

**USE OF BIOPESTICIDES FOR THE HANDLING OF ANTHRACNOSE
(*Colletotrichum gloeosporioides*) ON MANGO FOR EXPORT**

FINAL REPORT

**YEAR 1: BIOLOGICAL EFFECTIVENESS OF BIOPESTICIDES FOR THE CONTROL OF
ANTHRACNOSE IN MANGO FRUITS
"ATAULFO, KEITT, KENT AND TOMMY ATKINS"**

**YEAR 2: EFFECT OF BIOPESTICIDES ON THE QUALITY OF MANGO FRUIT "ATAULFO,
KEITT, KENT AND TOMMY ATKINS" IN POSTHARVEST**

TECHNICAL PROJECT MANAGER

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BIOLOGICAL EFFECTIVENESS OF BIOPESTICIDES FOR THE CONTROL OF ANTHRACNOSE IN MANGO FRUITS "ATAULFO, KEITT, KENT AND TOMMY ATKINS"

1. SPECIFIC OBJECTIVES

- I. Prepare formulations of biopesticides with greater control effect on *C. gloeosporioides* in postharvest fruits.
- II. Determine the doses and immersion time of biopesticide formulations for the control of anthracnose in postharvest fruits.
- III. Carry out biological effectiveness tests of biopesticides on fruits of the mango varieties "Ataulfo, Keitt, Kent and Tommy Atkins".
- IV. Obtain the doses and immersion time of biopesticide formulations with greater biological effectiveness for the control of anthracnose in postharvest fruits.

2. METHODOLOGY

2.1. Biopesticide formulations

Active ingredients with biofungicidal activity were used, with which five formulations were made (Table 1). The selection of the formulations was made based on the best control effects in postharvest fruits of the previous project "Use of biopesticides for the management of anthracnose (*Colletotrichum gloeosporioides*) in mango for export". Likewise, the effectiveness of the systemic fungicide Azoxystrobin (Amistar Gold®) was evaluated.

Table 1. Formulations of biopesticides and chemical fungicide for the control of anthracnose produced by the fungus (*C. gloeosporioides*) in mango fruits.

FORMULATION	ACTIVE INGREDIENT
F1	Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%).
F2	Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (4%).
F3	Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%).
F4	Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (<i>Larrea tridentata</i>) (50%) + Thymol (3%).
F5	Hydrogen Peroxide (50%) + Peacetic Acid (15%) + Acetic Acid (15%).
AZ1	Azoxystrobin (500 ppm)
AZ2	Azoxystrobin (1000 ppm)
Control	Water

2.2. Inoculation, dose and immersion time of biopesticide formulations

The inoculation of the fruits was carried out by making a wound in the shape of an "X" 1 mm deep and 3-4 mm long with a sterile scalpel. Eight wounds were made per fruit. In each wound, *C. gloeosporioides* was inoculated with a spore suspension (1×10^5 spores mL⁻¹); inoculation was carried out with a 120 mL atomizer, and the spore suspension was sprinkled on the face of the fruit where the wounds were made. The inoculated fruits were incubated for 8 hours in a humid chamber in sterile plastic bags and absorbent paper. The fruits were treated by immersion for 1, 5 and 10 minutes with the formulations of table one. The doses that were used were 2000, 3000, 4000, 5000 and 10000 ppm. In the case of Azoxystrobin, doses of 500 and 1000 ppm were evaluated at the same immersion times as the biopesticides. The treated fruits were incubated in a humid chamber at room temperature for 10 days.

2.3. Biological effectiveness tests on postharvest fruits of the main mango varieties

Healthy fruits in physiological maturity of the varieties "Ataulfo, Keitt, Kent and Tommy Atkins" were used. The fruits were harvested in different orchards in the state of Nayarit, Mexico, in the period from June to September 2019. The order of the evaluations with the varieties was as follows: "Ataulfo, Tommy Atkins, Kent and Keitt".

2.4. Effect of biopesticide formulations on anthracnose in mango fruits:

Fruits were inoculated with the virulent *Colletotrichum* strains in the aforementioned varieties. For each of the treatments, including the control (fruits treated with sterile distilled water), the incidence and severity of the disease was evaluated at 4, 6 and 8 days after immersion (DAI) of the fruits in the treatments. In the variable of effectiveness of control of biopesticides, two evaluations were made, at 6 and 8 DAI of the fruits.

2.5. Variables evaluated in the fruits

To determine the biological effectiveness of biopesticides on anthracnose control, the following variables were used:

I. **Incidence of anthracnose in wounds:** the number of incisions (wounds) with the presence of anthracnose on the fruit was counted, and it was expressed as a percentage. Anthracnose incidence was considered when dark brown to black lesions with more than 2 mm in length were observed on or next to the incisions.

II. **Diameter of the lesion due to anthracnose:** in the incisions that presented symptoms of anthracnose, two measurements were made per wound, with a digital vernier, of the diameter of the lesion, whose diameter was expressed in millimeters.

III. **Control efficacy of biopesticides:** the number of dark brown to black lesions with more than 2 mm in length that formed in the epidermis of the fruits after being sprayed with the spore suspension was counted. To know the effectiveness of the concentrations of the biopesticides in the control of anthracnose, the formula of Abbott (1925) was used, and the control efficacy was expressed as a percentage.

$$EC (\%) = \frac{NIC - NIT}{NIT} \times 100 \dots$$

Where:

EC = Effectiveness of biopesticide control (%)

NIC = Number of injuries in the control

NIT= Number of injuries in treatment

2.6. Design of the experiment

A completely randomized univariate design was used with seven repetitions per treatment, taking as response variables the incidence, diameter of the lesion due to anthracnose and control efficacy, where one wound was the experimental unit. An analysis of variance (ANOVA) and comparison of means (Tukey; $p \leq 0.05$) were performed using SAS (SAS Institute, Inc., 2010).

3. RESULTS

INCIDENCE OF ANTHRACNOSE IN MANGO FRUITS "ATAULFO" IN POSTHARVEST

The fungicide Azoxystrobin at 500 ppm presented an anthracnose incidence (in percentage) of 55% in one minute of immersion, 46% in five minutes, and 18% at ten minutes. While Azoxystrobin at 1000 ppm, had an incidence of 34, 33 and 18% in immersions of 1, 5 and 10 min respectively. On the other hand, the control fruits registered the highest incidence percentage, which was above 90% (Figures 1-5).

Anthracnose incidence at 2000 ppm.

The lowest incidence was recorded by formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) with 42 and 43% incidence at 5 and 10 min of immersion respectively. The second best treatment was F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), registering incidences of 57 and 61% at 1 and 10 min of immersion. The rest of the treatments had incidences above 65% (Figure 1).

Anthracnose incidence at 3000 ppm.

As a whole, the lowest incidences were recorded by formulation F3 (Hydrogen Peroxide (30%) + Peracid Acid (15%) + Acetic Acid (10%)), with 58, 53 and 36% at 1, 5 and 10 min immersion. On the other hand, the formulation F4 (Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%)) showed an incidence of 35% at 1 min of immersion, but the rest of the immersion times were greater than 60% incidence. The rest of the treatments showed incidences higher than 60% (Figure 2).

Anthracnose incidence at 4000 ppm.

The lowest incidence was presented by F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)) with 49% incidence at 1 min of immersion. On the other hand, formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)), registered incidences of 52 and 55% at 5 and 10 min. The rest of the treatments obtained incidences greater than 60% (Figure 3).

Anthracnose incidence at 5000 ppm.

The lowest incidence was presented by F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)) with 43 and 50% incidence at 5 and 10 min immersion. On the other hand, formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)), registered an incidence of 50% at 5 min immersion. The third best treatment was F4 (Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea*

tridentata) (50%) + Thymol (3%)) with a 54% incidence at 1 min of immersion. The rest of the treatments obtained incidences greater than 60% (Figure 4).

Anthracnose incidence at 10000 ppm.

The lowest incidence was recorded by formulation F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)), with 36% in 5 min of immersion. The second best treatment was F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)), obtaining an incidence of 45% at 1 min of immersion. The third best treatment was F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (*Larrea tridentata*) (50%) + Thymol (3%)) with 51, 51 and 47% at 1, 5 and 10 minutes. The rest of the treatments obtained incidences greater than 58% (Figure 5).

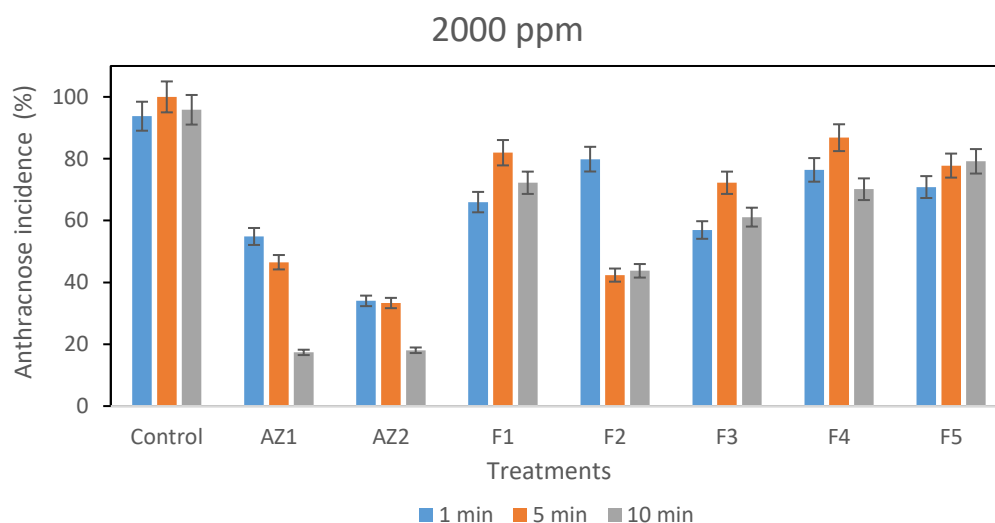


Figure 1. Evaluation of treatments in the incidence of anthracnose in mango fruits "Ataulfo" in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

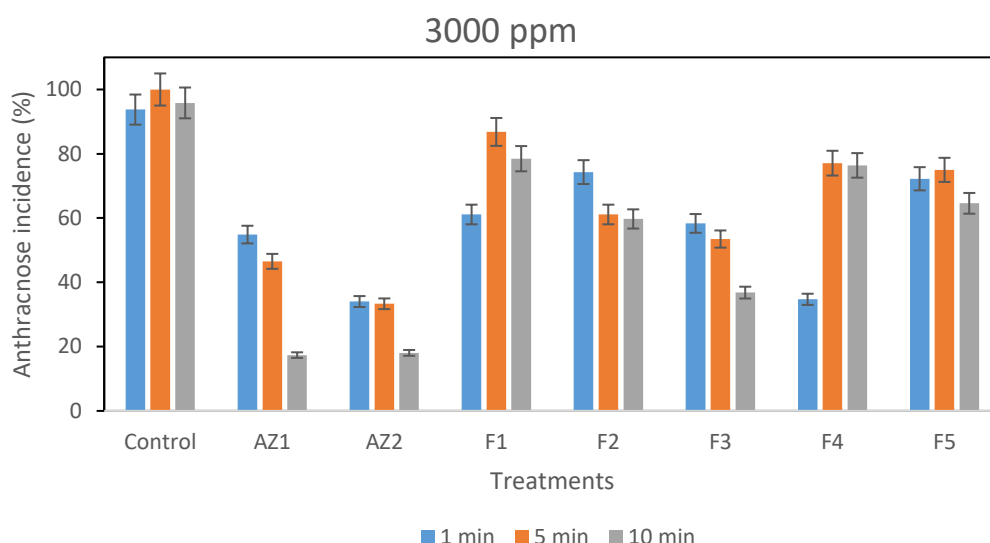


Figure 2. Evaluation of treatments in the incidence of anthracnose in mango fruits "Ataulfo" in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

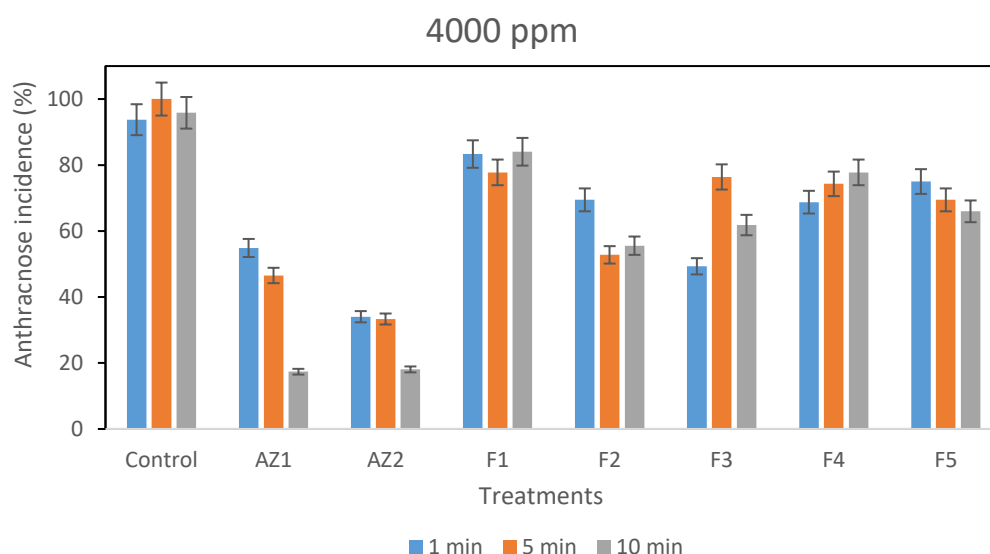


Figure 3. Evaluation of treatments in the incidence of anthracnose in mango fruits "Ataulfo" in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

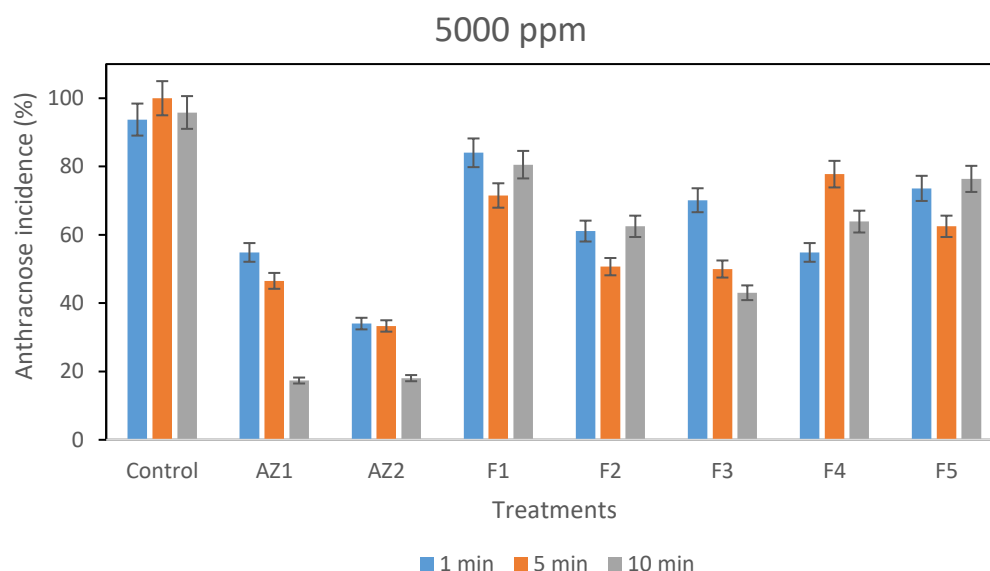


Figure 4. Evaluation of treatments in the incidence of anthracnose in mango fruits "Ataulfo" in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

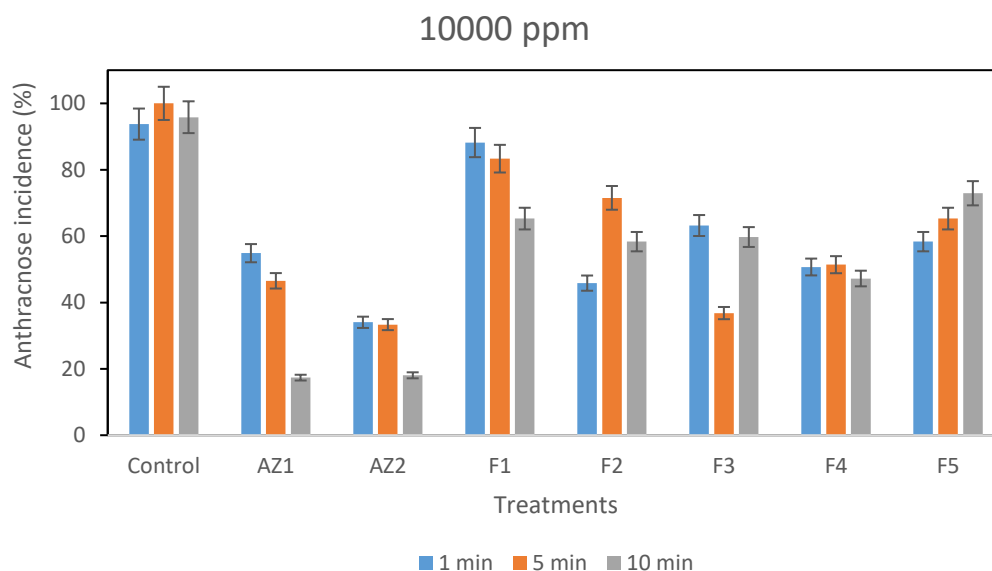


Figure 5. Evaluation of treatments in the incidence of anthracnose in mango fruits "Ataulfo" in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

DIAMETER OF ANTHRACNOSE LESION IN MANGO FRUITS "ATAULFO" IN POST-HARVEST

The fungicide Azoxystrobin at 500 ppm presented lesion diameters (mm) of 6, 6 and 1.4 mm at 1, 5 and 10 min of immersion. In turn, Azoxystrobin at 1000 ppm, had lesion diameters of 4, 3 and 1.6 mm in immersions of 1, 5 and 10 min. In the case of the control fruits, they generally showed the largest diameters of the lesions, which ranged between 7.5 and 8.2 mm (Figures 6-10).

Diameter of the anthracnose lesion at 2000 ppm.

The smallest diameter was shown by F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) with 2.5 and 2.3 mm in 5 and 10 min of immersion. On the other hand, F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), the second best treatment, registered lesions of 3.6 and 4.6 mm in immersions of 1 and 10 min respectively. The rest of the treatments developed lesions greater than 5 mm (Figure 6).

Diameter of the anthracnose lesion at 3000 ppm.

The smallest diameters of the lesions were recorded by formulations F3, F4, F2 and F1 in some of their immersion times. Formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), showed 3.5, 4.1 and 2.8 mm in 1, 5 and 10 min of immersion. Formulation F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (*Larrea tridentata*) (50%) + Thymol (3%)) presented 3.3 mm at 1 min of immersion. On the other hand, F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) showed lesions of 3.8 and 4.1 mm at 5 and 10 min. Finally, F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) obtained a diameter of the lesion of 4.1 mm at 1 min of immersion. The rest of the treatments and immersion times showed lesions above 4.3 mm (Figure 7).

Diameter of the anthracnose lesion at 4000 ppm.

The smallest diameters of the lesions were recorded by formulations F2 and F3 in some of their immersion times. Formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) showed lesions of 2.9 and 3.7 mm at 5 and 10 min of immersion. On the other hand, F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), presented lesions of 3.1 mm in 1 min of immersion. The rest of the treatments and immersion times showed lesions above 4.5 mm (Figure 8).

Diameter of the anthracnose lesion at 5000 ppm.

The smallest diameters of the lesions were recorded by formulations F3, F2 and F5. Formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), showed 4.4, 3.3 and 2.8 mm in 1, 5 and 10 min of immersion. Formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) presented lesions of 3.2 and

3.7 mm at 5 and 10 min. Finally, F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)) obtained a diameter of the lesion of 3.7 mm at 5 min immersion. The rest of the treatments and immersion times showed lesions above 4.4 mm (Figure 9).

Diameter of the anthracnose lesion at 10000 ppm.

The smallest diameters were recorded by formulations F3, F2, F4 and F5 in some of their immersion times. Formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), showed 2.3 mm in 5 min of immersion. Formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) presented lesions of 2.8 mm in 1 min. On the other hand, F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%)) obtained a diameter of the lesion from 2.9 mm to 10 min of immersion. Finally, F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)) showed 3.4 mm lesions at 1 min of immersion. The rest of the treatments and immersion times showed lesions above 4 mm (Figure 10).

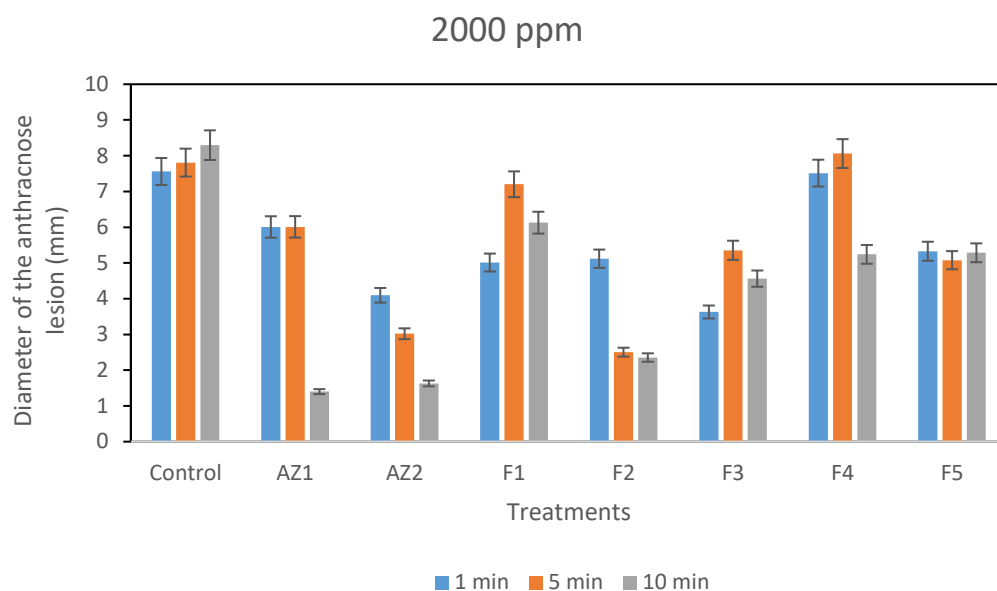


Figure 6. Evaluation of treatments in the diameter of the anthracnose lesion in "Ataulfo" mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

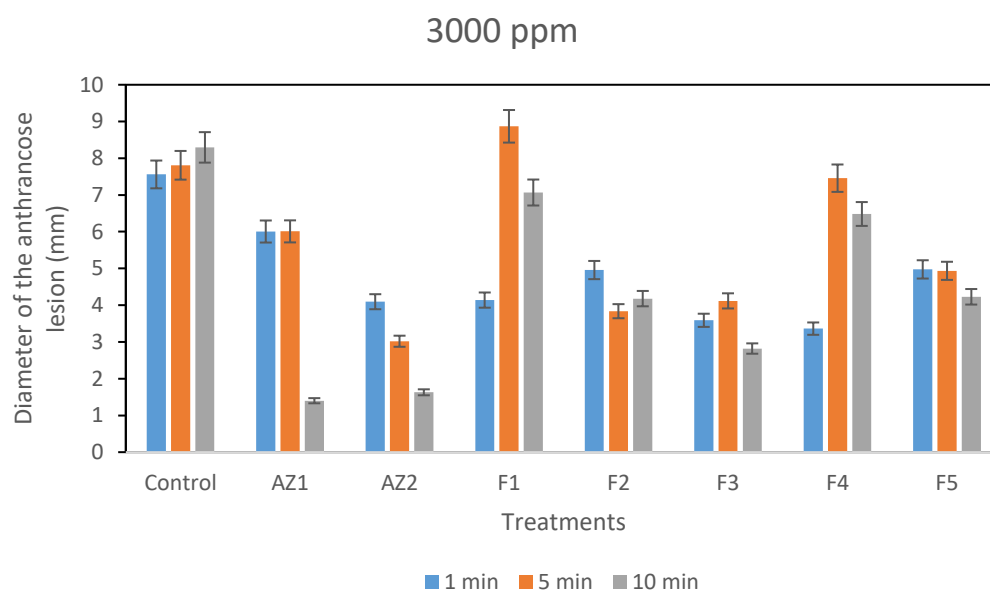


Figure 7. Evaluation of treatments in the diameter of the anthracnose lesion in "Ataulfo" mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

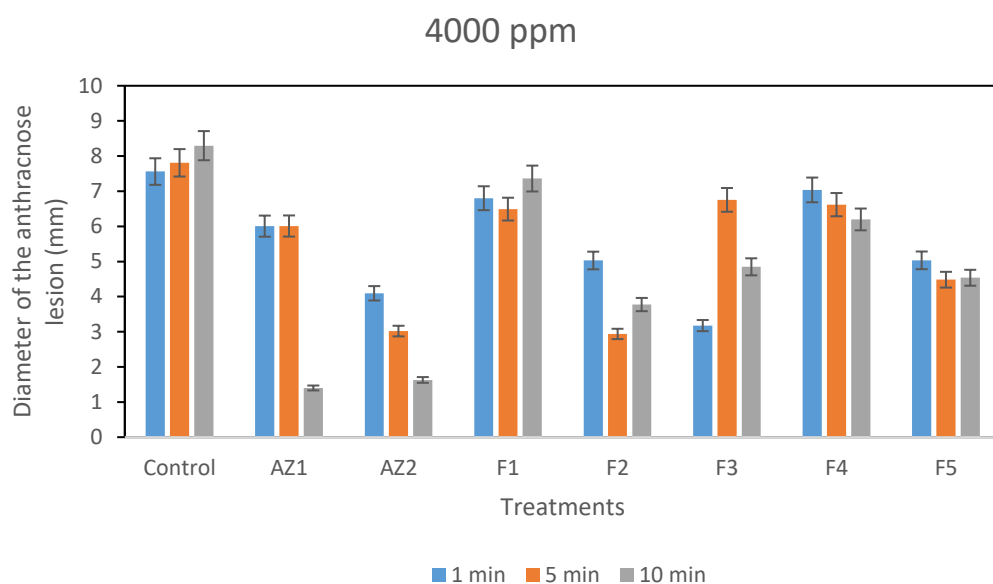


Figure 8. Evaluation of treatments in the diameter of the anthracnose lesion in "Ataulfo" mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

