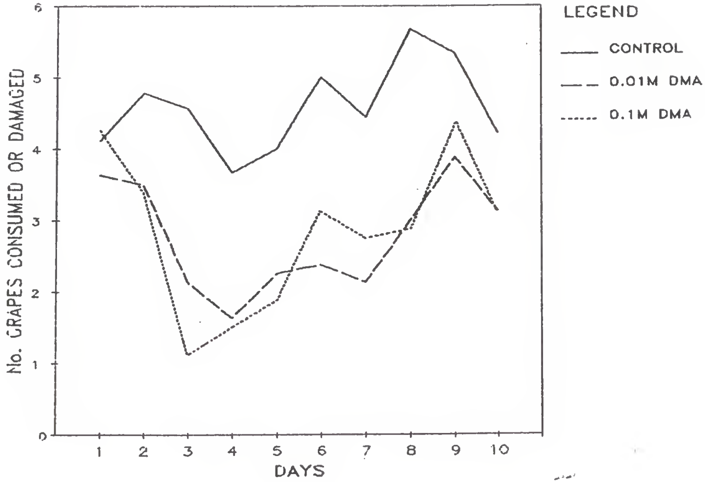


Figure 3. Consumption and damage of DMA treated grapes by European starlings.



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Preliminary Evaluation of Dimethyl Anthranilate as a Bird Repellent

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A preliminary study was conducted to evaluate dimethyl anthranilate (DMA) as a bird repellent on grapes. European starlings (turnus vulgaris), a common pest on grapes, were used as the test species. Thirty birds were caged individually and maintained on a high protein diet. Ten birds were randomly selected to receive one of three treatments. The treatments consisted of 10 fresh 'Thompson Seedless' grapes treated with a surface application of 0.01M DMA, 0.1M DMA, or untreated grapes (control). Treated or untreated grapes were offered to the birds at dawn for 90 minutes in the absence of the high protein diet. Number of grapes consumed or damaged was recorded. Both DMA treatments significantly reduced consumption of grapes compared to untreated grapes. There was no significant difference among the two treatment concentrations tested.