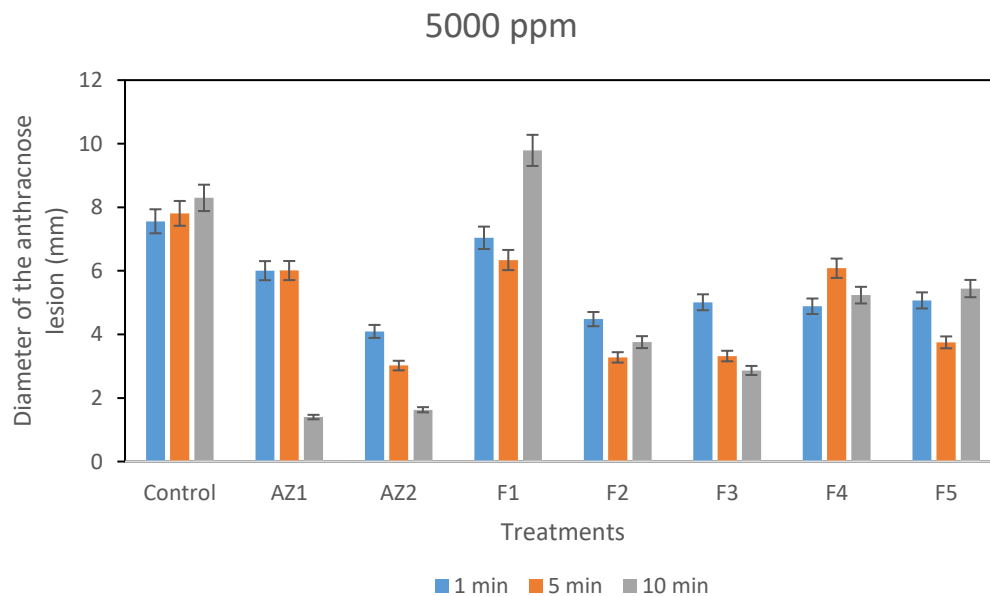


Figure 9. Evaluation of treatments in the diameter of the anthracnose lesion in "Ataulfo" mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

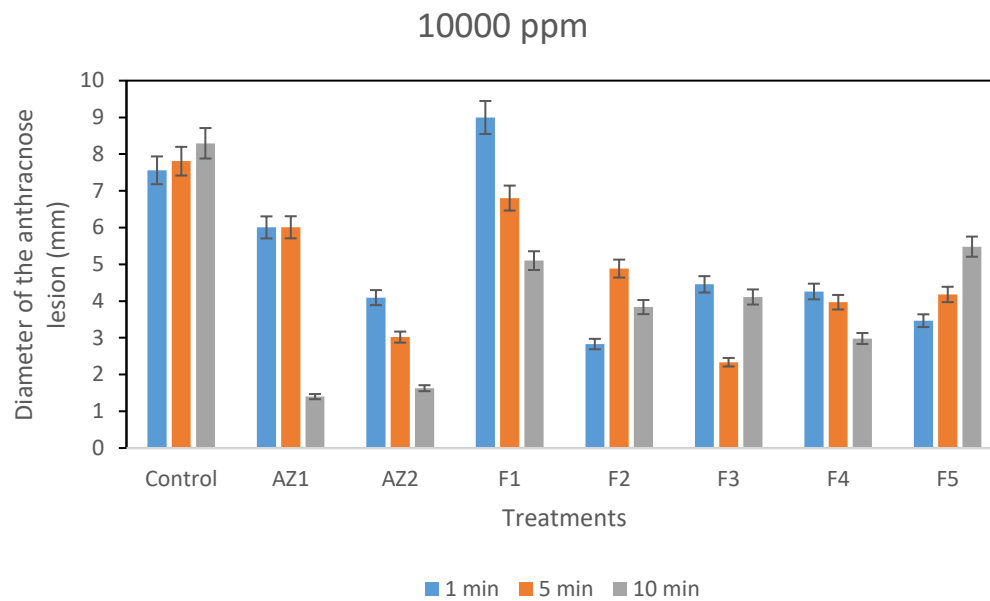


Figure 10. Evaluation of treatments in the diameter of the anthracnose lesion in "Ataulfo" mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

CONTROL EFFECTIVENESS OF BIOPESTICIDES AGAINST ANTHRACNOSE IN "ATAULFO" MANGO FRUITS

The fungicide Azoxystrobin at 500 ppm had a control efficacy (in percentage) of 90% in one minute of immersion, 92% in five minutes and 94% at ten minutes. While Azoxystrobin at 1000 ppm, had an efficacy of 96, 97 and 98% in immersions of 1, 5 and 10 min respectively (Figures 11-15).

Control effectiveness of biopesticides at 2000 ppm.

The highest efficacy was registered by the F3 formulation (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), with 82% efficacy in 1 min of immersion, and 73% in 5 and 10 min. The rest of the treatments had control efficiencies of between 52 and 63% (Figure 11)

Control effectiveness of biopesticides at 3000 ppm.

The highest efficacy was recorded by the F3 formulation (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), with 87% efficacy in 1 min immersion, and 80% in 5 and 10 min. The rest of the treatments showed control efficiencies of between 58 and 60% (Figure 12)

Control effectiveness of biopesticides at 4000 ppm.

The highest efficacy was registered by the formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), with 87% efficacy in 1 min of immersion, 81% in 5 min and 82 % in 10 min. The rest of the treatments presented control efficiencies of between 61 and 66% (Figure 13)

Control effectiveness of biopesticides at 5000 ppm.

The highest efficacy was recorded by the F3 formulation (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), with 89% efficacy in 1 min of immersion, 87% in 5 min and 91 % in 10 min. The rest of the treatments obtained control efficiencies of between 64 and 70% (Figure 14)

Control effectiveness of biopesticides at 10000 ppm.

The highest efficacy was recorded by the formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), with 96% efficacy in 1 min of immersion, 92% in 5 min and 94 % in 10 min. The rest of the treatments showed control efficiencies of between 71 and 82% (Figure 15).

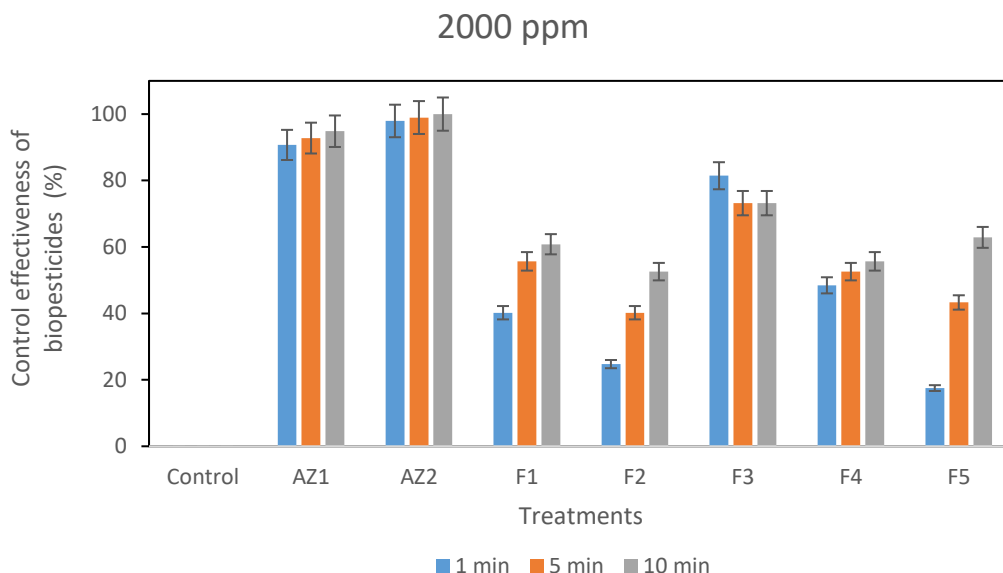


Figure 11. Evaluation of treatments in the effectiveness of anthracnose control in “Ataulfo” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

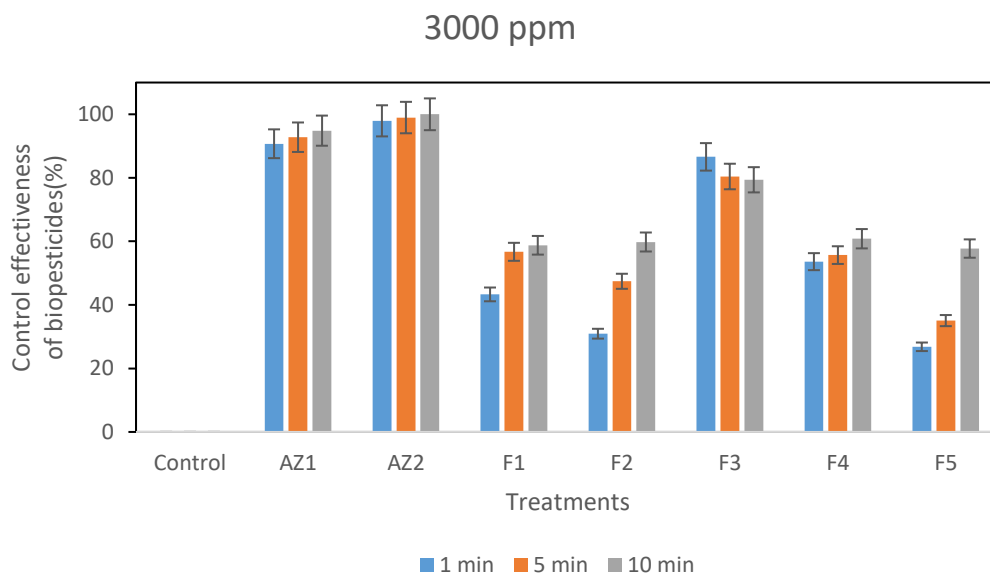


Figure 12. Evaluation of treatments in the effectiveness of anthracnose control in “Ataulfo” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

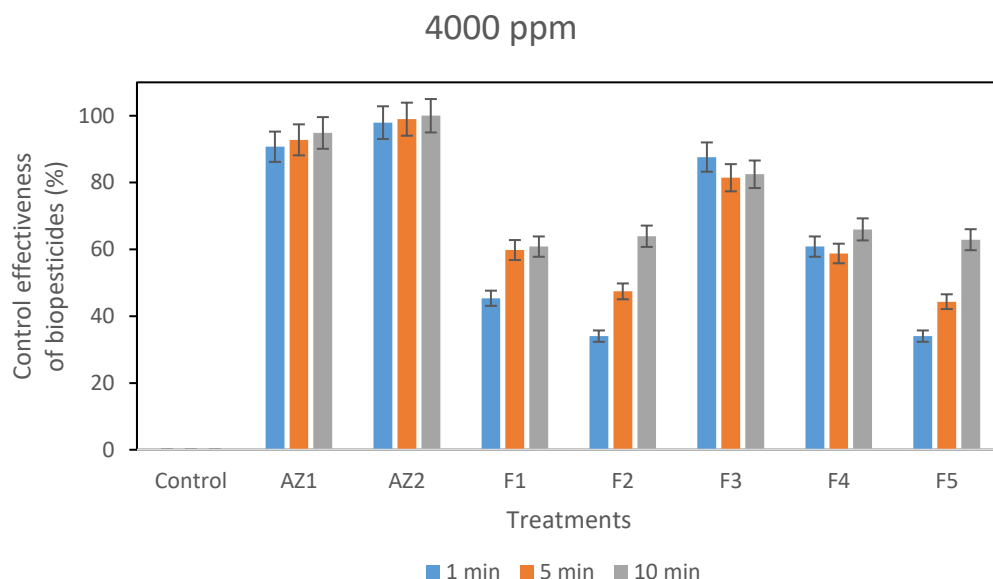


Figure 13. Evaluation of treatments in the effectiveness of anthracnose control in “Ataulfo” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

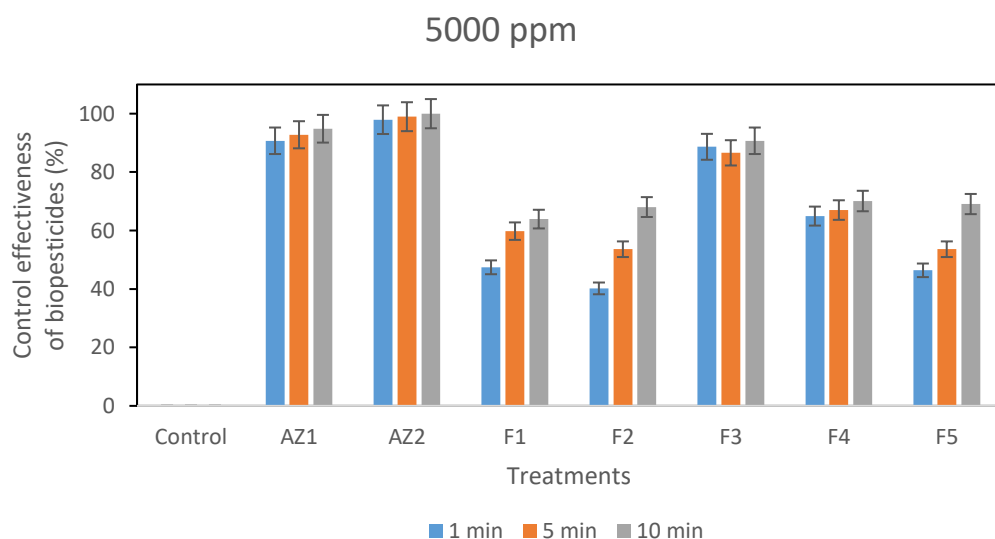


Figure 14. Evaluation of treatments in the effectiveness of anthracnose control in “Ataulfo” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

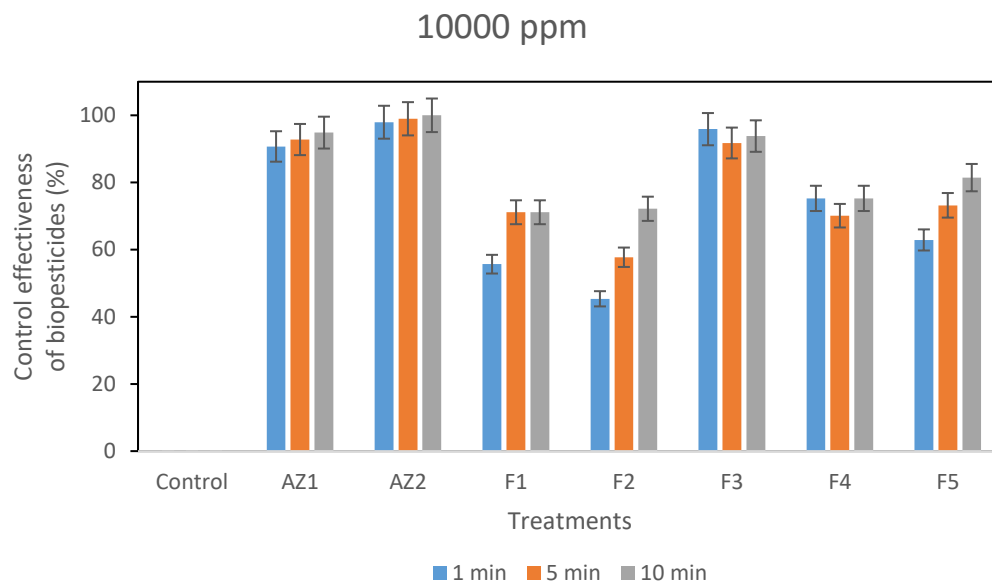


Figure 15. Evaluation of treatments in the effectiveness of anthracnose control in “Ataulfo” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

INCIDENCE OF ANTHRACNOSE IN MANGO FRUITS “KENT” IN POSTHARVEST

The fungicide Azoxystrobin at 500 ppm presented an anthracnose incidence (in percentage) of 50% in one minute of immersion, 52% in five minutes and 35% in ten minutes. While Azoxystrobin at 1000 ppm, had an incidence of 50, 38 and 43% in immersions of 1, 5 and 10 min respectively. On the other hand, the control fruits registered the highest incidence percentage, which was in the range of 95-100% (Figures 16-20).

Anthracnose incidence at 2000 ppm.

The lowest incidence was registered by formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 48 and 58% incidence at 5 and 10 min immersion respectively. The rest of the treatments had incidences above 60% (Figure 16).

Anthracnose incidence at 3000 ppm.

Similar to the previous concentration, the lowest incidence was presented by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 43 and 50% incidence at 5 and 10 min immersion respectively. The second formulation that showed the lowest incidence was F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)), which obtained 55% in the 5 min immersion. The remaining treatments had incidences greater than 60% (Figure 17).

Anthracnose incidence at 4000 ppm.

At this concentration, again the lower incidence was presented by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 49 and 33% incidence at 1 and 5 min immersion respectively. The second formulation that showed the lowest incidence was F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)), which obtained 59% in the 5 min immersion. The remaining treatments had incidences greater than 60% (Figure 18).

Anthracnose incidence at 5000 ppm.

Similarly to the previous concentration, the lowest incidence was presented by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 47, 40 and 46% of incidence at 1, 5 and 10 min of immersion respectively. The second formulation that showed the lowest incidence was F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)), which registered 37% in the 5 min immersion. The remaining treatments had incidences greater than 60% (Figure 19).

Anthracnose incidence at 10000 ppm.

In this last concentration the same pattern was observed as in the previous concentrations, where the lowest incidence was presented by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 38, 43 and 50% at 1, 5 and 10 min immersion respectively. The second formulation that showed the lowest incidence was F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)) with 51% in the 5 min immersion. The remaining treatments had incidences greater than 60% (Figure 20).

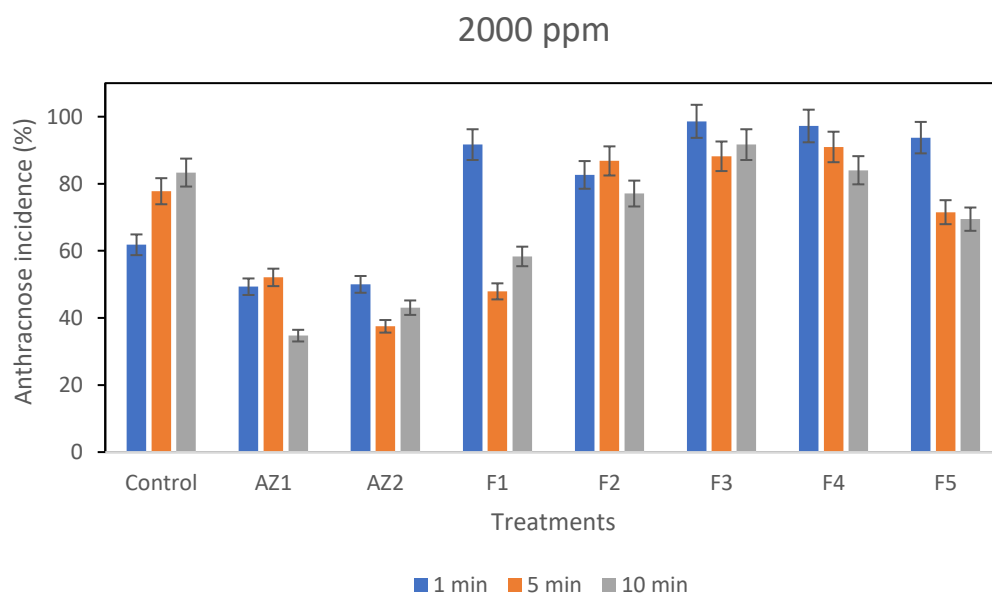


Figure 16. Evaluation of treatments in the incidence of anthracnose in mango fruits "Kent" in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

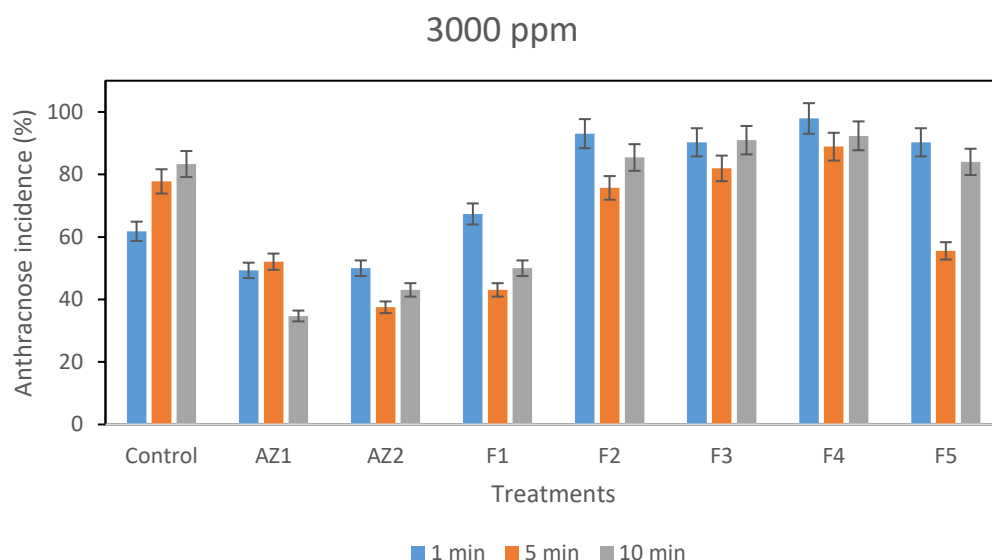


Figure 17. Evaluation of treatments in the incidence of anthracnose in mango fruits "Kent" in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

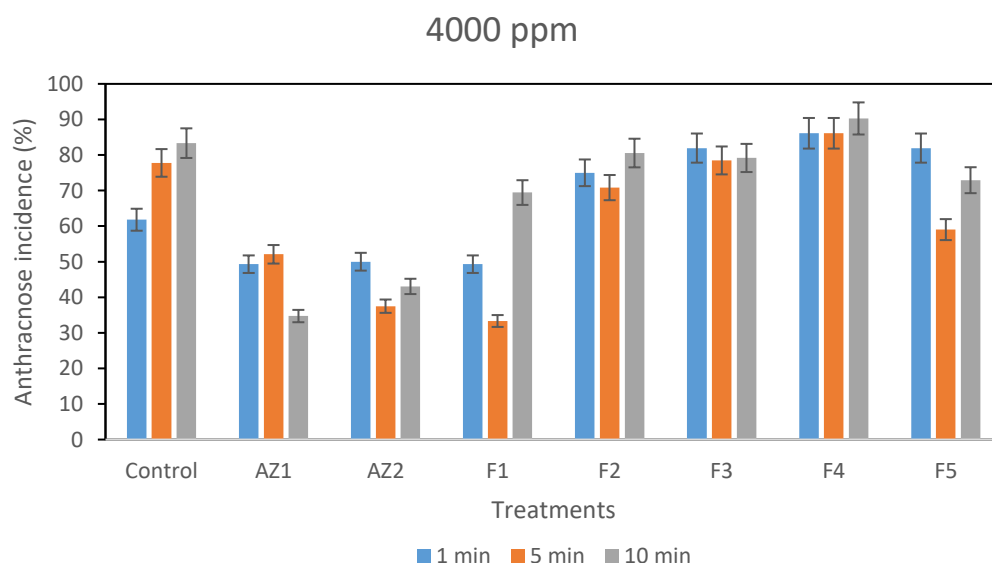


Figure 18. Evaluation of treatments in the incidence of anthracnose in mango fruits "Kent" in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

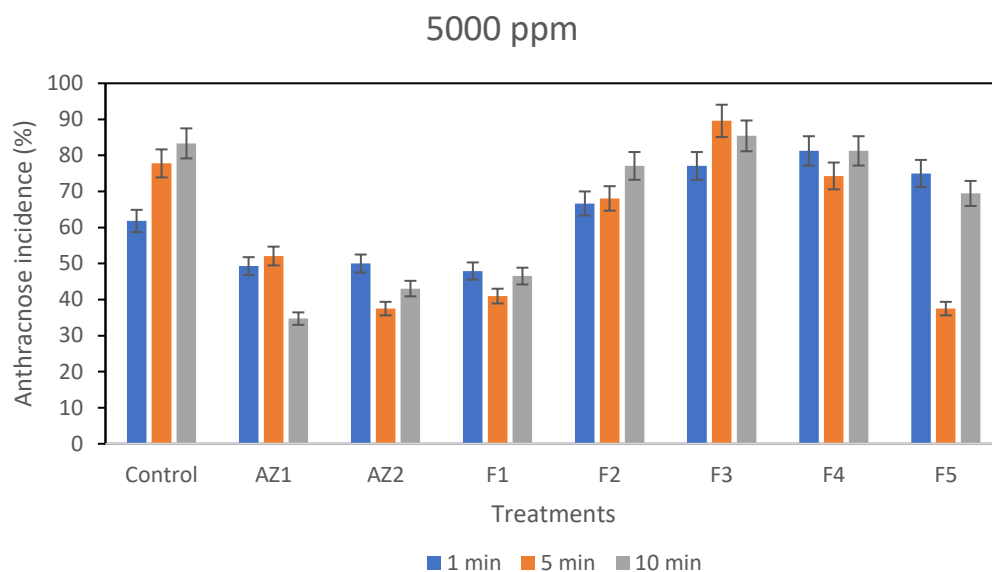


Figure 19. Evaluation of treatments in the incidence of anthracnose in mango fruits "Kent" in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

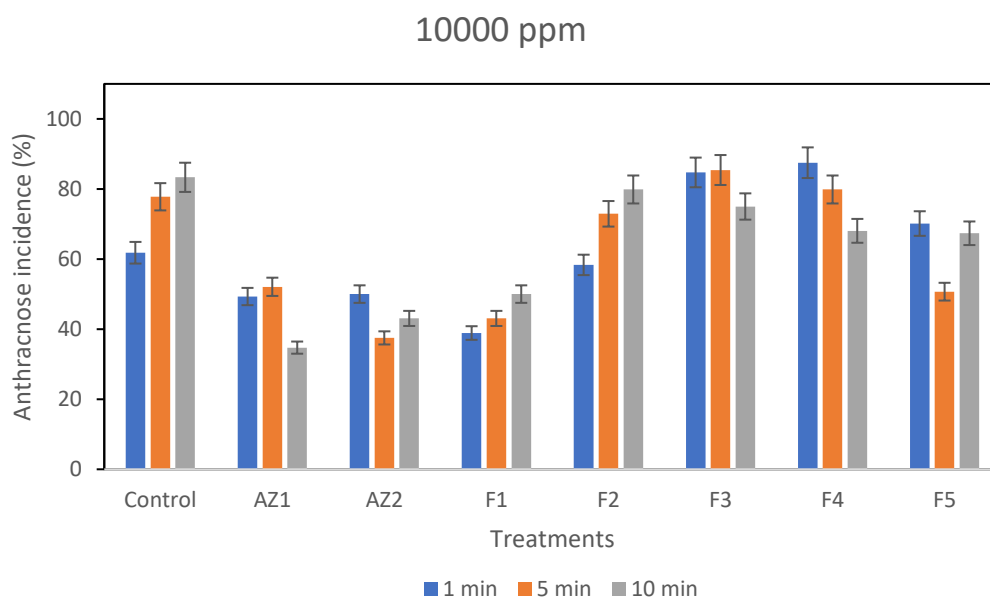


Figure 20. Evaluation of treatments in the incidence of anthracnose in mango fruits "Kent" in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

DIAMETER OF ANTHRACNOSE LESION IN MANGO FRUITS " KENT " IN POST-HARVEST

The fungicide Azoxystrobin at 500 ppm presented lesion diameters (mm) of 2.5, 2.2 and 2 mm at 1, 5 and 10 min of immersion. In turn, Azoxystrobin at 1000 ppm had lesion diameters of 2.4, 2 and 1.5 mm in immersions of 1, 5 and 10 min. In the case of the control fruits, in general the diameters of the lesions were in the range between 5.8 and 6.5 mm (Figures 21-25).

Diameter of the anthracnose lesion at 2000 ppm.

The smallest diameter was shown by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 2.3 and 3.2 mm in 5 and 10 min of immersion; followed by formulations F2 and F5, which showed similar lesion diameters. F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)), presented 4.4 and 4.3 mm at 1 and 5 min immersion, while formulation F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)) showed 4.4 and 4.3 mm in 5 and 10 min. The rest of the formulations developed lesions above 4.8 mm, which in some treatments were higher than those of the control fruits (Figure 21).

Diameter of the anthracnose lesion at 3000 ppm.

The minor lesions were shown by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 3.9, 2.3 and 2.6 mm in 1, 5 and 10 min of immersion respectively. This was followed by formulation F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)) registering 4 mm in diameter at 5 minutes. Finally, F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) presented lesions of 4.4 mm at 5 min of immersion. The rest of the formulations developed lesions greater than 5 mm (Figure 22).

Diameter of the anthracnose lesion at 4000 ppm.

Like the previous concentration, the minor lesions were shown by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 2.3, 1.6 and 4 mm in 1, 5 and 10 min of immersion respectively. This was followed by formulation F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)) with 3.8 mm diameter at 5 minutes. Finally, the F2 formulation (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) showing lesions of 4.2 and 4.4 mm at 1 and 5 min of immersion. The rest of the formulations developed lesions greater than 5 mm (Figure 23).

Diameter of the anthracnose lesion at 5000 ppm.

In this penultimate concentration, the minor lesions were shown by the F1 formulation (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 2.3, 1.6 and 4 mm in 1, 5 and 10 min of immersion respectively. This was followed by formulation F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)) registering 2.3 mm in diameter at 5 minutes.

On the other hand, F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) presented lesions of 3.9 mm at 1 min of immersion. Finally, F4 (Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%)) presented lesions of 4.1 mm at 5 min. The rest of the formulations developed superior lesions at 4.6 mm (Figure 24).

Diameter of the anthracnose lesion at 10000 ppm.

The smaller diameters were shown by the F1 formulation (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 1.7, 2.4 and 2.3 mm in 1, 5 and 10 min of immersion respectively. This was followed by formulation F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)) with 2.6 mm diameter at 5 minutes. On the other hand, F4 (Peacetic acid (30%) + Hydrogen Peroxide (10%) + Governor extract (*Larrea tridentata*) (50%) + Thymol (3%)) presented lesions of 3.6 mm at 10 min. Finally F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) registered lesions of 3.8 mm at 10 min immersion. The remaining treatments developed lesions greater than 4.2 mm (Figure 25).

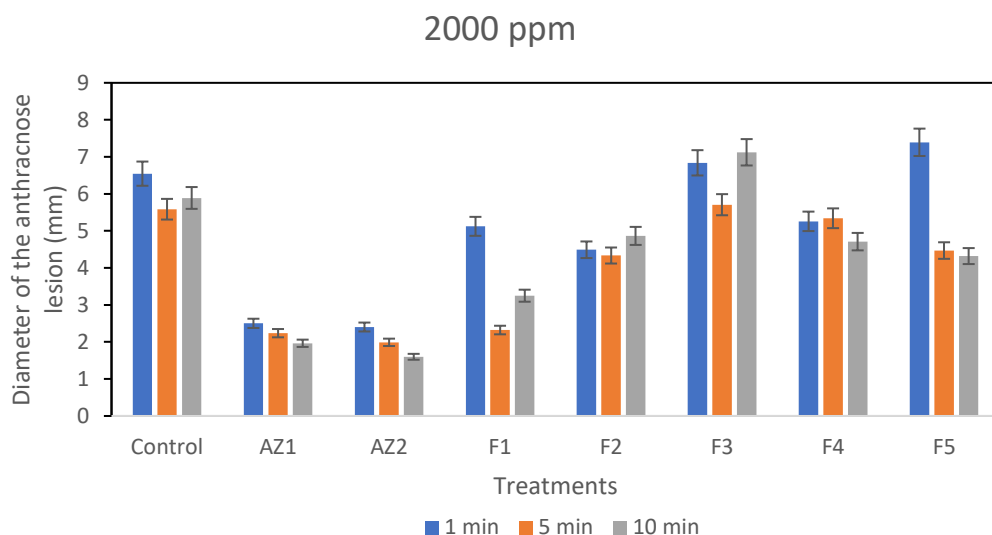


Figure 21. Evaluation of treatments in the diameter of the anthracnose lesion in "Kent" mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

3000 ppm

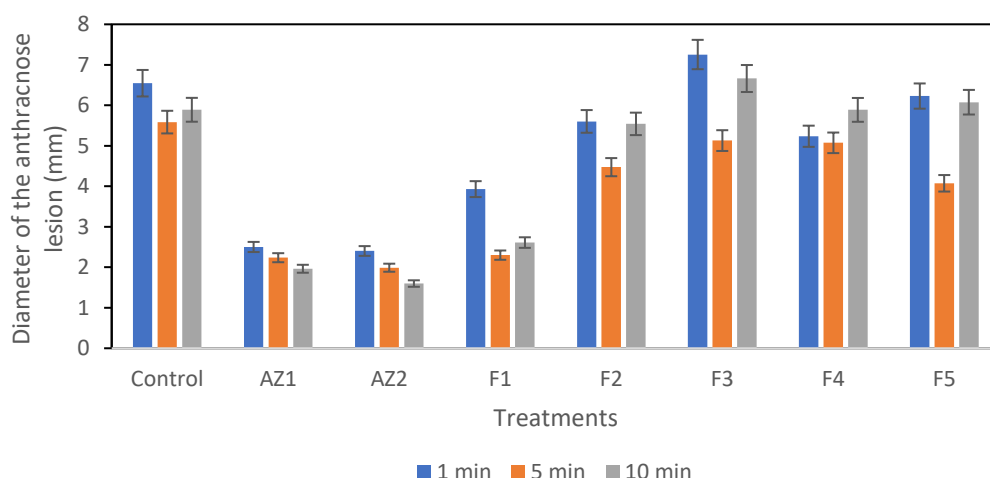


Figure 22. Evaluation of treatments in the diameter of the anthracnose lesion in "Kent" mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

4000 ppm

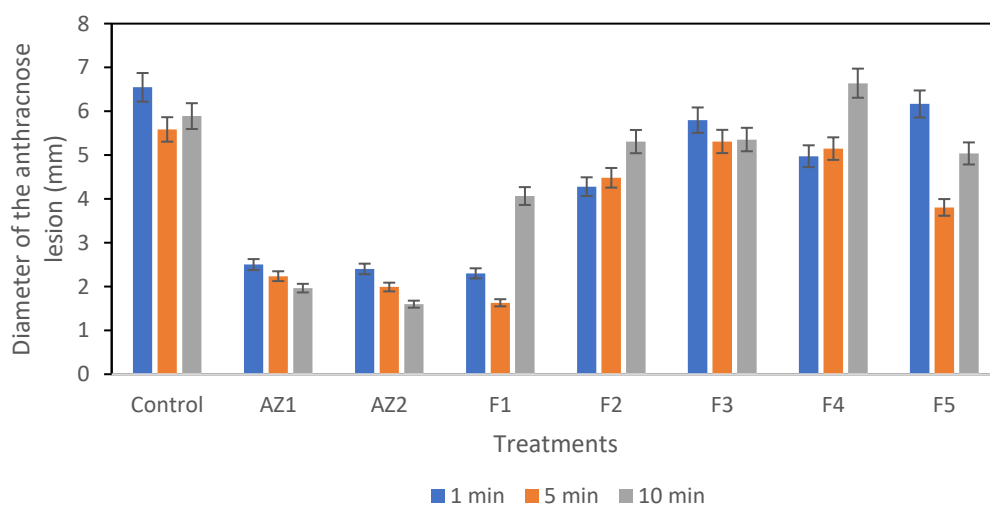


Figure 23. Evaluation of treatments in the diameter of the anthracnose lesion in "Kent" mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

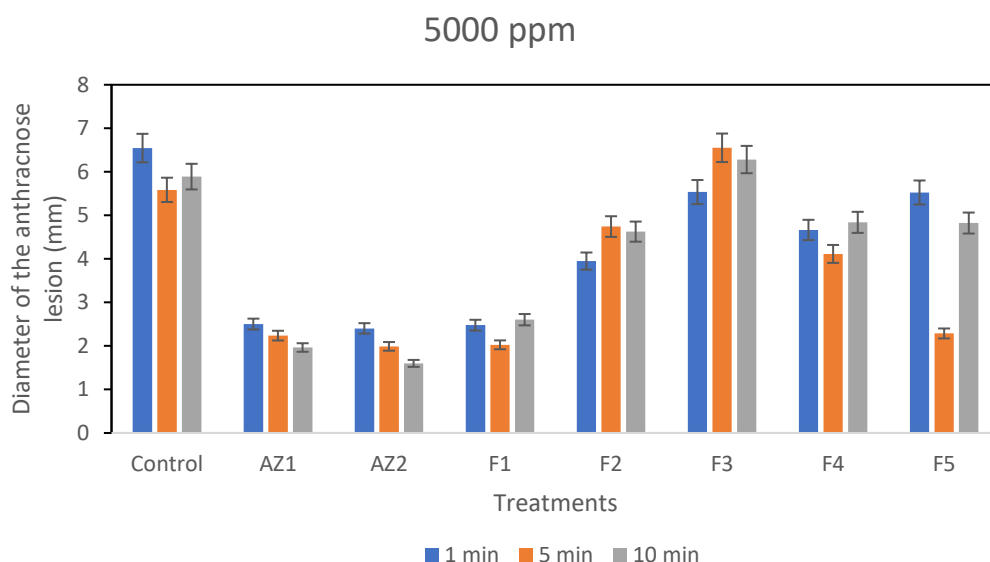


Figure 24. Evaluation of treatments in the diameter of the anthracnose lesion in "Kent" mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

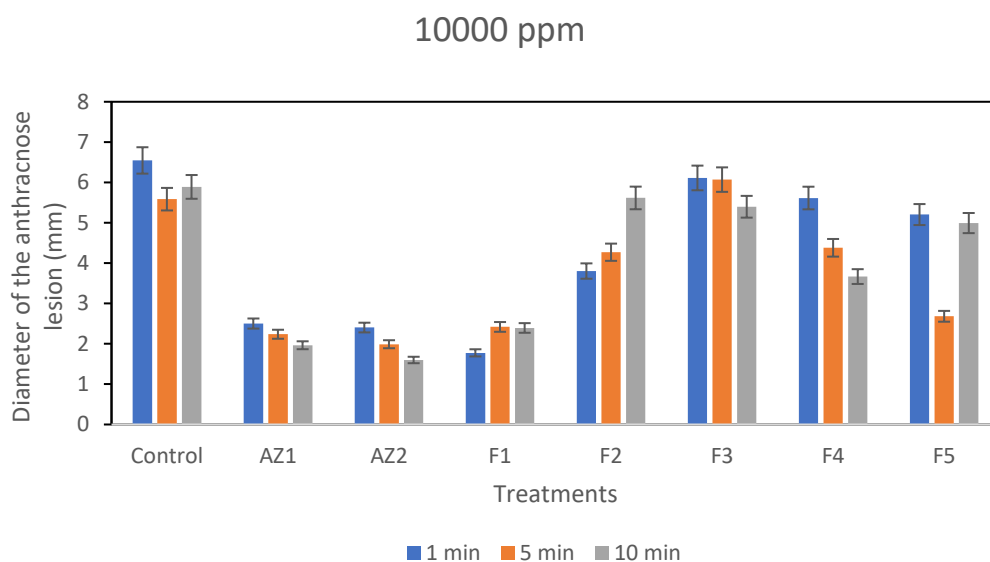


Figure 25. Evaluation of treatments in the diameter of the anthracnose lesion in "Kent" mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

CONTROL EFFECTIVENESS OF BIOPESTICIDES AGAINST ANTHRACNOSE IN " KENT" MANGO FRUITS

The fungicide Azoxystrobin at 500 ppm had a control efficacy (in percentage) of 91% in one minute of immersion, 94% in five minutes and 91% in ten minutes. While Azoxystrobin at 1000 ppm, showed an efficacy of 97, 97 and 99% in immersions of 1, 5 and 10 min respectively (26-30).

Control effectiveness of biopesticides at 2000 ppm.

The highest efficacy was registered by the F1 formulation (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 79% efficacy in 1 min immersion, 83% in 5 min and 87 in 10 minutes. The second best treatment was F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)), which registered efficiencies of 80, 72 and 76% in 1, 5 and 10 min respectively (Figure 26).

Control effectiveness of biopesticides at 3000 ppm.

The highest efficacy was recorded by formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), with 91% efficacy in 1 min of immersion, followed by formulation F2 (Acid peacetic (35%) + Hydrogen Peroxide (15%) + Acetic acid (10%) + Chitosan (40%)), with 89% efficacy at 10 min. The third best treatment was F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), with 86% efficacy at 10 min (Figure 27).

Control effectiveness of biopesticides at 4000 ppm.

The highest efficacy was shown by the F5 treatment (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)), who recorded efficiencies of 89, 90 and 88% in 1, 5 and 10 min respectively . The second best treatment was F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), with 67, 88 and 86% efficacy in 1, 5 and 10 min respectively (Figure 28).

Control effectiveness of biopesticides at 5000 ppm.

The highest efficacy was shown by the F1 treatment (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), with 86, 97 and 96% efficacy in 1, 5 and 10 min respectively. The second best treatment was F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)), which registered efficiencies of 80, 94 and 91% in 1, 5 and 10 min respectively. The third best treatment was F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)), with 65, 85 and 85% efficacy at 1, 5 and 10 min immersion (Figure 29).

Control effectiveness of biopesticides at 10000 ppm.

The greatest efficacy was shown by treatments F1 and F5. Treatment F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), showed 96, 92 and 94% efficacy in 1, 5 and 10 min respectively. While the F5 treatment (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)), registered efficiencies of 88, 97 and 91% in 1, 5 and 10 min respectively. The third best treatment was F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), with 92, 91 and 89% efficacy at 1, 5 and 10 min immersion (Figure 30).

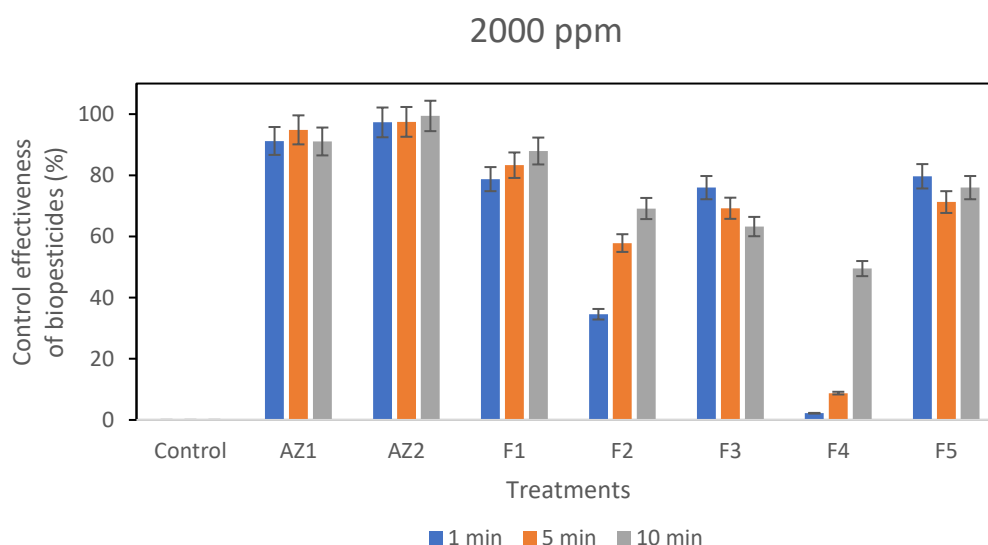


Figure 26. Evaluation of treatments in the effectiveness of anthracnose control in “Kent” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

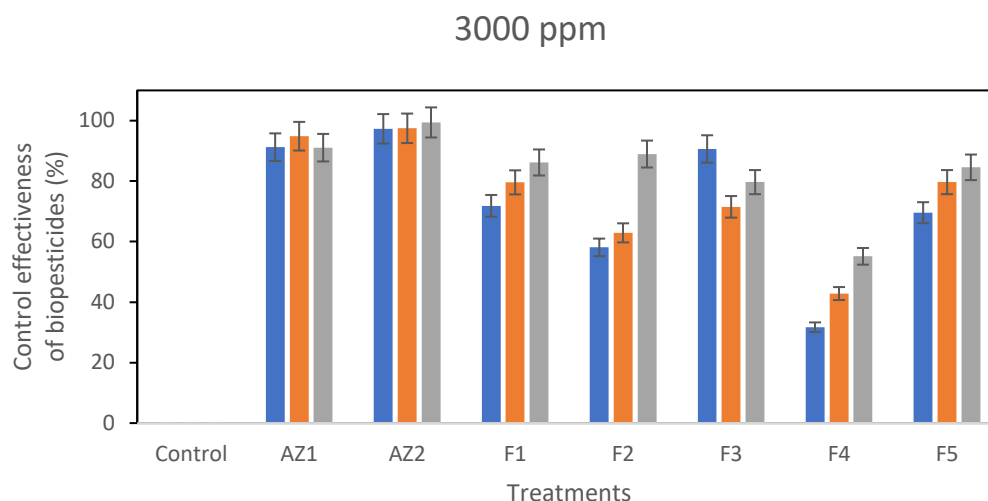


Figure 27. Evaluation of treatments in the effectiveness of anthracnose control in “Kent” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

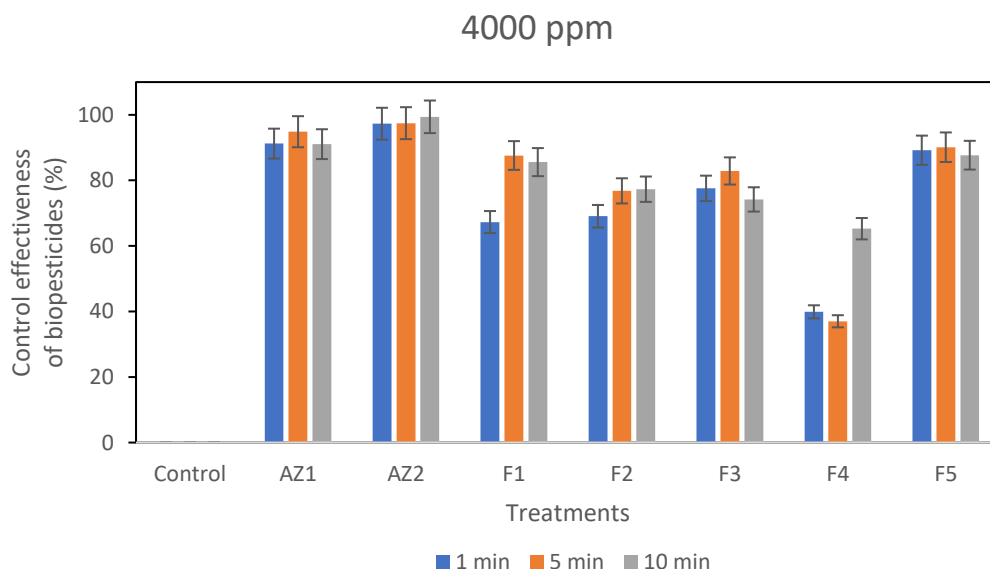


Figure 28. Evaluation of treatments in the effectiveness of anthracnose control in “Kent” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

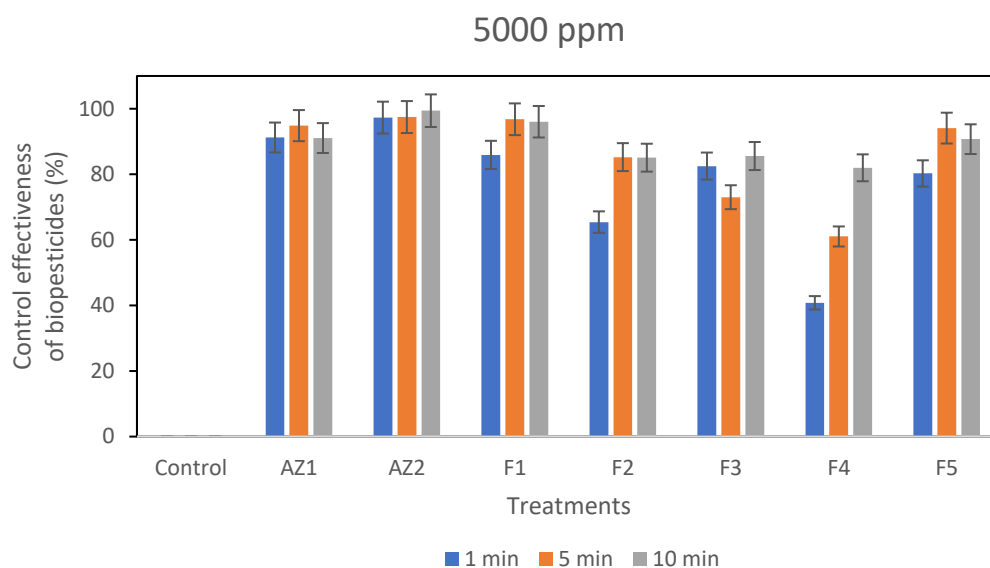


Figure 29. Evaluation of treatments in the effectiveness of anthracnose control in “Kent” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

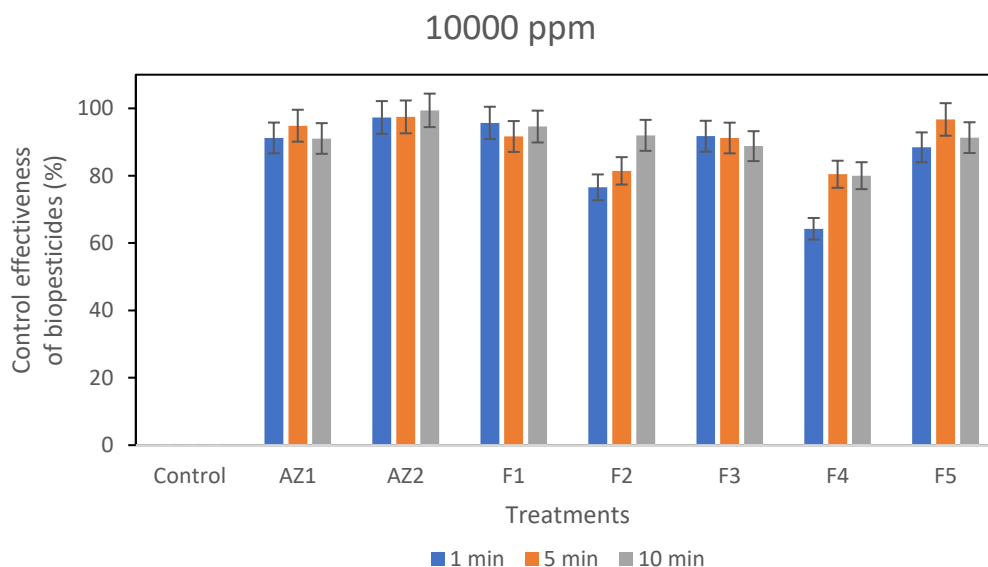


Figure 30. Evaluation of treatments in the effectiveness of anthracnose control in “Kent” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

INCIDENCE OF ANTHRACNOSE IN MANGO FRUITS “KEITT” IN POSTHARVEST

The fungicide Azoxystrobin at 500 ppm presented an anthracnose incidence (in percentage) of 45% in one minute of immersion, 53% in five minutes and 27% in ten minutes. While Azoxystrobin at 1000 ppm, had an incidence of 15, 24 and 30% in immersions of 1, 5 and 10 min respectively. On the other hand, the control fruits registered the highest incidence percentage, which was in the range of 89-100% (Figures 31-35).

Anthracnose incidence at 2000 ppm.

The lowest incidence was registered by formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 25 and 39% incidence at 1 and 5 min immersion respectively. On the other hand, F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)) showed 47 and 37% incidence at 5 and 10 min of immersion. Finally, F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)) registered 45% incidence at 5 min. The remaining treatments had incidences above 50% (Figure 31).

Incidence of anthracnose at 3000 ppm.

Similar to the previous concentration, the lowest incidence was presented by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 30% incidence at 10 min of immersion. The second formulation that showed the lowest incidence was F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)), which obtained 35% in the 5 min immersion. Finally, F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)) registered 46% incidence at 5 min. The rest of the treatments had incidences higher than 56% (Figure 32).

Anthracnose incidence at 4000 ppm.

At this concentration, the lowest incidence was reported by F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)) with 32% at 10 min. Followed by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) whose incidence was 43 and 36% at 5 and 10 min of immersion respectively. On the other hand, F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)) registered 40, 47 and 47% in the immersions at 1, 5 and 10 min. The remaining treatments had incidences greater than 50% (Figure 33).

Anthracnose incidence at 5000 ppm.

The lowest incidence was presented by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 34, 25 and 43% incidence at 1, 5 and 10 min immersion respectively. The second formulation that showed the lowest incidence was F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)), which registered 37% in the 5 min immersion. On the other hand, F3 (Hydrogen Peroxide (30%) + Peracetic acid (15%) + Acetic acid (10%))

presented 44 and 40% at 5 and 10 min. The remaining treatments had incidences greater than 57% (Figure 34).

Anthracnose incidence at 10000 ppm.

In this last concentration, it was again observed that formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) registered the lowest incidence with 30, 31 and 34% at 1, 5 and 10 min immersion respectively. The second formulation that showed the lowest incidence was F4 Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%), presenting 44% incidence at 10 min. Finally, F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)) showed 45% in the immersion at 1 min. The remaining treatments had incidences greater than 49% (Figure 35).

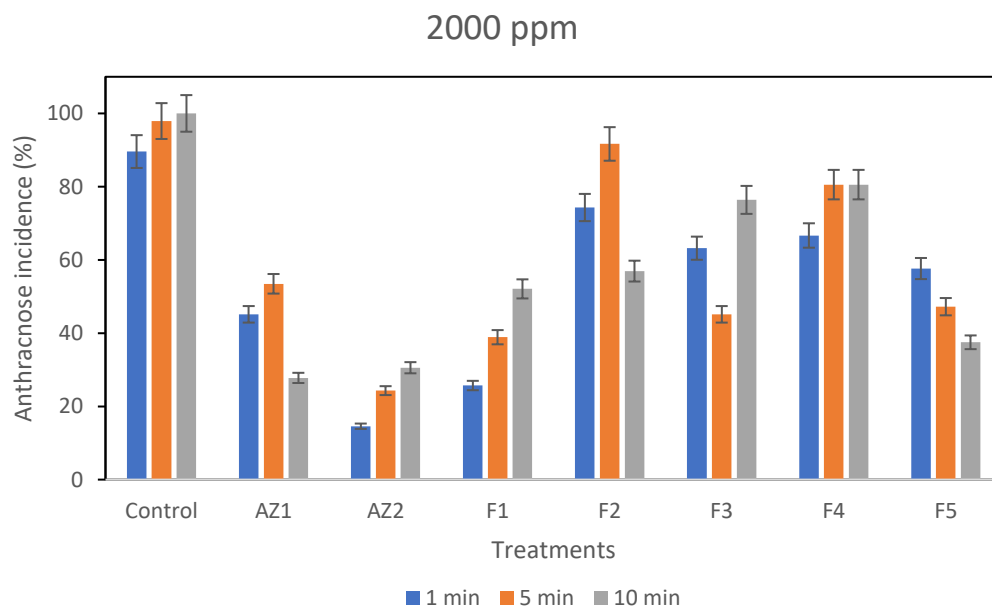


Figure 31. Evaluation of treatments in the incidence of anthracnose in mango fruits "Keitt" in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

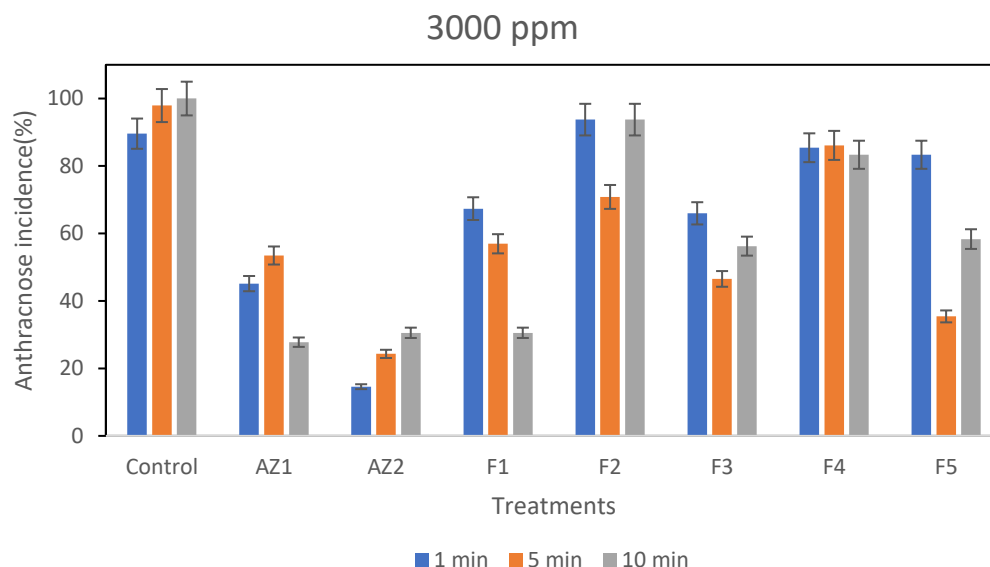


Figure 32. Evaluation of treatments in the incidence of anthracnose in mango fruits "Keitt" in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

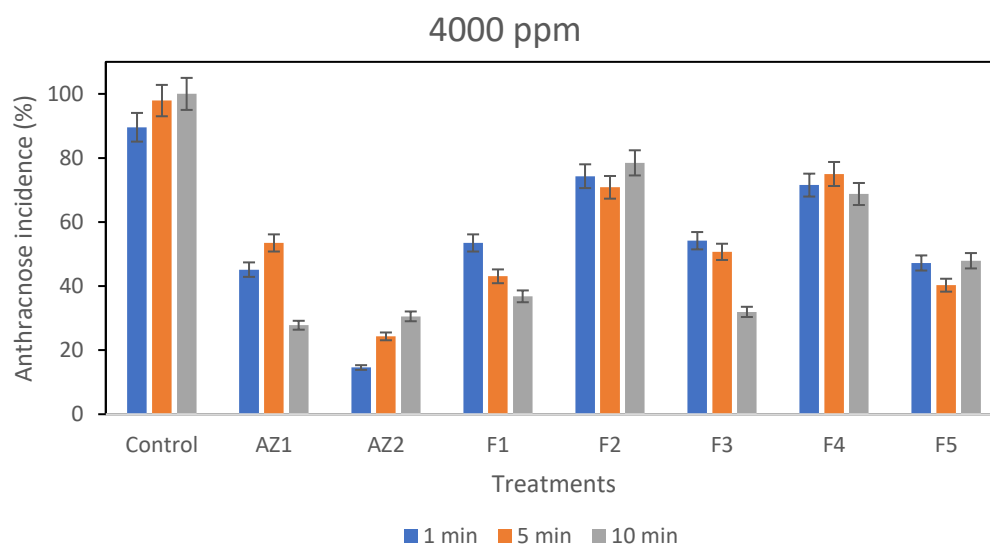


Figure 33. Evaluation of treatments in the incidence of anthracnose in mango fruits "Keitt" in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

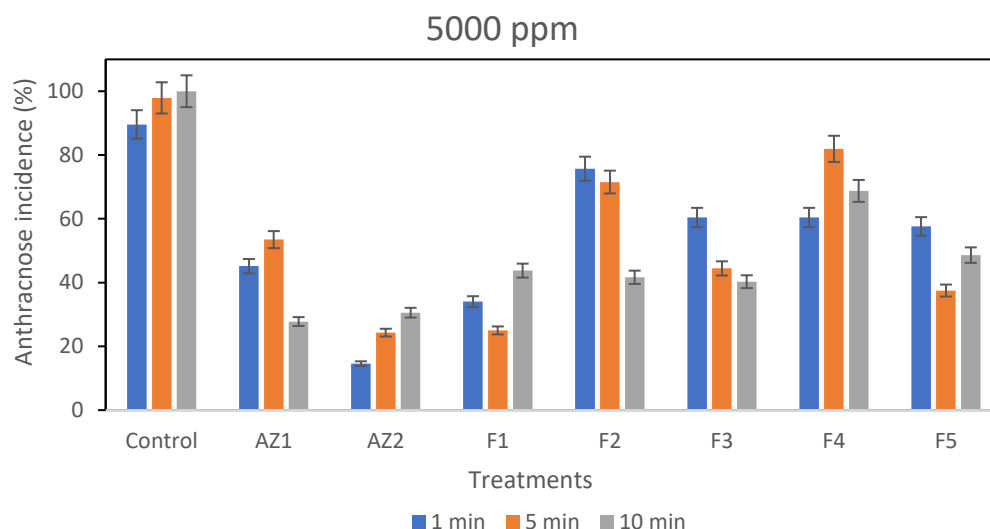


Figure 34. Evaluation of treatments in the incidence of anthracnose in mango fruits "Keitt" in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

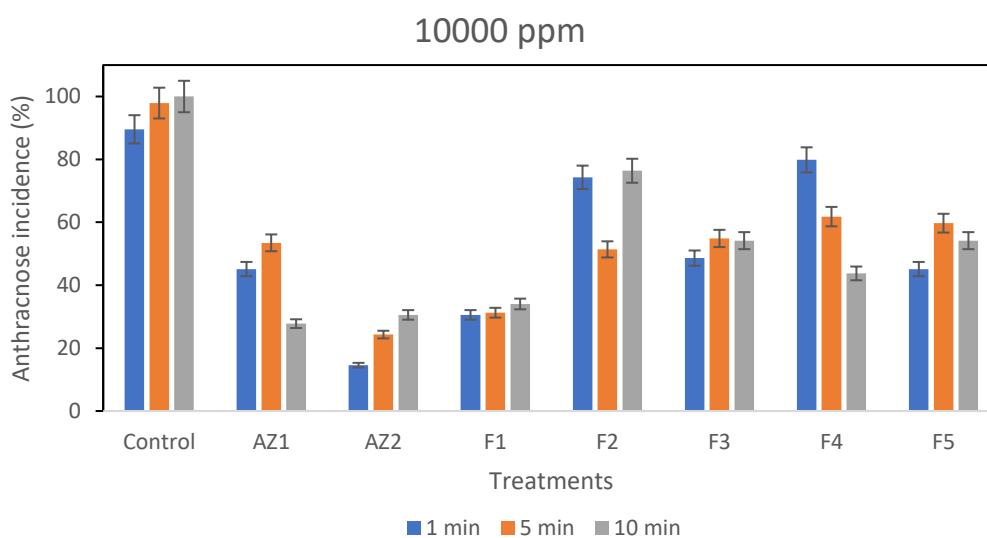


Figure 35. Evaluation of treatments in the incidence of anthracnose in mango fruits "Keitt" in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

DIAMETER OF ANTHRACNOSE LESION IN MANGO FRUITS " KEITT " IN POST-HARVEST

The fungicide Azoxystrobin at 500 ppm presented lesion diameters (mm) of 2.6, 3 and 1.7 mm at 1, 5 and 10 min of immersion. In turn, Azoxystrobin at 1000 ppm, had diameters of the lesion of 1, 1.4 and 1.8 mm in immersions of 1, 5 and 10 min. In the case of the control fruits, in general the diameters of the lesions were in the range between 7.1 and 8.8 mm (Figures 36-40).

Diameter of the anthracnose lesion at 2000 ppm.

The smallest diameter was shown by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 1.4, 2.8 and 3.6 mm in 1, 5 and 10 min of immersion respectively; followed by formulation F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)), which showed 3.7 and 2.9 mm in 5 and 10 min. On the other hand, F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)) obtained lesions of 3.1 mm at 5 min of immersion. The rest of the formulations developed lesions greater than 4 mm (Figure 36).

Diameter of the anthracnose lesion at 3000 ppm.

The minor lesions were shown by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 1.9 mm in 10 min of immersion. This was followed by formulation F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)) registering 2.8 and 4.3 mm in diameter at 5 and 10 minutes. Finally, F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)) registered lesions of 3.1 and 4.1 mm at 5 and 10 min of immersion. The rest of the formulations developed lesions greater than 4.6 mm (Figure 37).

Diameter of the anthracnose lesion at 4000 ppm.

The smallest diameter of the lesion was recorded by the formulation F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)) with 1.9 mm at 10 min of immersion; followed by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 3.5, 3.1 and 2.2 mm in 1, 5 and 10 min of immersion respectively. Finally, F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)) with 3.3 and 3.2 mm in diameter at 1 and 10 minutes. The rest of the formulations developed lesions greater than 4 mm (Figure 38).

Diameter of the anthracnose lesion at 5000 ppm.

The minor lesions were shown by the F1 formulation (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 2.4, 1.7 and 2.5 mm in 1, 5 and 10 min of immersion respectively. This was followed by formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)) whose lesions had a diameter of 3.4 and 2.5 mm at 5 and 10 min.

For its part, formulation F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)) registered 2.5 and 3.7 mm in diameter at 5 and 10 minutes. Finally, F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) presented lesions of 2.8 mm at 10 min immersion. The remaining treatments developed lesions greater than 4 mm (Figure 39).

Diameter of the anthracnose lesion at 10000 ppm.

The smaller diameters were shown by formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 1.8, 2.2 and 2.4 mm in 1, 5 and 10 min immersion respectively; followed by formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)) with lesions that had a diameter of 2.9 mm at 1 min. On the other hand, F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%)) presented 2.9 mm at 10 min, while F5 (Hydrogen peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)) registered 3.7 mm in diameter at 1 minute. On the other hand, F4 (Peacetic acid (30%) + Hydrogen Peroxide (10%) + Governor extract (*Larrea tridentata*) (50%) + Thymol (3%)) presented lesions of 3.6 mm at 10 min. Finally, F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) registered lesions of 3.8 mm at 10 min immersion. The remaining treatments developed lesions greater than 4 mm (Figure 40).

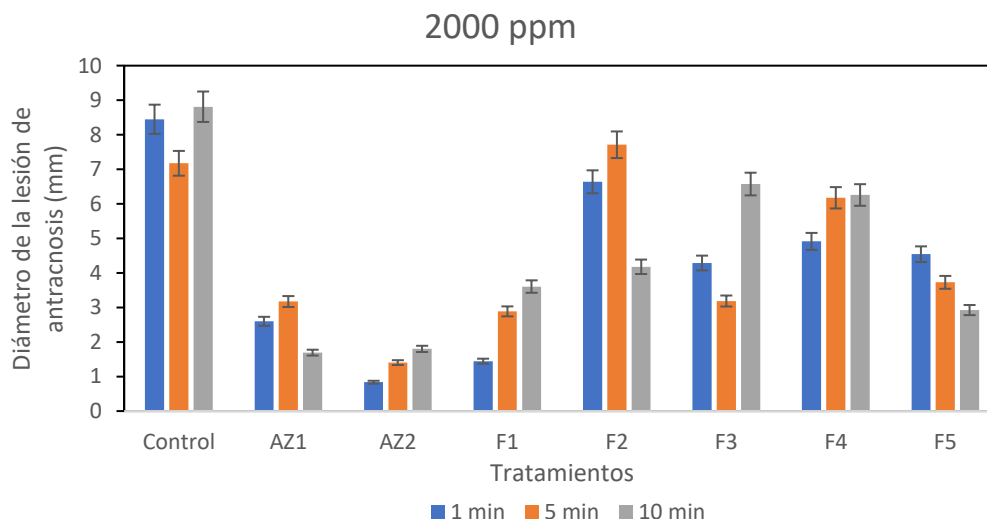


Figure 36. Evaluation of treatments in the diameter of the anthracnose lesion in "Keitt" mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

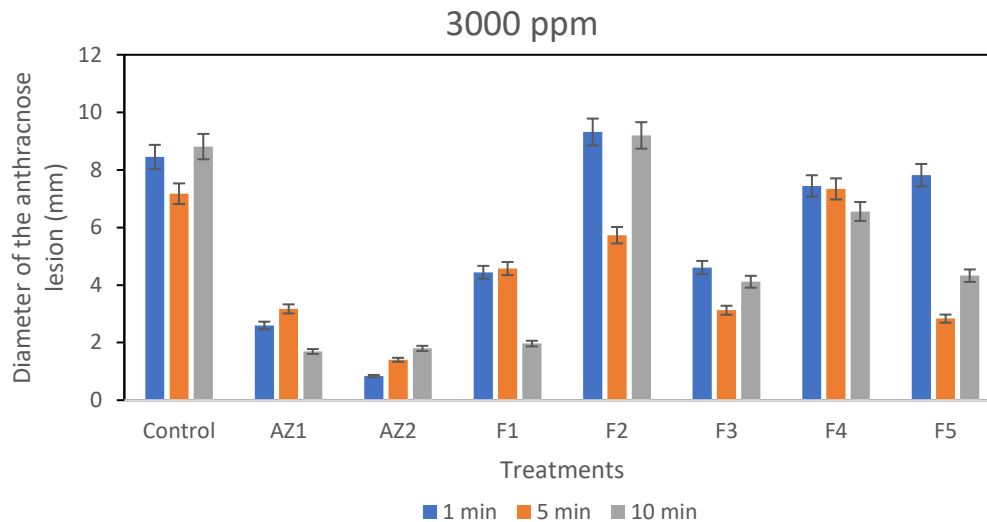


Figure 37. Evaluation of treatments in the diameter of the anthracnose lesion in "Keitt" mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

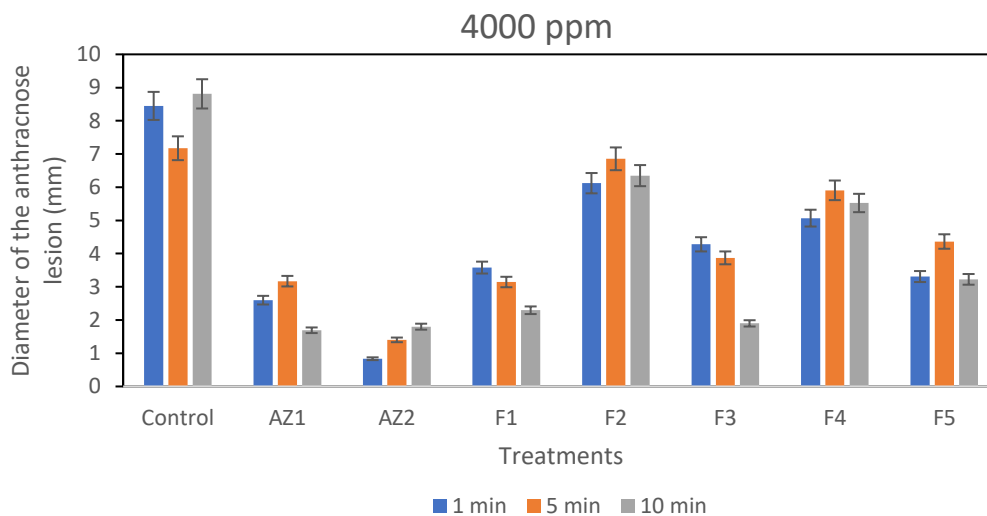


Figure 38. Evaluation of treatments in the diameter of the anthracnose lesion in "Keitt" mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

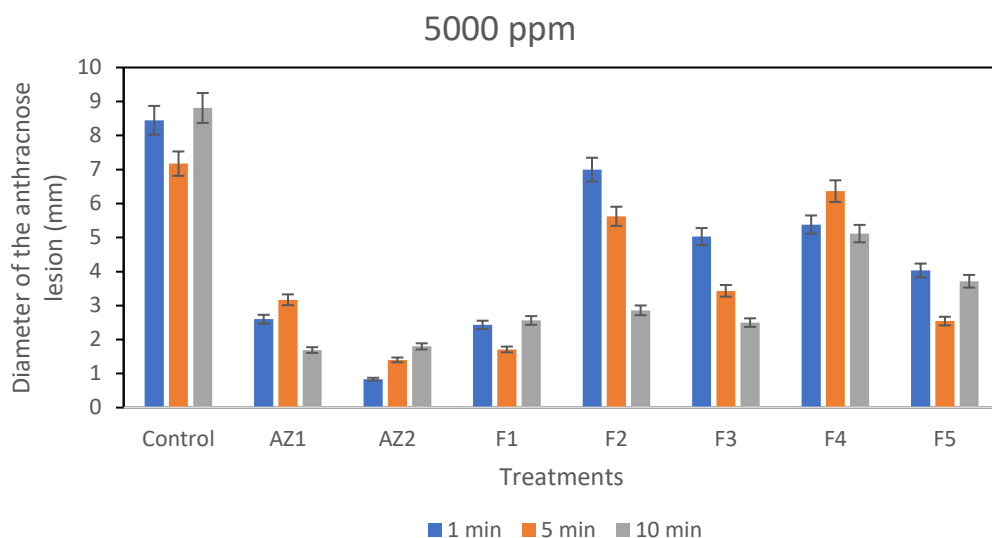


Figure 39. Evaluation of treatments in the diameter of the anthracnose lesion in "Keitt" mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

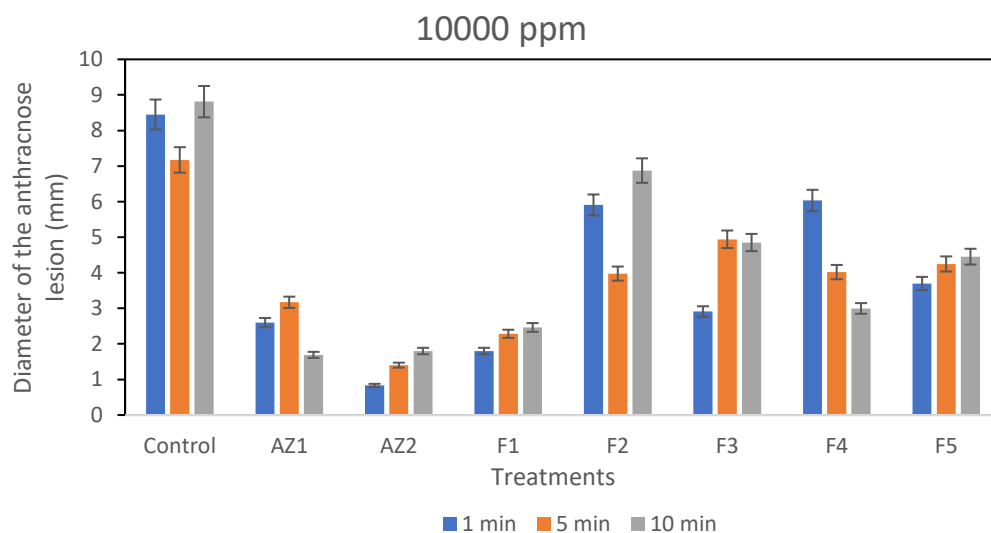


Figure 40. Evaluation of treatments in the diameter of the anthracnose lesion in "Keitt" mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

CONTROL EFFECTIVENESS OF BIOPESTICIDES AGAINST ANTHRACNOSE IN " KEITT " MANGO FRUITS

The fungicide Azoxystrobin at 500 ppm showed a control efficacy (in percentage) of 71% in one minute of immersion, 91% in five minutes and 98% in ten minutes. While Azoxystrobin at 1000 ppm, had an efficacy of 92, 91 and 94% in immersions of 1, 5 and 10 min respectively (Figure 41-45).

Control effectiveness of biopesticides at 2000 ppm.

The highest efficacy was recorded by formulations F5 and F1. Formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) showed 83% efficacy in 1 min immersion, 83% in 5 min and 95 in 10 min. In the case of the F5 treatment (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)), it registered efficiencies of 90, 97 and 74% in 1, 5 and 10 min respectively. On the other hand, formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)) presented control efficiencies of 85, 84 and 75% in 1, 5 and 10 min of immersion (Figure 41).

Control effectiveness of biopesticides at 3000 ppm.

The highest efficacy was recorded by formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), with 96% efficacy in 1 min of immersion, and 97% in 5 and 10 min. In the case of the F5 treatment (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)), it registered efficiencies of 90, 85 and 81% in 1, 5 and 10 min respectively. On the other hand, formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)) presented control efficiencies of 78, 87 and 89% in 1, 5 and 10 min of immersion (Figure 42).

Control effectiveness of biopesticides at 4000 ppm.

The highest efficacy was registered by the F3 formulation (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), registering efficiencies of 91, 96 and 93% in 1, 5 and 10 min of immersion. On the other, F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), presented 88, 96 and 94% efficacy in 1, 5 and 10 min. In the case of the F5 treatment (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%)), it registered efficiencies of 92, 85 and 93% in 1, 5 and 10 min respectively. The rest of the treatments had control efficiencies between 81 and 92% in their different immersion times (Figure 43).

Control effectiveness of biopesticides at 5000 ppm.

The highest efficacy was shown by the F1 treatment (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), with 98, 97 and 98% efficacy in 1, 5 and 10 min respectively. The second best treatment was F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (Larrea tridentata) (50%) + Thymol (3%)), showing control efficiencies of 89, 95 and

96% at 1, 5 and 10 min immersion. The third best treatment was F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), registering efficiencies of 91, 96 and 80% in 1, 5 and 10 min. The rest of the treatments had control efficiencies of between 75 and 95% in their different immersion times (Figure 44).

Control effectiveness of biopesticides at 10000 ppm.

The highest efficacy was shown by the F1 treatment (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), with 98, 97 and 99% efficacy in 1, 5 and 10 min of immersion respectively. The second best treatment was F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (*Larrea tridentata*) (50%) + Thymol (3%)), with control efficiencies of 77, 99 and 95% at 1, 5 and 10 min. On the other hand, the F2 treatment (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) registered efficiencies of 94, 77 and 96% in 1, 5 and 10 minutes. In the case of the F5 treatment (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)), it registered efficiencies of 96, 96 and 64% in 1, 5 and 10. Finally, the Treatment F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), showed efficiencies of 71, 97 and 73% in 1, 5 and 10 min of immersion (Figure 45).

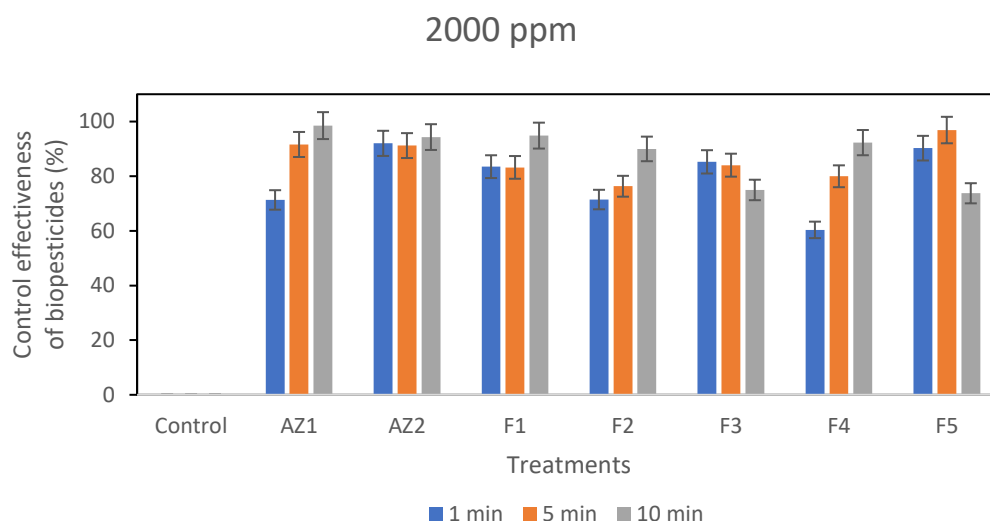


Figure 41. Evaluation of treatments in the effectiveness of anthracnose control in “Keitt” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

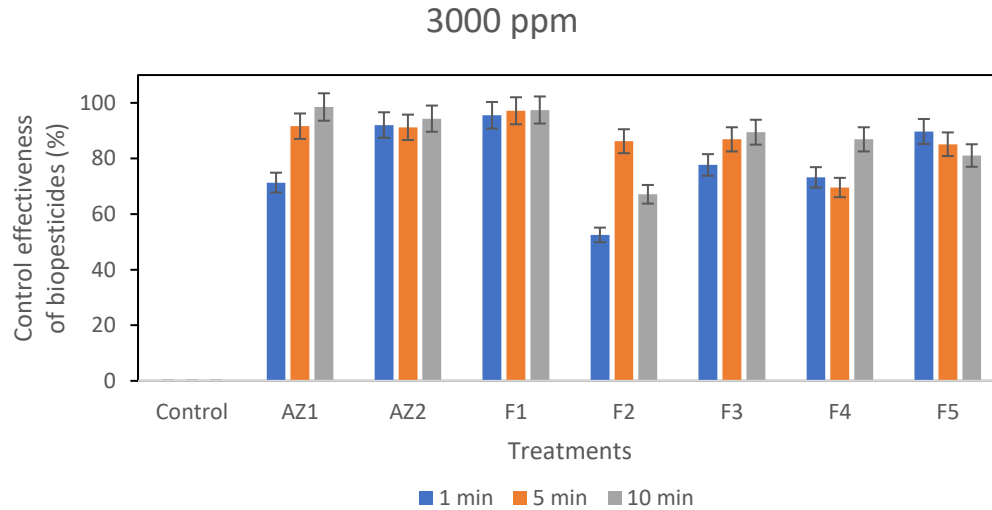


Figure 42. Evaluation of treatments in the effectiveness of anthracnose control in “Keitt” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

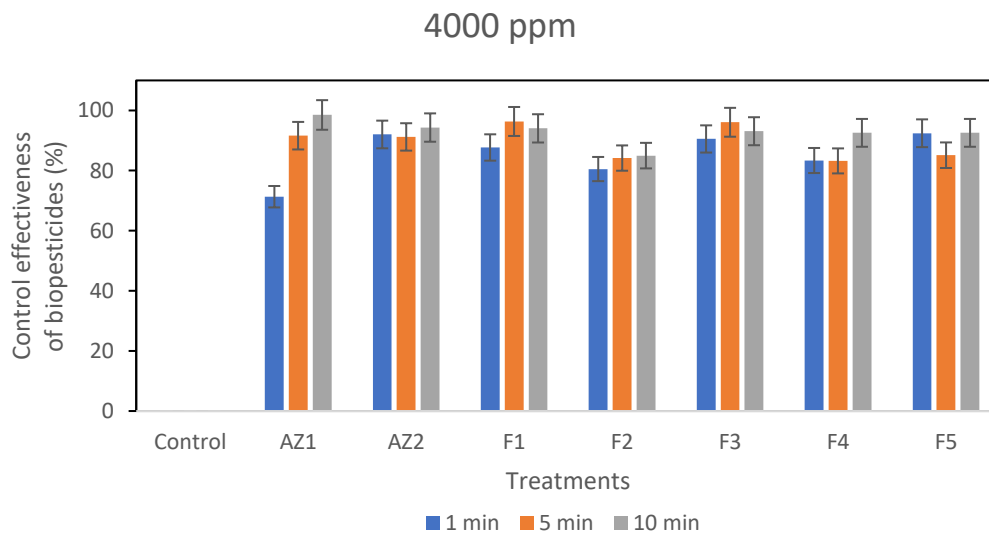


Figure 43. Evaluation of treatments in the effectiveness of anthracnose control in “Keitt” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

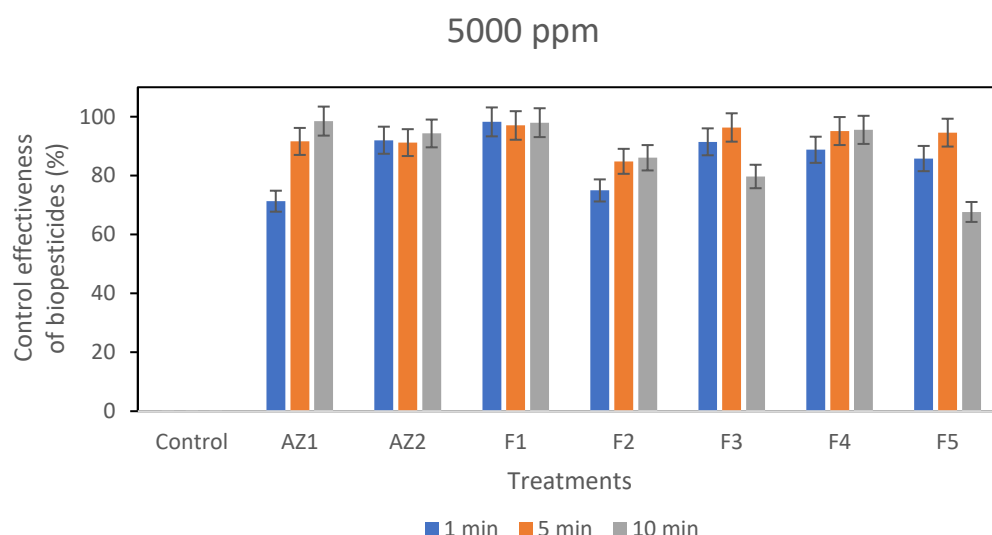


Figure 44. Evaluation of treatments in the effectiveness of anthracnose control in “Keitt” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

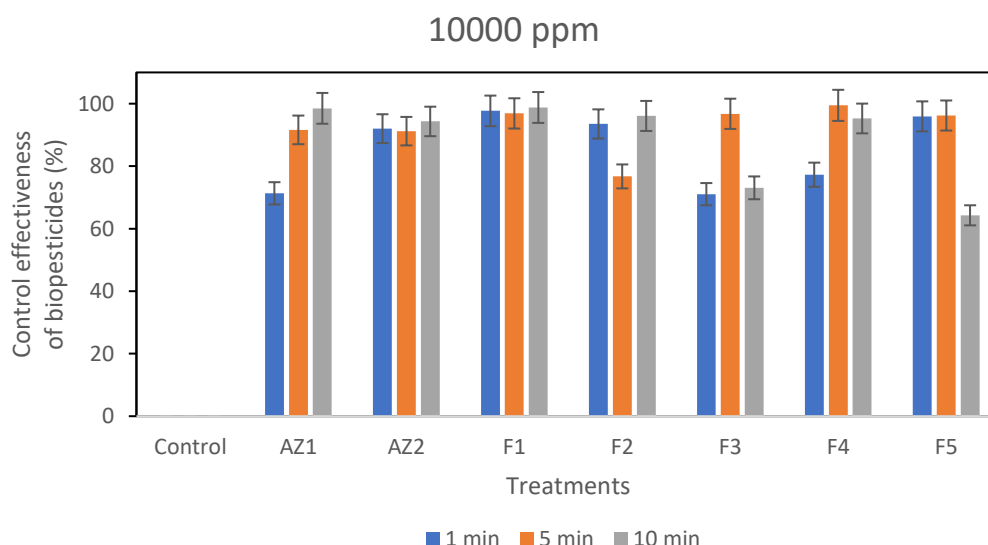


Figure 45. Evaluation of treatments in the effectiveness of anthracnose control in “Keitt” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

INCIDENCE OF ANTHRACNOSE IN MANGO FRUITS “TOMMY ATKINS” IN POSTHARVEST

The fungicide Azoxystrobin at 500 ppm presented an anthracnose incidence (in percentage) of 63% in one minute of immersion, 60% in five minutes and 71% in ten minutes. While Azoxystrobin at 1000 ppm, had an incidence of 63, 60 and 66% in immersions of 1, 5 and 10 min respectively. On the other hand, the control fruits registered the highest incidence percentage, which was in the range of 90-97% (Figures 46-50).

Anthracnose incidence at 2000 ppm.

The lowest incidence was registered by the formulation F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Governor extract (*Larrea tridentata*) (50%) + Thymol (3%)) with 61% at 10 minutes of immersion. The remaining treatments had incidences above 70% (Figure 46).

Incidence of anthracnose at 3000 ppm.

The lowest incidence was presented by formulations F2 and F4. F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) registered 70 and 73% at 1 and 10 min immersion respectively, while F4 (Acid peacetic (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%)) showed 72, 73 and 71% incidence in 1, 5 and 10 min. The rest of the treatments had incidences higher than 80% (Figure 47).

Anthracnose incidence at 4000 ppm.

Similar to the previous evaluation, the lowest incidence was presented by formulations F2 and F4. F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) registered 61% at 10 min immersion; on the other hand, F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%)) showed 74, 75 and 64% incidence in 1, 5 and 10 min. The remaining treatments had incidences higher than 79% (Figure 48).

Anthracnose incidence at 5000 ppm.

The lowest incidence was presented by F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) with 75 and 62% incidence at 1 and 5 min immersion respectively. The second formulation that showed the lowest incidence was F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) registering 77 and 66% at 1 and 10 min immersion; On the other hand, F4 (Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%)) showed 67, 71 and 77% incidence in 1, 5 and 10 min. The remaining treatments had incidences greater than 82% (Figure 49).

Anthracnose incidence at 10000 ppm.

In this last evaluation, the lowest incidence was presented by formulations F4 and F2. The F4 (Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%)) registered 64, 59 and 53% at 1, 5 and 10 min of immersion respectively; on the other hand, F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) showed 59, 72 and 59% incidence in 1, 5 and 10 min. The remaining treatments had incidences greater than 79% (Figure 50).

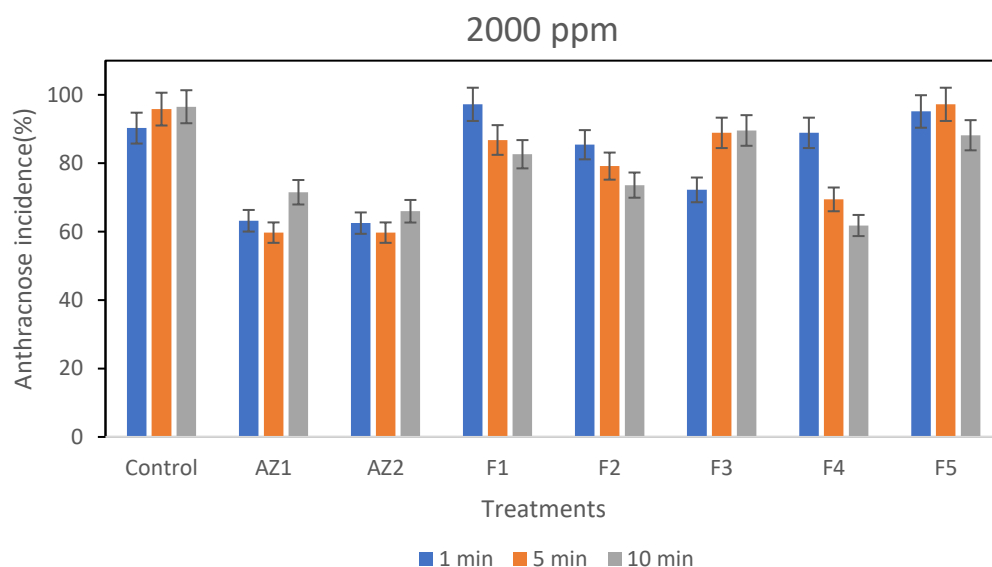


Figure 46. Evaluation of treatments in the incidence of anthracnose in mango fruits "Tommy" in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

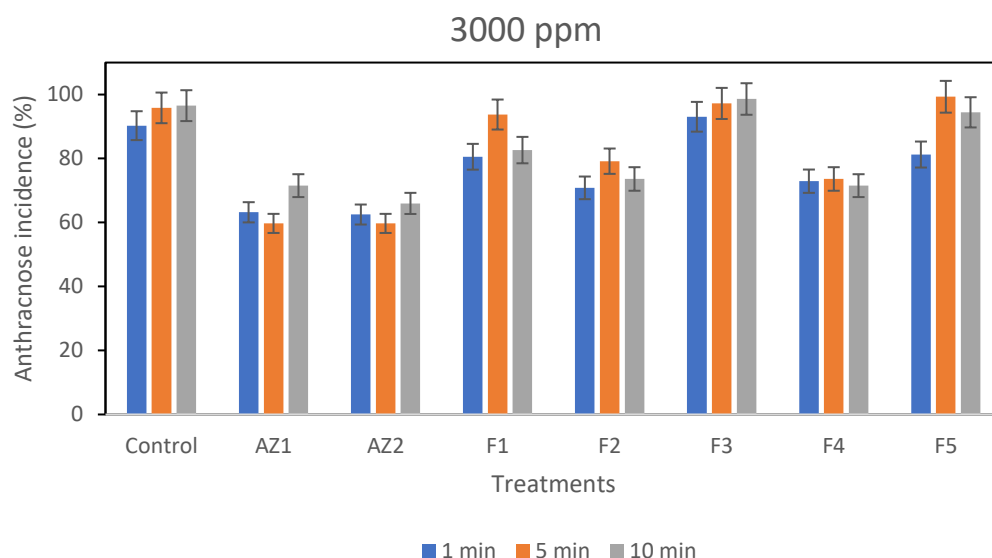


Figure 47. Evaluation of treatments in the incidence of anthracnose in mango fruits "Tommy" in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

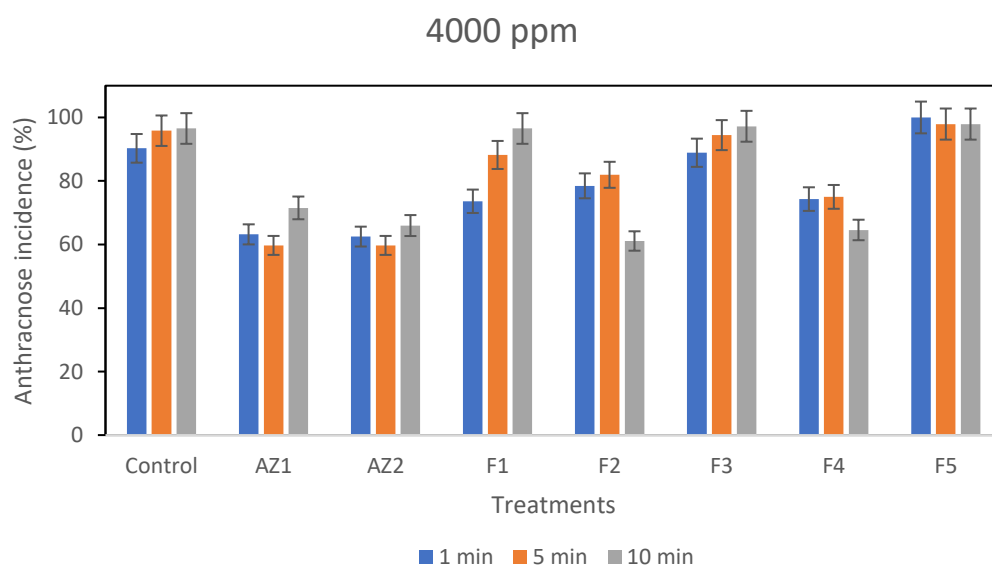


Figure 48. Evaluation of treatments in the incidence of anthracnose in mango fruits "Tommy" in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

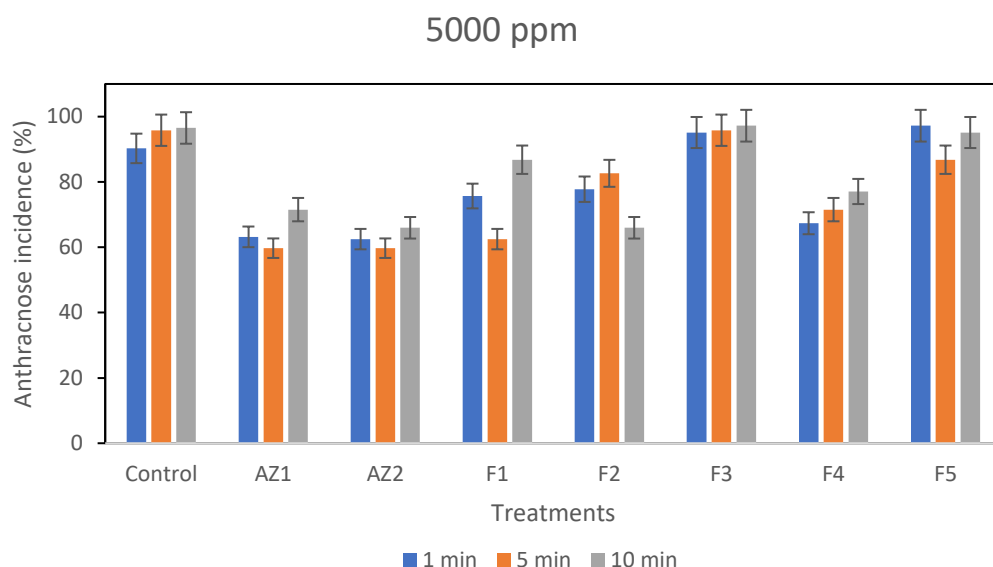


Figure 49. Evaluation of treatments in the incidence of anthracnose in mango fruits "Tommy" in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

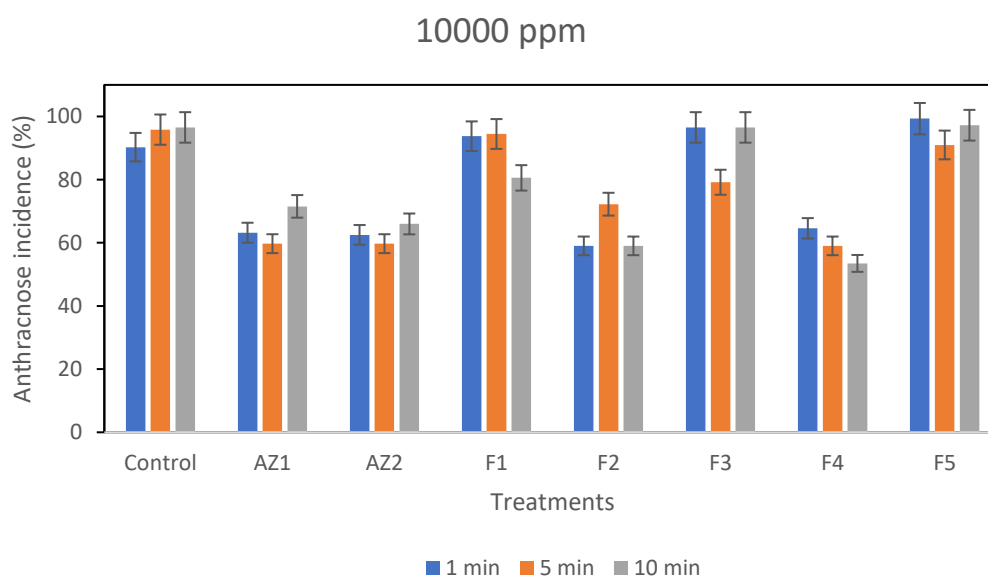


Figure 50. Evaluation of treatments in the incidence of anthracnose in mango fruits "Tommy" in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

DIAMETER OF ANTHRACNOSE LESION IN MANGO FRUITS "TOMMY ATKINS" IN POST-HARVEST

The fungicide Azoxystrobin at 500 ppm presented lesion diameters (mm) of 4.4, 3.7 and 4 mm at 1, 5 and 10 min of immersion. In turn, Azoxystrobin at 1000 ppm had lesion diameters of 3.7, 3.4 and 4.4 mm in immersions of 1, 5 and 10 min. In the case of the control fruits, in general the diameters of the lesions were in the range between 7.4 and 9.1 mm (Figures 51-55).

Diameter of the anthracnose lesion at 2000 ppm.

The smallest diameter was shown by F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) with 4.8, 4.5 and 3.9 mm in 1, 5 and 10 min of immersion respectively; followed by formulation F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%)), which showed 5 and 4.2 mm in 1 and 5 min. The rest of the formulations developed lesions above 5.8 mm (Figure 51).

Diameter of the anthracnose lesion at 3000 ppm.

As in the previous evaluation, the smallest diameter was shown by F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) with 4.1, 4.6 and 4.8 mm in 1, 5 and 10 min of immersion respectively; followed by formulation F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%)), which showed 5.8 and 5 mm in 1 and 10 minutes. On the other hand, F5 (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)) presented 5.3 mm in diameter in 1 min of immersion. Finally, F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) showed 5.6 mm in 10 min of immersion. The remaining treatments developed lesions greater than 6.6 mm (Figure 52).

Diameter of the anthracnose lesion at 4000 ppm.

The smallest diameter was shown by F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) with 4.8, 5 and 2.5 mm in 1, 5 and 10 min of immersion respectively; followed by formulation F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%)), which showed 4.0 mm in 10 min. On the other hand, F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) showed 4.6 mm in 1 min of immersion. The rest of the formulations developed lesions greater than 6 mm (Figure 53).

Diameter of the anthracnose lesion at 5000 ppm.

The smaller diameter was shown by F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) with 4.6, 5 and 3.8 mm in 1, 5 and 10 min of immersion respectively; followed by formulation F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%)), which showed 4.6, 4.9 and 5.3 mm in 1, 5 and 10 min. On the other hand, F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%))

+ Acetic Acid (10%)) showed 5.2 and 4.9 mm in 1 and 10 min of immersion. The remaining treatments developed lesions greater than 6.5 mm (Figure 54).

Diameter of the anthracnose lesion at 10000 ppm.

The smaller diameter was shown by F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) with 2.6, 4.7 and 3.6 mm in 1, 5 and 10 min of immersion respectively; followed by formulation F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%)), which showed 4.8, 4.7 and 3.7 mm in 1, 5 and 10 min. The remaining treatments developed lesions larger than 8 mm (Figure 55).

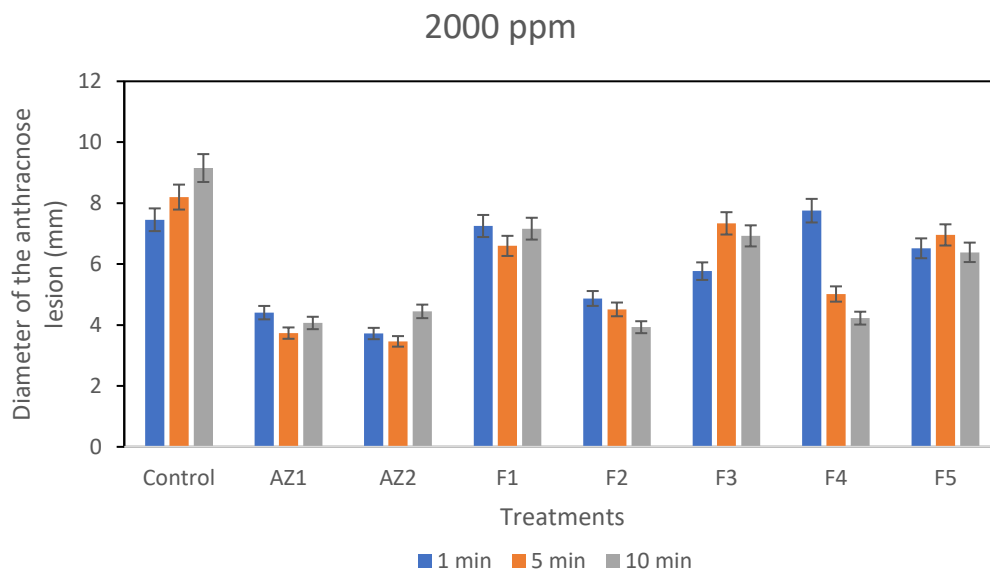


Figure 51. Evaluation of treatments in the diameter of the anthracnose lesion in "Tommy" mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

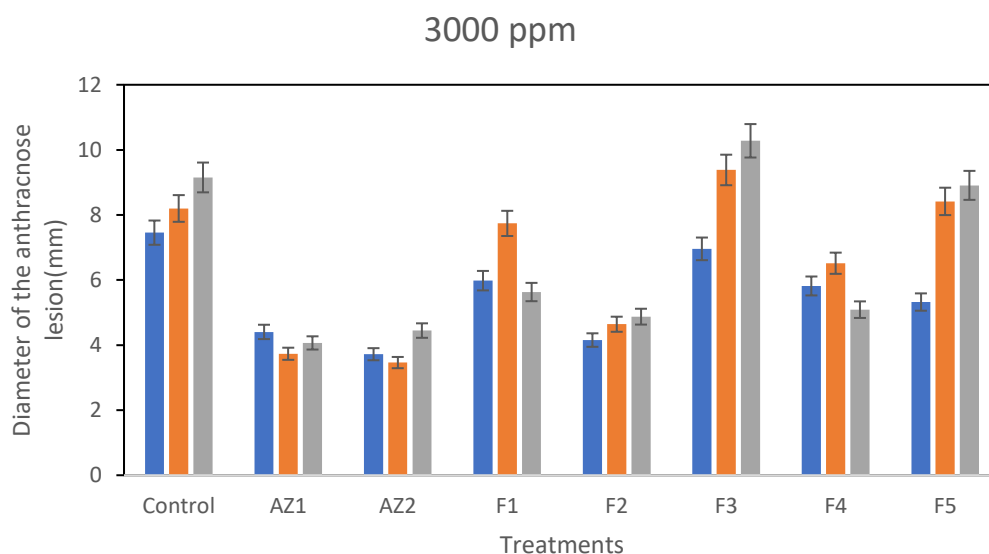


Figure 52. Evaluation of treatments in the diameter of the anthracnose lesion in "Tommy" mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

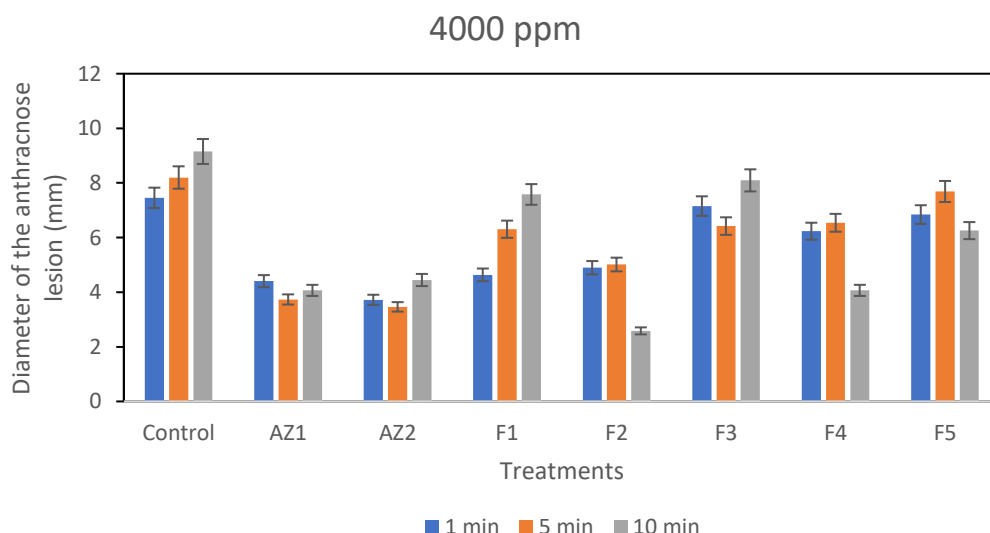


Figure 53. Evaluation of treatments in the diameter of the anthracnose lesion in "Tommy" mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

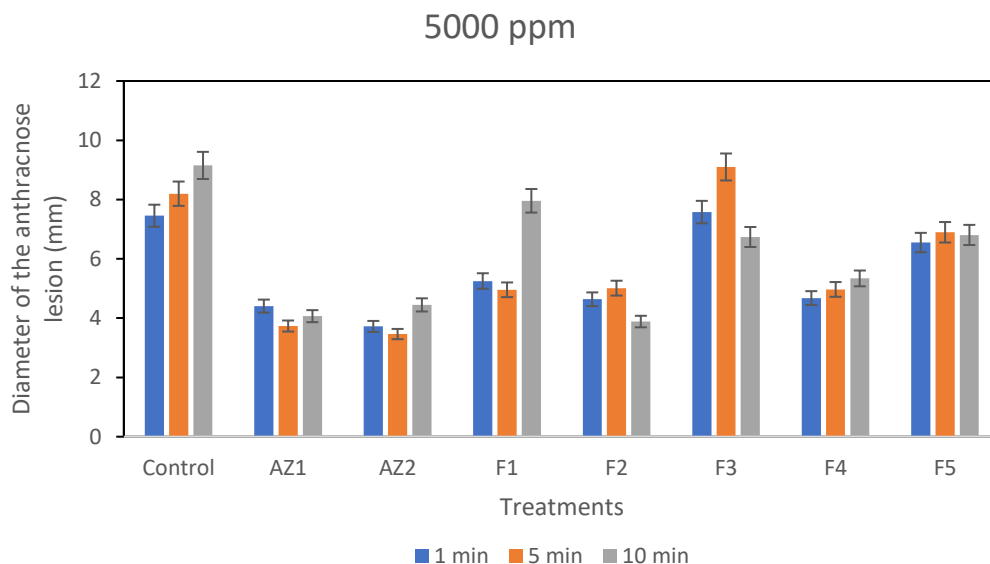


Figure 54. Evaluation of treatments in the diameter of the anthracnose lesion in "Tommy" mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

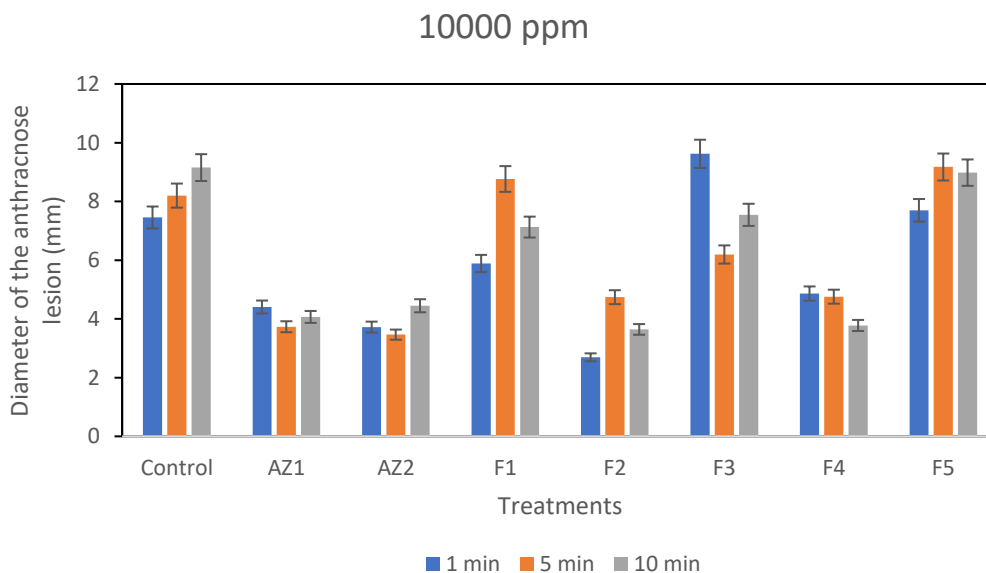


Figure 55. Evaluation of treatments in the diameter of the anthracnose lesion in "Tommy" mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

CONTROL EFFECTIVENESS OF BIOPESTICIDES AGAINST ANTHRACNOSE IN " TOMMY ATKINS " MANGO FRUITS

The fungicide Azoxystrobin at 500 ppm had a control efficacy (in percentage) of 97% in one minute of immersion, 92% in five minutes and 99% in ten minutes. While Azoxystrobin at 1000 ppm, showed an efficacy of 94, 99 and 99% in immersions of 1, 5 and 10 min respectively (Figure 56-60).

Control effectiveness of biopesticides at 2000 ppm.

The highest efficacy was recorded by formulations F2 and F1. Formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) showed control efficiencies of 73, 90 and 96% in immersions at 1, 5 and 10 min, respectively. On the other hand, formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) registered 82% efficacy in 1 min of immersion, 85% in 5 min and 90% in 10 minutes. The third best formulation was F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (*Larrea tridentata*) (50%) + Thymol (3%)), with 56, 90 and 86% of efficacy at 1, 5 and 10 min (Figure 56).

Control effectiveness of biopesticides at 3000 ppm.

The highest efficacy was recorded by formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), with 91% efficacy in 1 min immersion, 97% in 5 min and 93% % in 10 min. Formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) showed control efficiencies of 90, 94 and 90% in immersions at 1, 5 and 10 min, respectively. On the other hand, formulation F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)) presented control efficiencies of 89, 88 and 79% in 1, 5 and 10 min of immersion. In the case of the F5 treatment (Hydrogen Peroxide (50%) + Acetic acid (15%) + Peacetic acid (15%)), it recorded efficiencies of 72, 95 and 87% in 1, 5 and 10 min respectively (Figure 57).

Control effectiveness of biopesticides at 4000 ppm.

The highest efficiencies were recorded by formulations F1, F2 and F4. Formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), showed 86% efficacy in 1 min of immersion, 98% in 5 min and 95 in 10 min. Formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) presented control efficiencies of 92, 92 and 98% in immersions at 1, 5 and 10 min, respectively. The third best formulation was F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%)), with 94, 94 and 93% of efficacy at 1, 5 and 10 min. On the other hand, formulation F3 (Hydrogen Peroxide (30%) + Peacetic acid (15%) + Acetic acid (10%)) presented control efficiencies of 90, 94 and 77% in 1, 5 and 10 min of immersion . Formulation F5 had control efficiencies between 49 and 76% (Figure 58).

Control effectiveness of biopesticides at 5000 ppm.

Anthrachnose control efficacies were similar in formulations F1, F2, F3, and F4. Formulation F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), showed 99% efficacy in 1 min of immersion, 94% in 5 min and 91% in 10 min. Formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) presented control efficiencies of 90, 95 and 94% in immersions at 1, 5 and 10 min, respectively. Formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)) obtained control efficiencies of 88, 92 and 92% in 1, 5 and 10 min immersion. On the other hand, F4 (Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%)) showed 88, 94 and 91% efficacy at 1, 5 and 10 min. Formulation F5 had control efficiencies between 60 and 84% (Figure 59).

Control effectiveness of biopesticides at 10000 ppm.

The efficiencies were similar in formulations F4, F2, F1 and F3. Formulation F4 (Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (*Larrea tridentata*) (50%) + Thymol (3%)) showed 97, 98 and 98% efficacy at 1.5 and 10 min. Formulation F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) presented control efficiencies of 99, 98 and 95% in immersions at 1, 5 and 10 min, respectively. For its part, the F1 formulation (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), showed 95% efficacy in 1 min immersion, 95% in 5 min and 93 in 10 min. Finally, formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)) obtained control efficiencies of 84, 94 and 79% in 1, 5 and 10 min of immersion. Formulation F5 had control efficiencies between 66 and 80% (Figure 60).

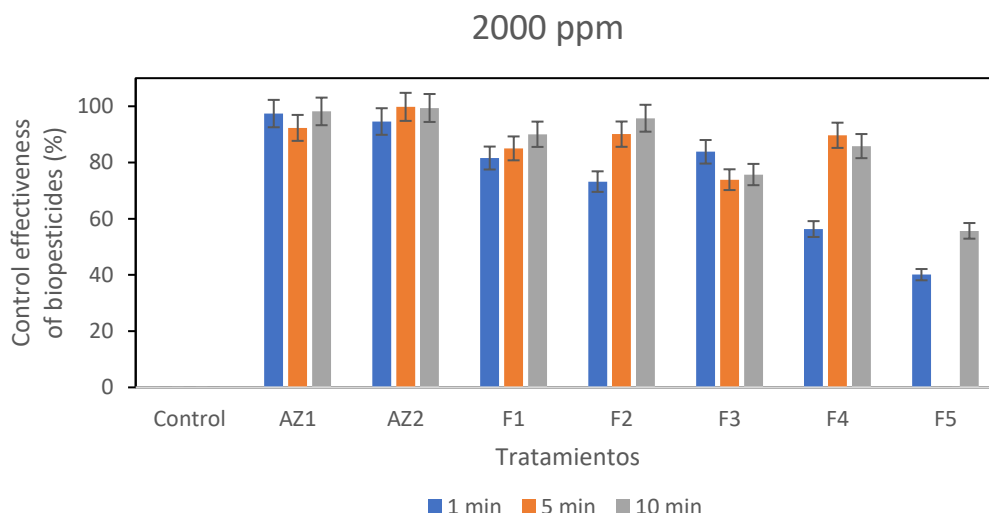


Figure 56. Evaluation of treatments in the effectiveness of anthracnose control in “Tommy” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

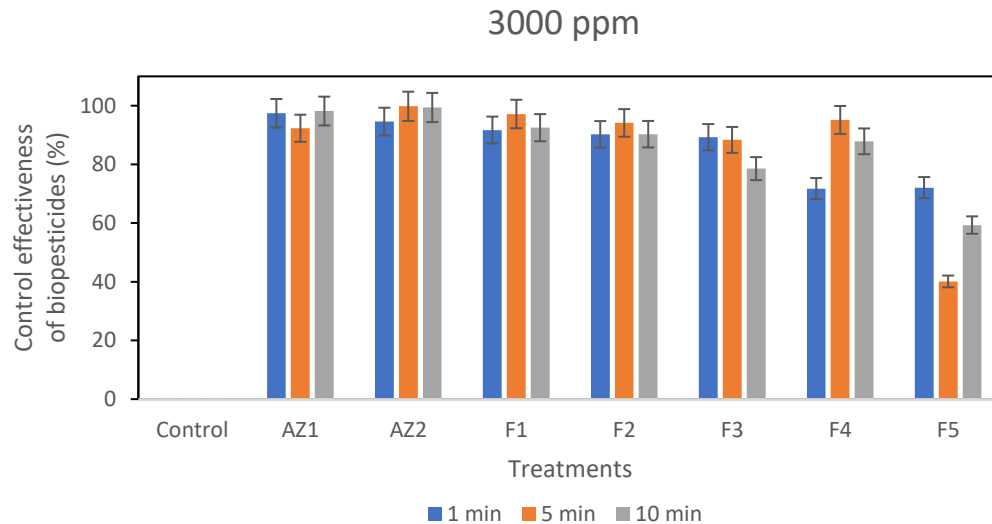


Figure 57. Evaluation of treatments in the effectiveness of anthracnose control in “Tommy” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

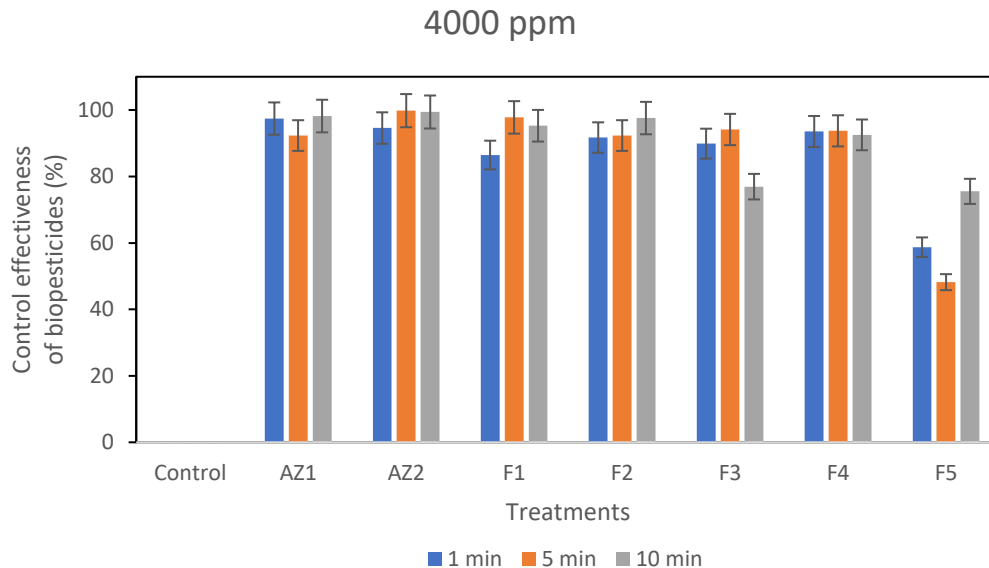


Figure 58. Evaluation of treatments in the effectiveness of anthracnose control in “Tommy” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

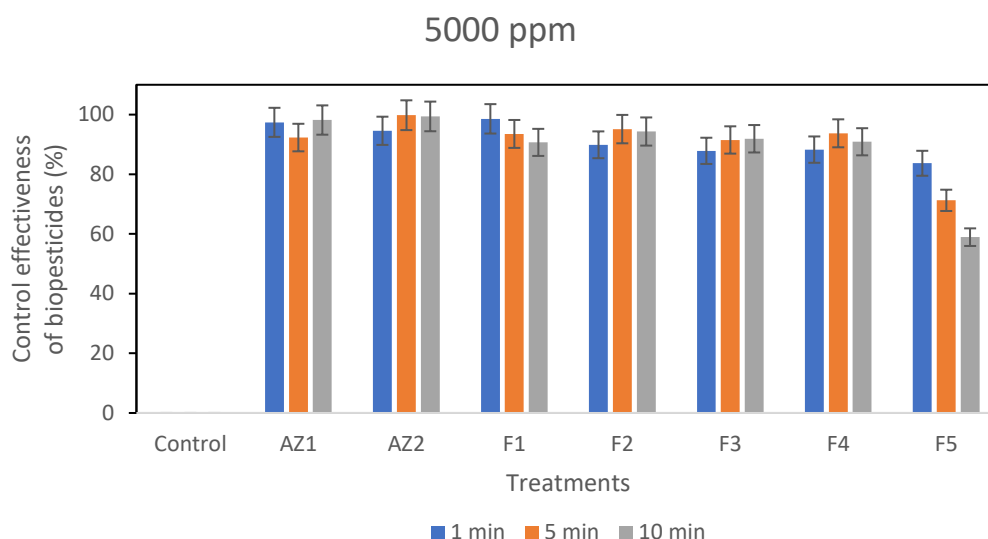


Figure 59. Evaluation of treatments in the effectiveness of anthracnose control in “Tommy” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

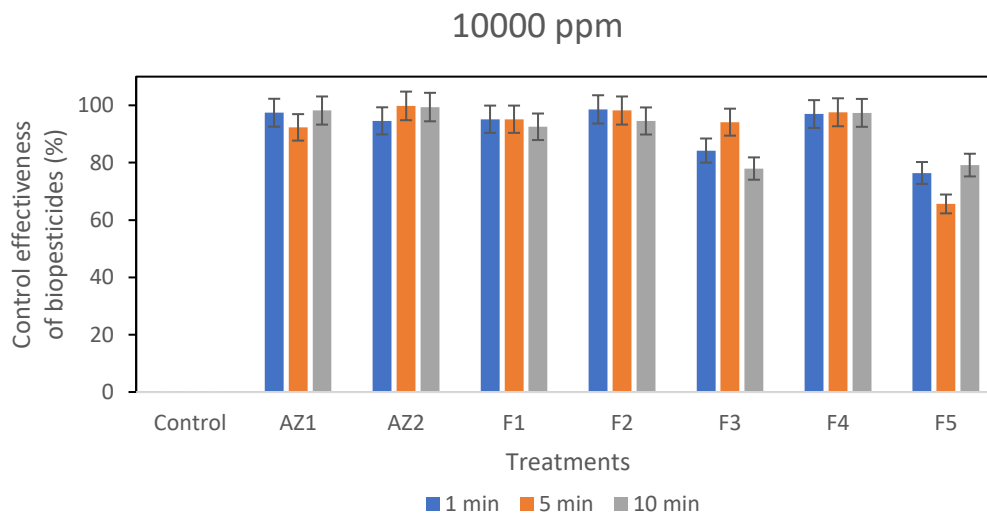


Figure 60. Evaluation of treatments in the effectiveness of anthracnose control in “Tommy” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%); F4) Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic Acid (15%).

4. CONCLUSIONS

1. The chemical fungicide Azoxystrobin in its two concentrations (500 and 1000 ppm) and the biopesticide formulations in their different concentrations, had no effect in stopping the incidence and severity (diameter of the lesion) of anthracnose in wounds. Therefore, it is concluded that none of the treatments, including the chemical fungicide, stop the infection process completely once the pathogen is already inside the fruit.
2. The formulations that showed the lowest incidence of anthracnose in fruits of the four varieties (Ataúlfo, Kent, Keit and Tommy) were F1 (Peacetic acid (30%) + Hydrogen Peroxide (30%) + Acetic acid (10%)), F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) and F5 (Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peacetic acid (15%)).
3. The formulations that showed the shortest length in diameter of the anthracnose lesion in fruits of the four varieties were F1 (Peacetic acid (30%) + Hydrogen Peroxide (30%) + Acetic acid (10%)), F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%)) and F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10 %)).
4. The chemical fungicide Azoxystrobin showed control efficiencies greater than 90% at concentrations of 500 and 1000 ppm, in 1, 5 and 10 min of immersion, in the four varieties evaluated (Ataúlfo, Kent, Keit and Tommy).
5. All the biopesticide formulations showed biological effectiveness of control against anthracnose in mango. The control efficacy depended on the variety, concentration and immersion time.
6. It was observed that some formulations had biological effectiveness against anthracnose above 90% at concentrations of 2000 or 3000 ppm, and one minute of immersion. However, the highest control efficiencies were observed at concentrations of 4000, 5000 and 10000 ppm, in immersion times of 5 and 10 minutes.
7. The highest effectiveness for the control of anthracnose in "Ataúlfo" mango was recorded by the formulation F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)), which showed efficiencies of 84, 91 and 96% from 4000, 5000 and 10000 ppm, respectively.

8. In the effectiveness for the control of anthracnose in the variety "Kent", it was observed that the formulations F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)) and F5 (Peroxide Hydrogen (50%) + Acetic acid (15%) + Peacetic acid (15%)), were the most constant in the control, which were in the range of 87 and 96% efficacy. Although the rest of the formulations showed control efficiencies above 90% in at least one of their concentrations and / or immersion times.

9. In the effectiveness for the control of anthracnose in mango "Keit", it was determined that the formulations F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), F5 (Peroxide of Hydrogen (50%) + Acetic Acid (15%) + Peacetic Acid (15%)) and F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)) showed greater effectiveness, the which were mostly above 90% control efficacy. However, the rest of the formulations also showed control efficiencies above 90% in at least one of their concentrations and / or immersion times.

10. For the control of anthracnose in "Tommy" mango, it was observed that four formulations showed the highest effectiveness, which was above 90% of control efficacy. These formulations in order from highest to lowest effectiveness were F1 (Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%)), F2 (Peacetic Acid (35%) + Hydrogen Peroxide (15%)) + Acetic acid (10%) + Chitosan (40%)), F4 (Peacetic acid (30%) + Hydrogen Peroxide (10%) + Extract of governor (*Larrea tridentata*) (50%) + Thymol (3%)) and F3 (Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%)).

5. ANNEX

IMAGES OF THE TREATMENTS IN MANGO "ATAULFO"



Figure 1. Incidence and severity of anthracnose in “Ataulfo” mango fruits in formulation 1: Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000 , 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 2. Incidence and severity of anthracnose in "Ataulfo" mango fruits in formulation 2: Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (4%), at concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 3. Incidence and severity of anthracnose in "Ataulfo" mango fruits in formulation 3: Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000 , 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 4. Incidence and severity of anthracnose in "Ataulfo" mango fruits in formulation 4: Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (50%) + Thymol (3%), a concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 5. Incidence and severity of anthracnose in "Ataulfo" mango fruits in formulation 5: Hydrogen Peroxide (50%) + Peracetic Acid (15%) + Acetic Acid (15%), at concentrations (2000, 3000, 4000 , 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 6. Incidence and severity of anthracnose in "Ataulfo" mango fruits with the chemical fungicide Azoxystrobin at concentrations (500 and 1000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 7. Incidence and severity of anthracnose in control fruits of mango "Aaulfo".

IMAGES OF THE TREATMENTS IN MANGO “KENT”



Figure 8. Incidence and severity of anthracnose in “Kent” mango fruits in formulation 1: Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000 , 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 9. Incidence and severity of anthracnose in “Kent” mango fruits in formulation 2: Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (4%), at concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 10. Incidence and severity of anthracnose in "Kent" mango fruits in formulation 3: Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000 , 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 11. Incidence and severity of anthracnose in “Kent” mango fruits in formulation 4: Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (50%) + Thymol (3%), a concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 12. Incidence and severity of anthracnose in “Kent” mango fruits in formulation 5: Hydrogen Peroxide (50%) + Peracetic Acid (15%) + Acetic Acid (15%), at concentrations (2000, 3000, 4000 , 5000 and 10000 ppm) and 1.5 and 10 minutes of immersion.

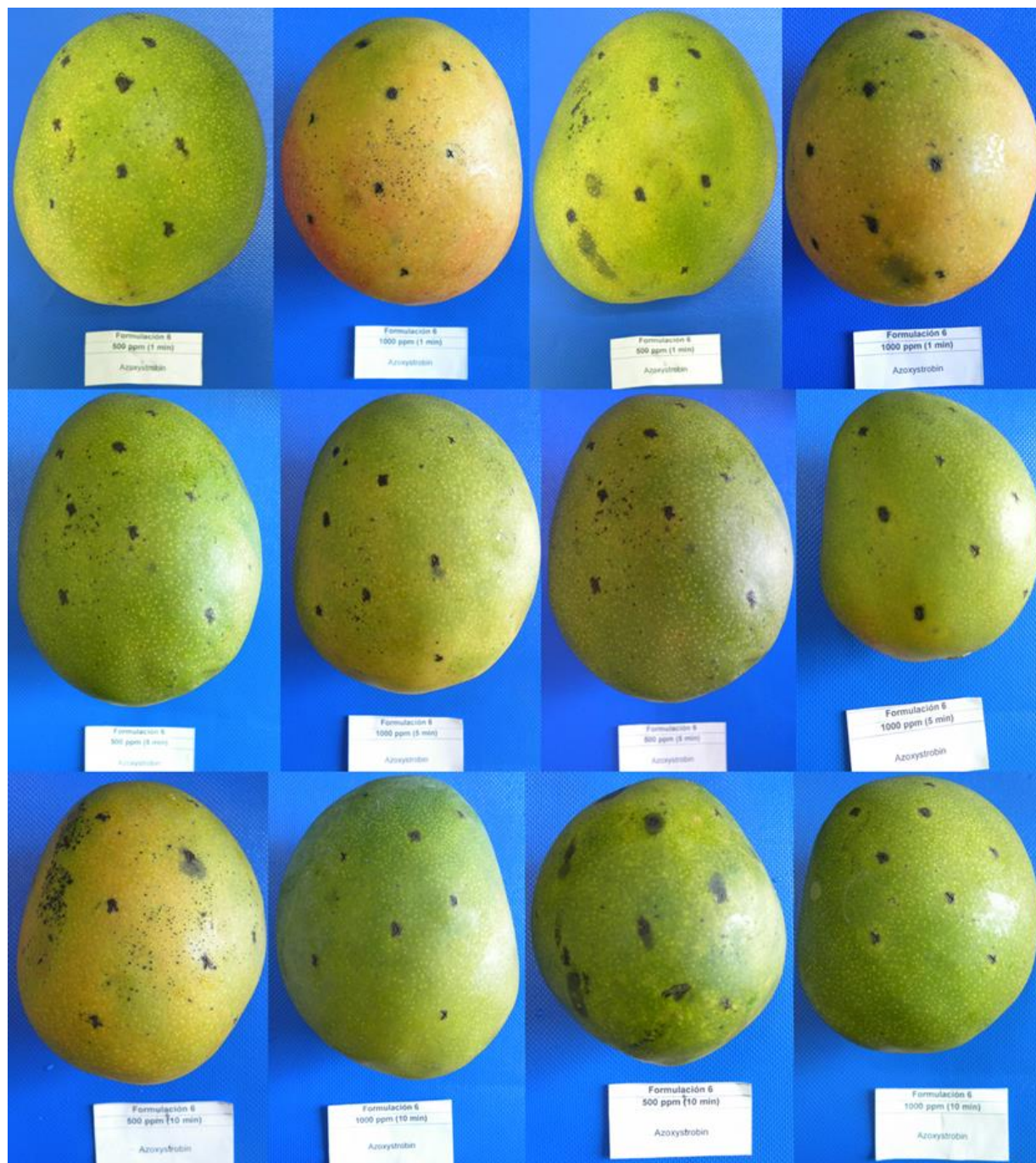


Figure 13. Incidence and severity of anthracnose in “Kent” mango fruits with the chemical fungicide Azoxystrobin at concentrations (500 and 1000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 14. Incidence and severity of anthracnose in the control fruits of mango "Kent".

IMAGES OF THE TREATMENTS IN MANGO "KEITT"



Figure 15. Incidence and severity of anthracnose in “Keitt” mango fruits in formulation 1: Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000 , 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 16. Incidence and severity of anthracnose in “Keitt” mango fruits in formulation 2: Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (4%), at concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 17. Incidence and severity of anthracnose in “Keitt” mango fruits in formulation 3: Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000 , 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 18. Incidence and severity of anthracnose in “Keitt” mango fruits in formulation 4: Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (50%) + Thymol (3%), a concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 19. Incidence and severity of anthracnose in “Keitt” mango fruits in formulation 5: Hydrogen Peroxide (50%) + Peracetic Acid (15%) + Acetic Acid (15%), at concentrations (2000, 3000, 4000 , 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.

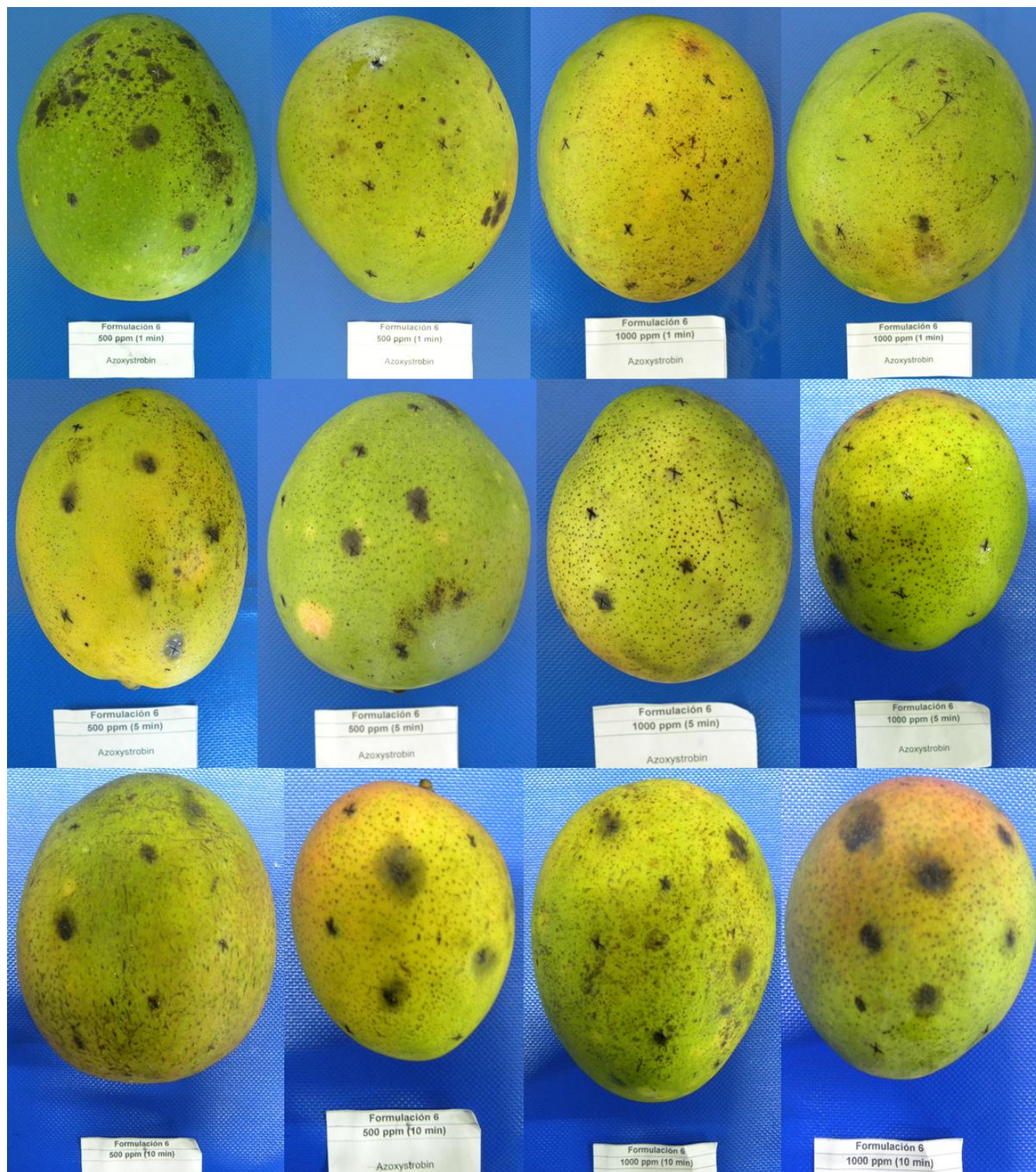


Figure 20. Incidence and severity of anthracnose in “Keitt” mango fruits with the chemical fungicide Azoxystrobin at concentrations (500 and 1000 ppm) and 1, 5 and 10 minutes of immersion.

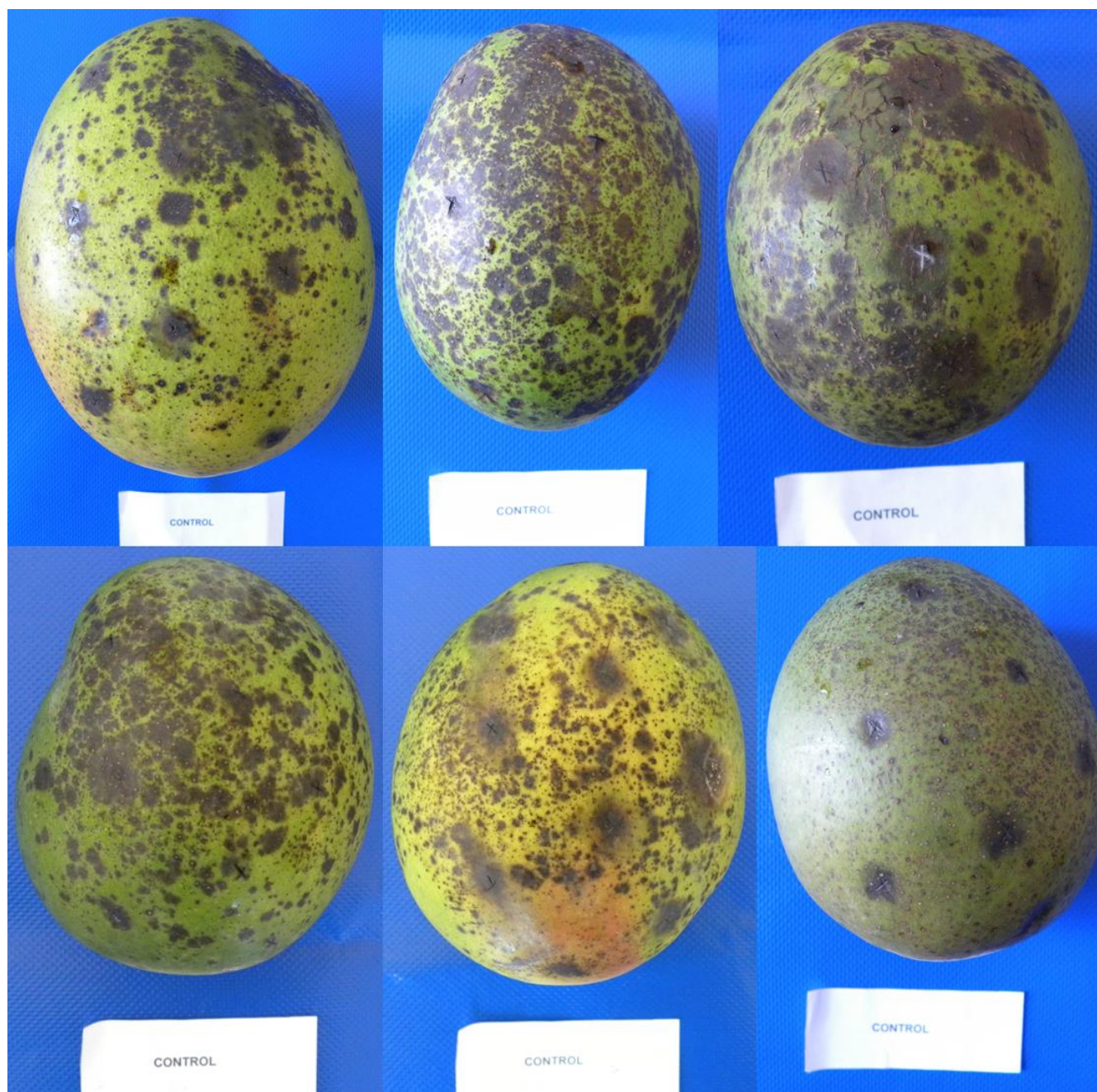


Figure 21. Incidence and severity of anthracnose in control fruits of mango "Keitt".

IMAGES OF TREATMENTS IN MANGO 'TOMMY ATKINS'



Figure 22. Incidence and severity of anthracnose in "Tommy Atkins" mango fruits in formulation 1: Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 23. Incidence and severity of anthracnose in "Tommy Atkins" mango fruits in formulation 2: Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 24. Incidence and severity of anthracnose in "Tommy Atkins" mango fruits in formulation 3: Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.

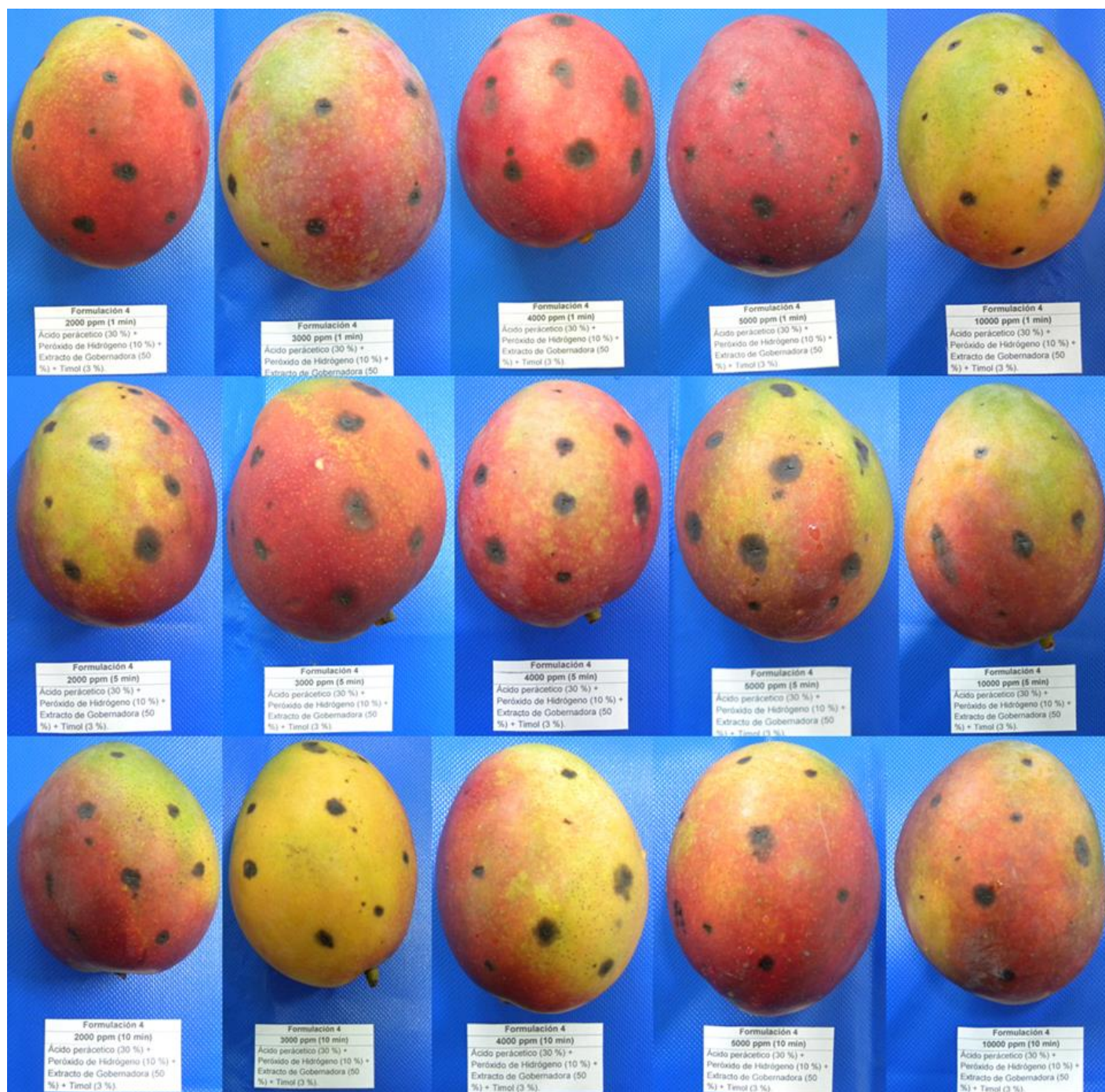


Figure 25. Incidence and severity of anthracnose in "Tommy Atkins" mango fruits in formulation 4: Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 26. Incidence and severity of anthracnose in "Tommy Atkins" mango fruits in formulation 5: Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%), at concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 27. Incidence and severity of anthracnose in “Tommy Atkins” mango fruits with the chemical fungicide Azoxystrobin at concentrations (500 and 1000 ppm) and 1, 5 and 10 minutes of immersion.



Figure 28. Incidence and severity of anthracnose in control fruits of mango "Tommy Atkins".

EFFECT OF BIOPESTICIDES ON THE QUALITY OF MANGO FRUIT "ATAULFO, KEITT, KENT AND TOMMY ATKINS" IN POSTHARVEST

1. SPECIFIC OBJECTIVES

- I. Prepare formulations of biopesticides with greater control effect on *C. gloeosporioides* in postharvest fruits.
- II. Evaluate the effect of biopesticide formulations on ripening and physical appearance of the fruits.
- III. Identify the effect of post-harvest treatment with biopesticides on the quality of the fruit.

2. METHODOLOGY

2.1. Biopesticide formulations

Active ingredients with fungicidal activity were used, with which five formulations were made (Table 1). The formulations that were used were the same that were evaluated for the control of *Colletotrichum gloeosporioides* in year one of this project. Likewise, the effectiveness of the systemic fungicide Azoxystrobin (Amistar Gold®) was evaluated.

Table 1. Formulations of biopesticides and chemical fungicide for the control of anthracnose produced by the fungus (*C. gloeosporioides*) in mango fruits.

FORMULATION	ACTIVE INGREDIENT
F1	Peacetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%).
F2	Peacetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (4%).
F3	Hydrogen Peroxide (30%) + Peacetic Acid (15%) + Acetic Acid (10%).
F4	Peacetic Acid (30%) + Hydrogen Peroxide (10%) + Governor Extract (<i>Larrea tridentata</i>) (50%) + Thymol (3%).
F5	Hydrogen Peroxide (50%) + Peacetic Acid (15%) + Acetic Acid (15%).
AZ1	Azoxystrobin (500 ppm)
AZ2	Azoxystrobin (1000 ppm)
Control	Water

2.2.

Establishment of the experiment

The experiment was established in the 2020 production cycle in laboratories of the INIFAP-Campo Experimental Santiago Ixcuintla, Nayarit, Mexico. Physiologically mature fruits of the same varieties of experiment one ("Ataulfo, Tommy Atkins, Kent and Keitt") were used.

2.3. Effect of formulations on fruit quality

The fruits were treated with the same concentrations and immersion times of the treatments of the first experiment (year 1). For which five concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and three immersion times (1, 5 and 10 min) in the five biopesticide formulations were evaluated. In the case of the two treatments of the chemical fungicide Azoxystrobin, two concentrations were used, 500 ppm (AZ1) and 1000 ppm (AZ2) with the three immersion times. The control fruits (control) were only treated with clean water. The fruits were kept at a constant temperature of 26 ± 1 ° C. An initial evaluation was carried out on the same day of harvest, later evaluations were made at 3, 5 and 8 days after harvest (DAH).

2.4. Variables to be evaluated

Firmness of the pulp: It was evaluated with a Chatillon® penetrometer with conical tip (11 mm diameter and 5 mm height), with a capacity of 0 to 12 kg. The reading of each fruit was recorded in Newtons (N).

Total soluble solids (° Brix): It was determined with the A.O.A.C. (1984) with an ATAGO-Pelete PR-101 digital refractometer (0 to 45%). The result was expressed in °Brix units.

Fruit color: L * (brightness), saturation index (chroma) and hue angle (hue) were determined with a Hunter Lab® colorimeter, which will indicate the L *, a * and b * values. The color changes were determined by calculating the b * / a * ratio, to obtain the hue angle ($\arctan b^* / a^*$) and saturation index $[(a^{*2} + b^{*2})^{1/2}]$ (McGuire, 1992).

Dry matter content: The dry matter content of the pulp was determined and expressed as a percentage of dry matter.

$$\left\{ \frac{\text{Final Slice Net Dry Weight (g)}}{\text{Initial Fresh Net Dry Weight of the Slice (g)}} \times 100 \right\}$$

Weight loss: The fruits were weighed on a digital scale and the initial weight was compared on each evaluation date and the percentage of fruit weight loss was calculated.

$$\left\{ \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100 \right\}$$

Incidence of diseases and physical damage to the fruit: A diagrammatic and visual logarithmic scale was used, with which the ranges of incidence and physical damage to the fruits were determined.

2.5. Design of the experiment

A completely randomized univariate design was used with five replications per treatment (one fruit was the experimental unit), having total soluble solids response variables, color, firmness, dry matter content, weight loss, incidence and severity, and physical damage. in fruit. An analysis of variance (ANOVA) and comparison of means (Tukey; $p \leq 0.05$) were performed using SAS (SAS Institute, Inc., 2010).

3. RESULTS

POSTHARVEST QUALITY OF "ATAULFO" MANGO

Total soluble solids (° Brix): The control fruits (control) showed a content of total soluble solids between 17 and 18 ° Brix. Compared with the control, all the treatments of the formulations (F1, F2, F3, F4 and F5) and the treatments with Azoxystrobin, showed similar TSS contents in each of the concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and immersion times (1, 5 and 10 min), therefore, no treatment effects were observed on the TSS content (Figures 1-5).

Color (Hue): The control fruits showed hue values of 75 to 80, whose values indicate yellow tones; values close to 90 indicate more yellow tones. At the concentration of 2000 ppm, all treatments including chemical fungicides showed hue values similar to the control. In the remaining concentrations (3000, 4000, 5000 and 10000 ppm) it was observed that all the treatments were in the range of hue values of the control fruits. It was not found that the immersion time of the treatments altered the color or that the values went out of the range of the control fruits in a significant way (Figures 6-10).

Firmness: The firmness in the control fruits was in the range of 8 to 14 N. At 2000 ppm the treatments presented firmness similar to the control. The fruits of formulations F1 and F3, obtained slightly lower firmness than the control (between 6 and 7 N) in 1 and 5 min of immersion. At 3000 ppm, formulation F1 at 1 and 5 min immersion, and formulation F3 at 5 min immersion, registered slightly lower firmness than the control (6 and 7 N). In the rest of the concentrations (4000, 5000 and 10000) and immersion times, the firmness values of the treatments, including chemical fungicides, were similar to the firmness of the control fruits (Figures 11-15). The results obtained indicate that there were no significant effects on the increase or decrease of the firmness of the fruits between treatments.

Weight loss: The control fruits showed weight losses of between 6 and 8%. On the other hand, the weight loss between treatments was similar in the five concentrations and the three immersion times. Compared with the control, the percentage of weight loss of the formulations at 2000 ppm was between 7 and 9, in 3000 ppm (7-9), 4000 ppm (7-9), 5000 ppm (7-9) and 10000 ppm (7-9) (Figures 16-20). In this variable, the fruits treated with biopesticides registered slightly higher values than the control fruits in some immersion times of the concentrations tested.

Dry matter content: The dry matter content of the control fruits was between 36 and 46%. The rest of the treatments, including chemical fungicides and biopesticide formulations, obtained similar values in the dry matter content compared to the control fruits, in the five concentrations and the three immersion times (Figures 21-25).

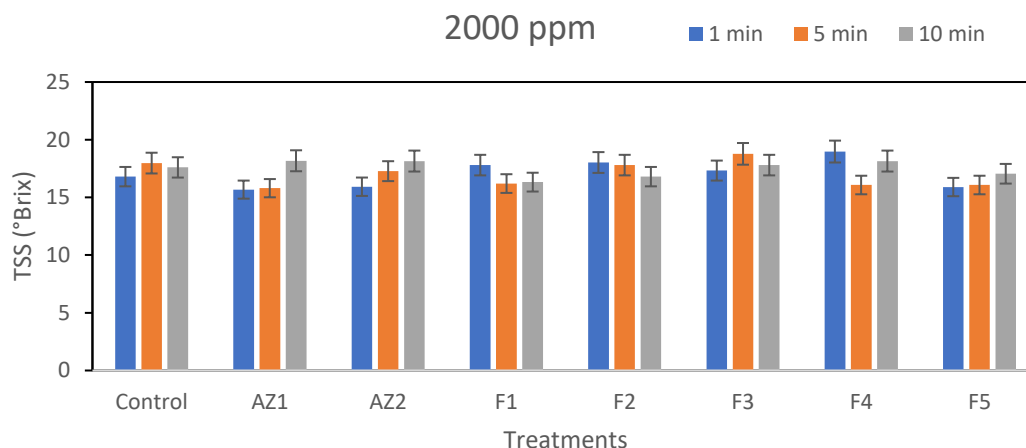


Figure 1. Total Soluble Solids (° Brix) in “Ataulfo” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

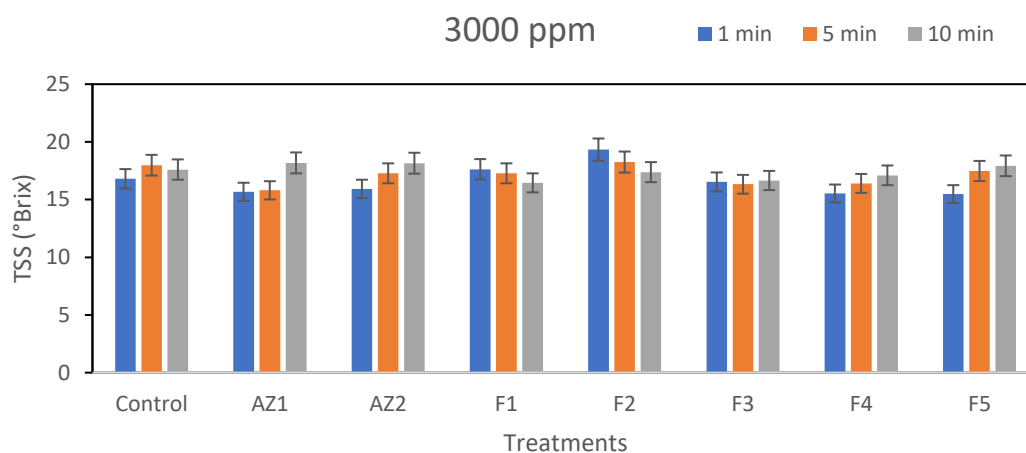


Figure 2. Total Soluble Solids (° Brix) in “Ataulfo” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

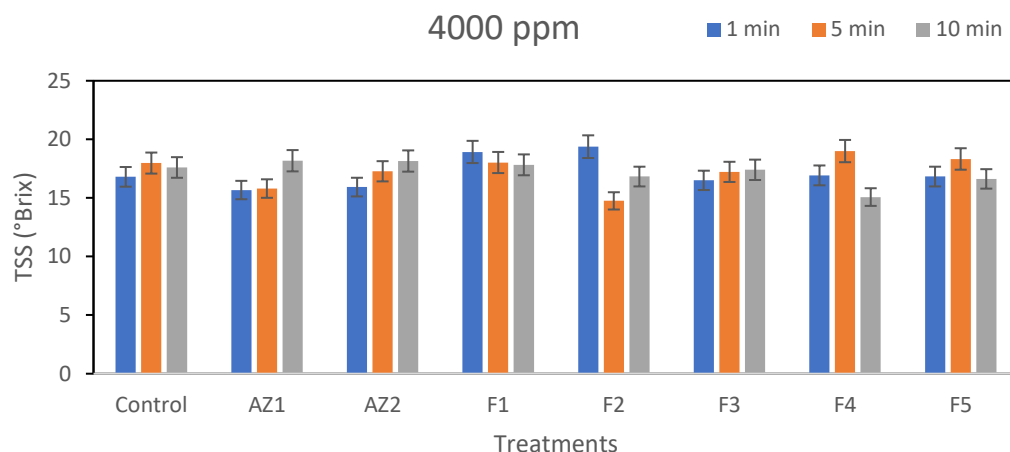


Figure 3. Total Soluble Solids (° Brix) in “Ataulfo” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

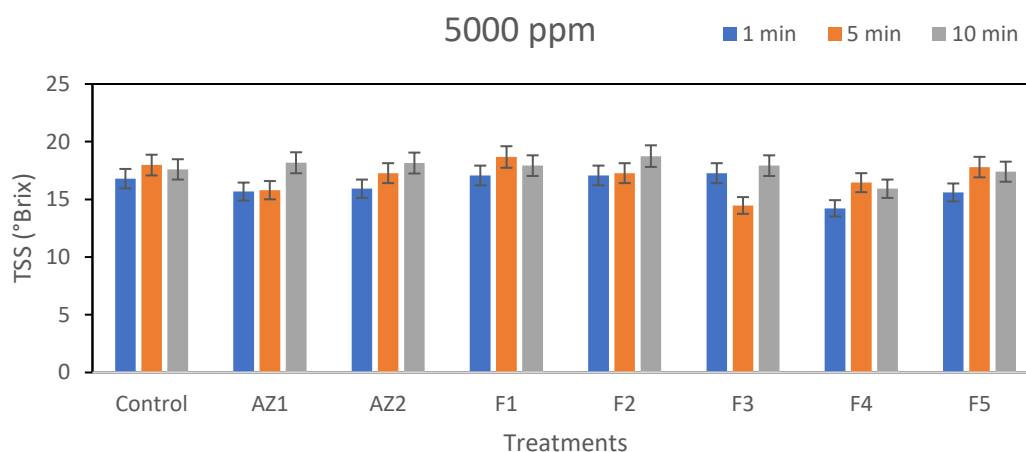


Figure 4. Total Soluble Solids (° Brix) in “Ataulfo” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

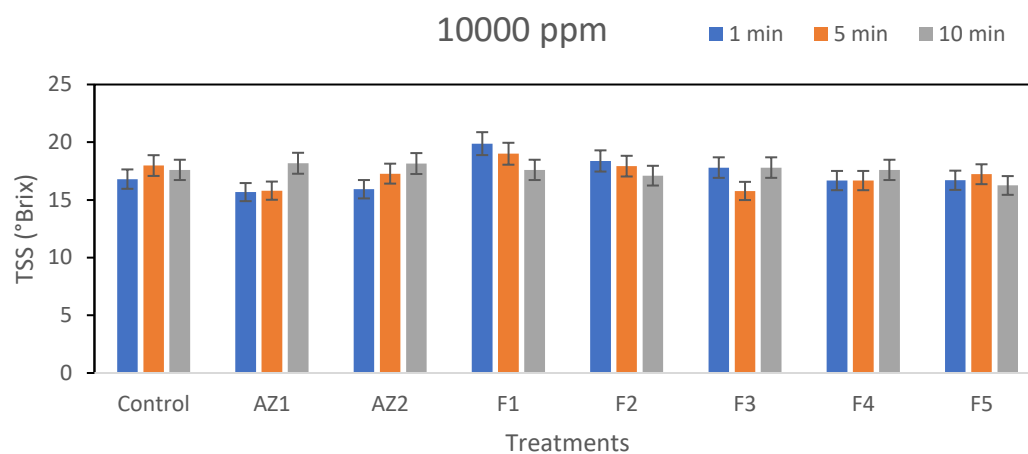


Figure 5. Total Soluble Solids (° Brix) in “Ataulfo” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

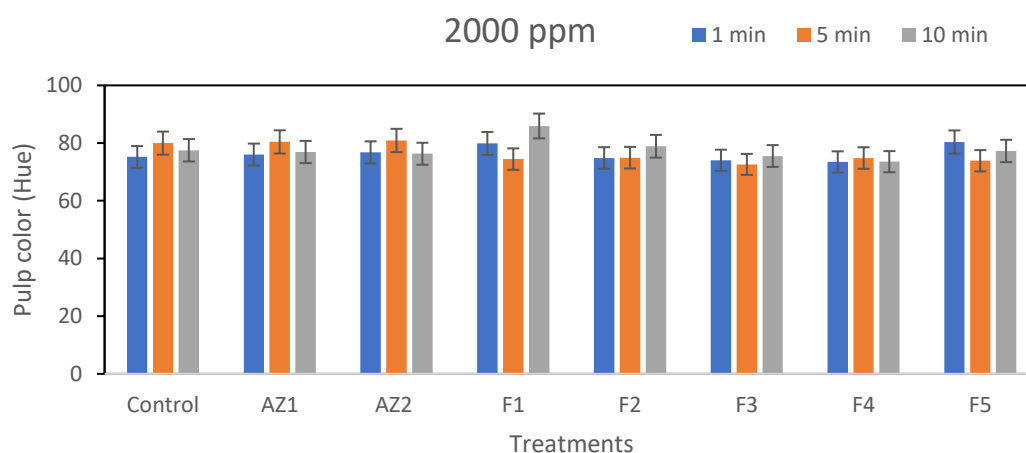


Figure 6. Color (Hue) in “Ataulfo” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

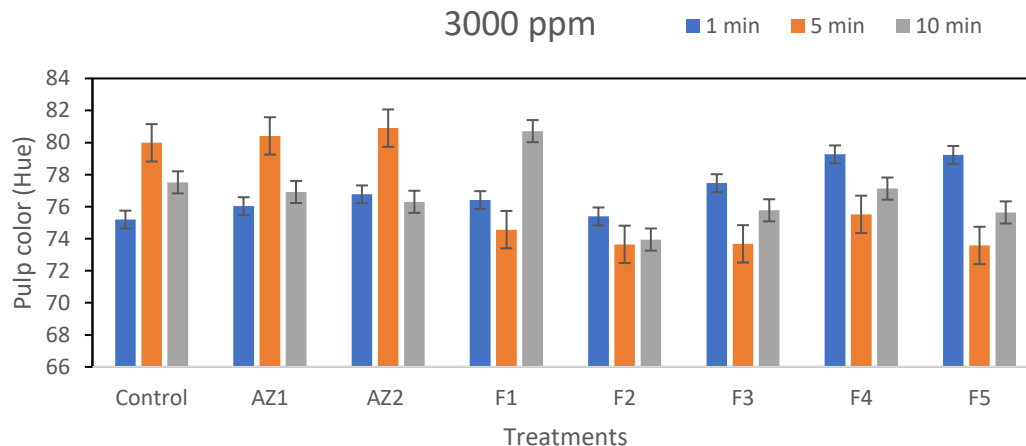


Figure 7. Color (Hue) in “Ataulfo” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

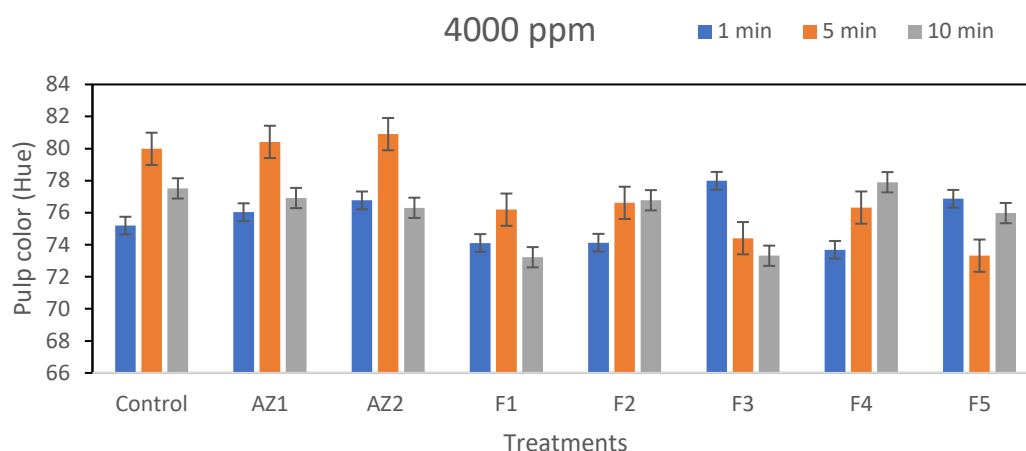


Figure 8. Color (Hue) in “Ataulfo” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

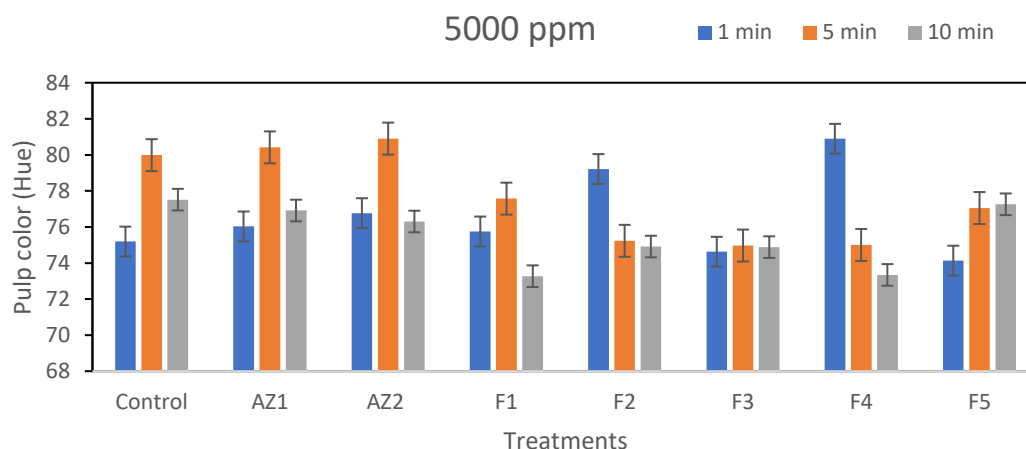


Figure 9. Color (Hue) in “Ataulfo” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

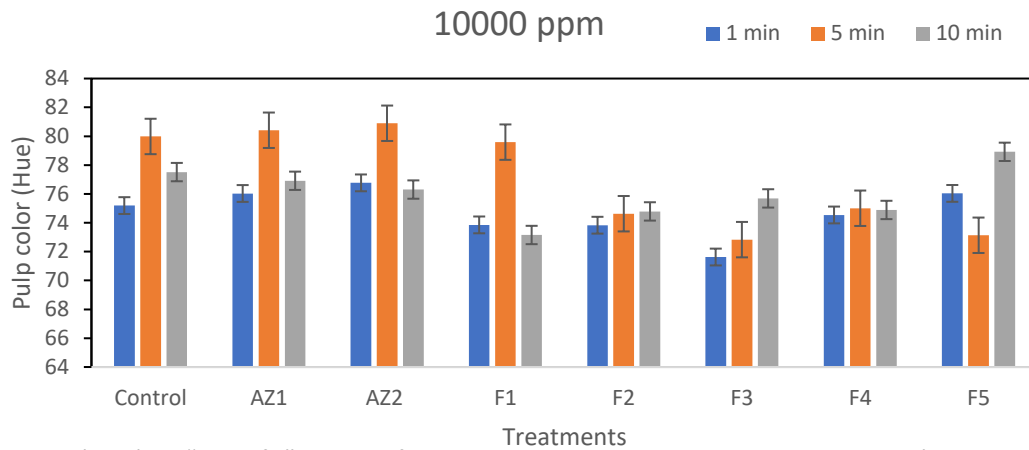


Figure 10. Color (Hue) in “Ataulfo” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

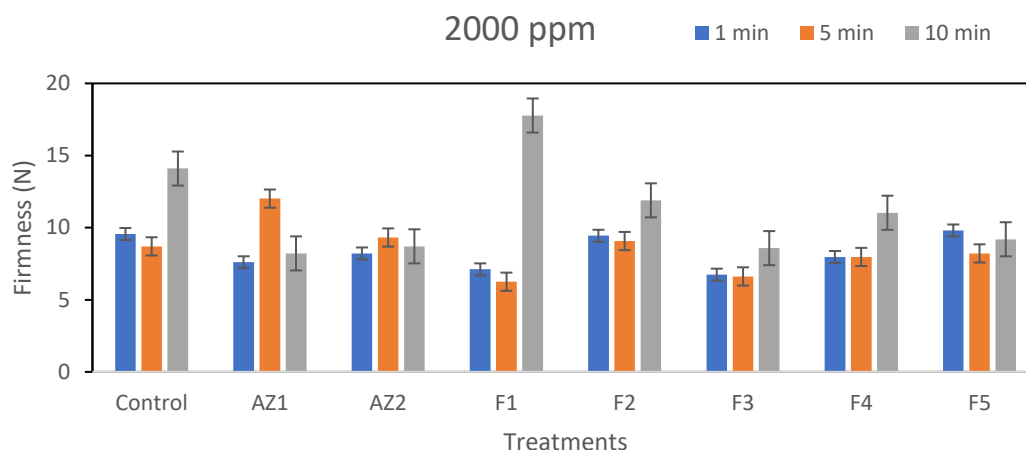


Figure 11. Firmness (N) in postharvest “Ataulfo” mango fruits at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

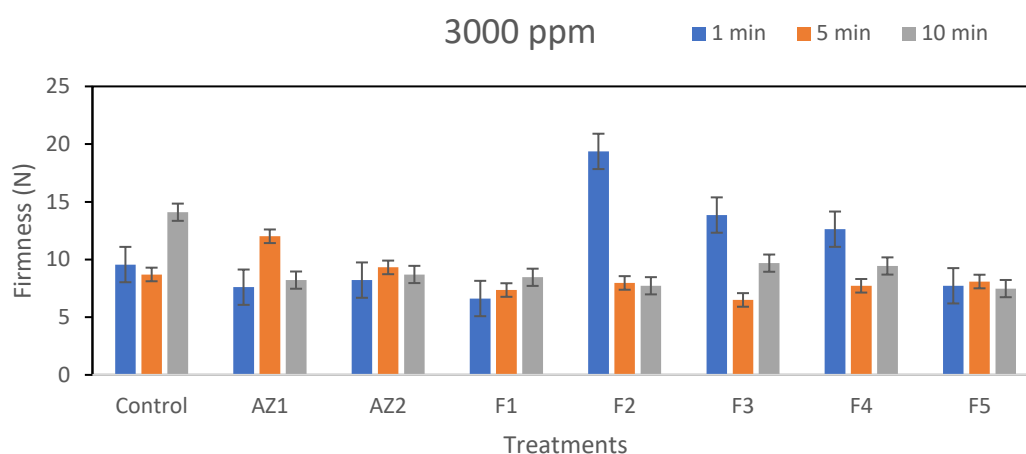


Figure 12. Firmness (N) in postharvest “Ataulfo” mango fruits at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

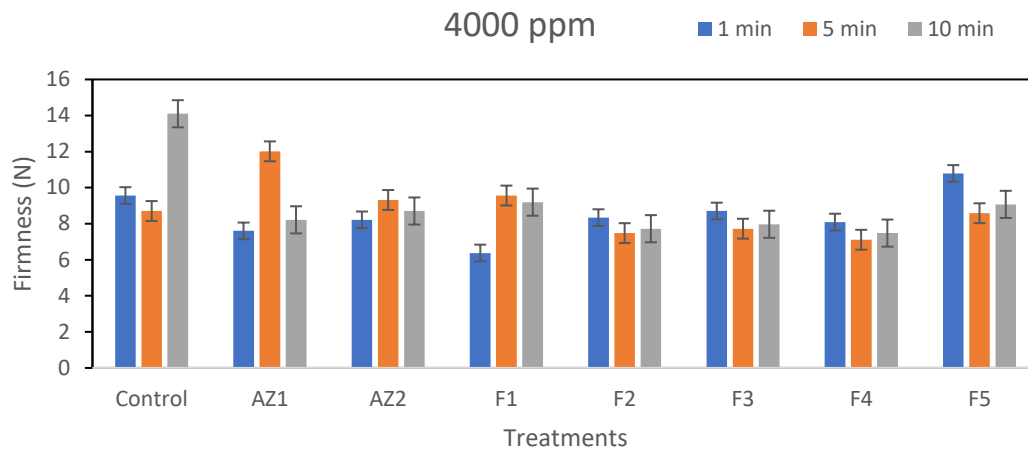


Figure 13. Firmness (N) in postharvest “Ataulfo” mango fruits at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

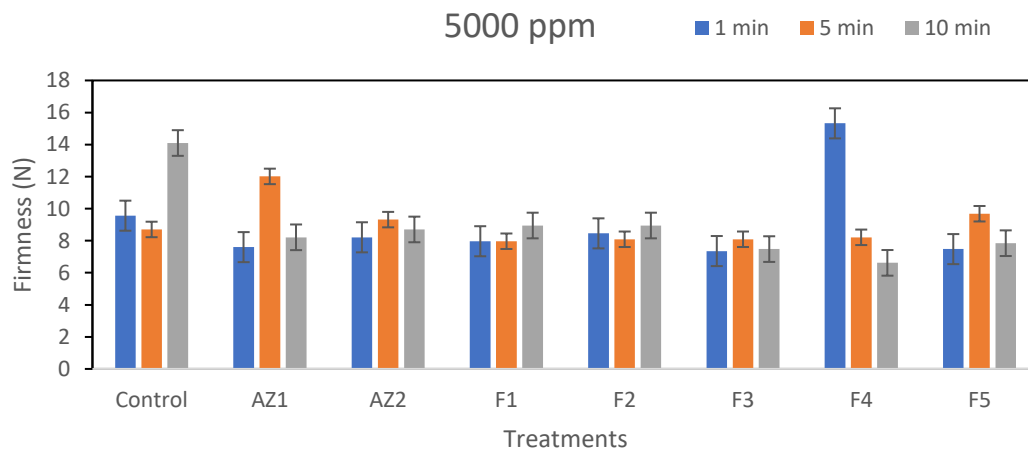


Figure 14. Firmness (N) in postharvest “Ataulfo” mango fruits at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

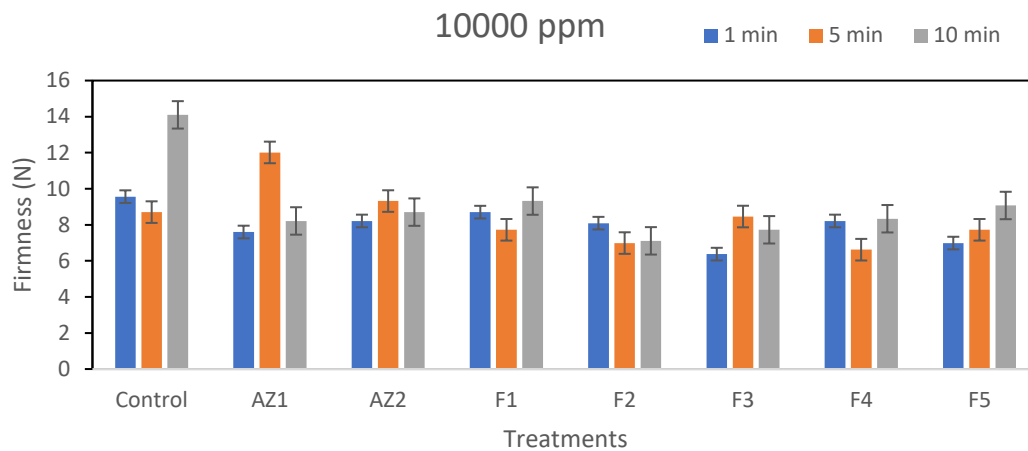


Figure 15. Firmness (N) in postharvest “Ataulfo” mango fruits at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

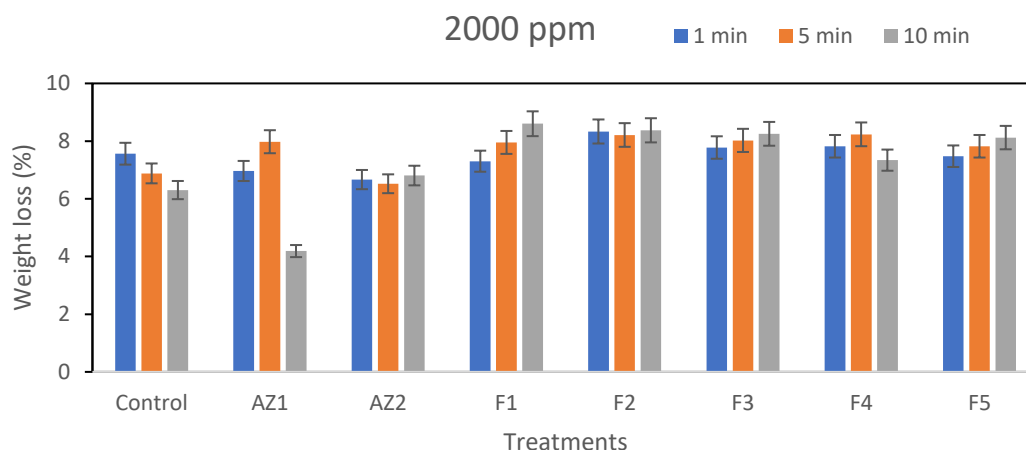


Figure 16. Weight loss in "Ataulfo" mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

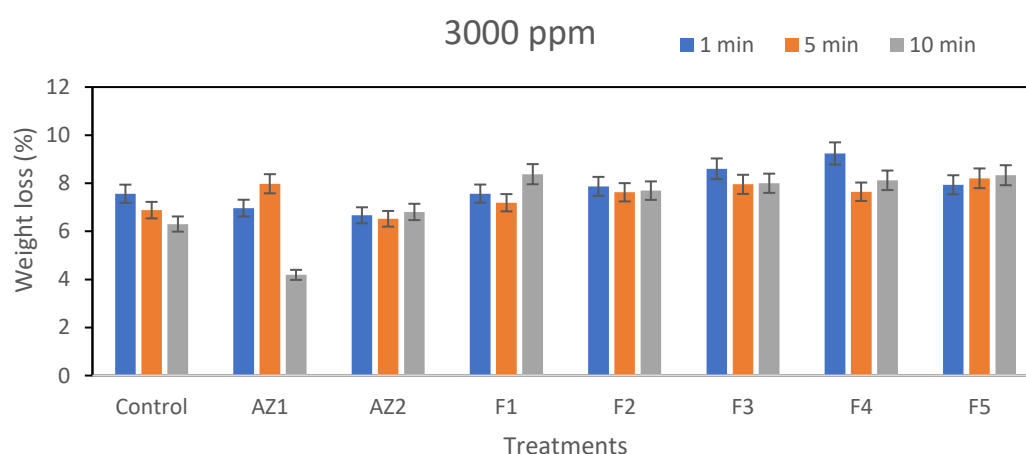


Figure 17. Weight loss in "Ataulfo" mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

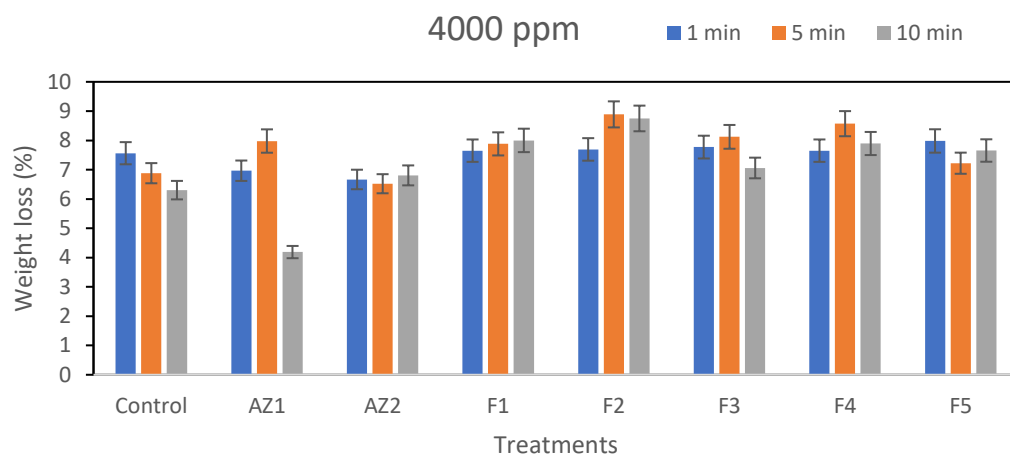


Figure 18. Weight loss in "Ataulfo" mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

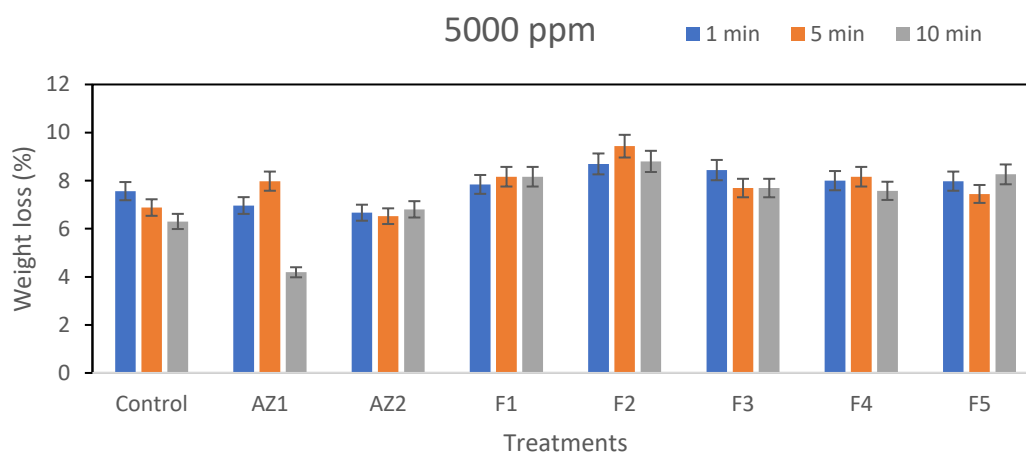


Figure 19. Weight loss in "Ataulfo" mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

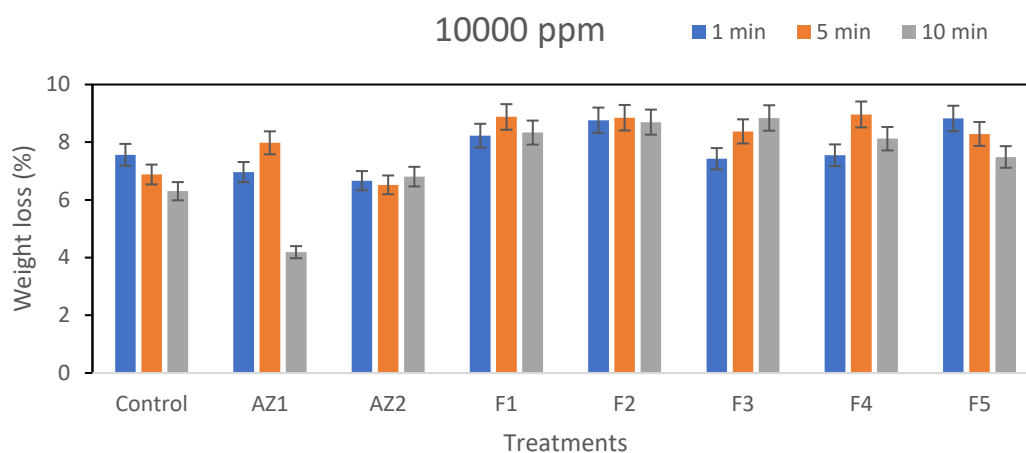


Figure 20. Weight loss in "Ataulfo" mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

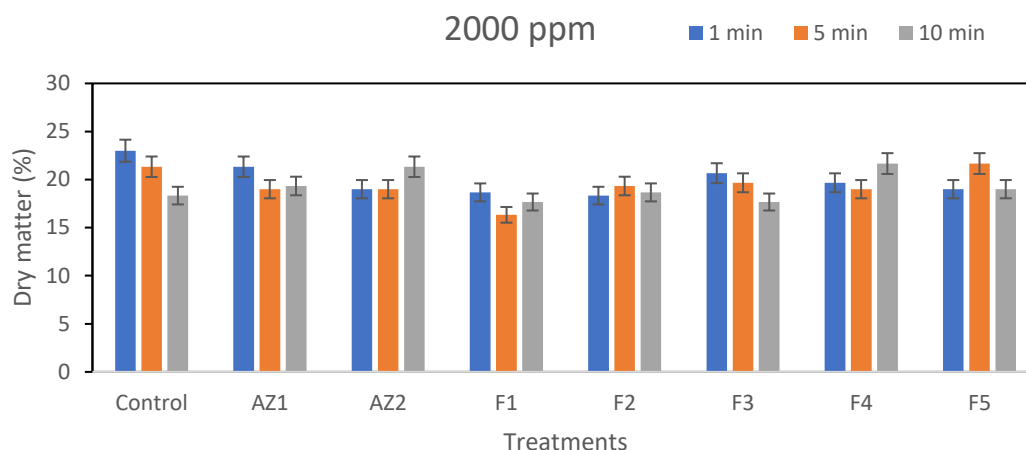


Figure 21. Dry matter in “Ataulfo” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

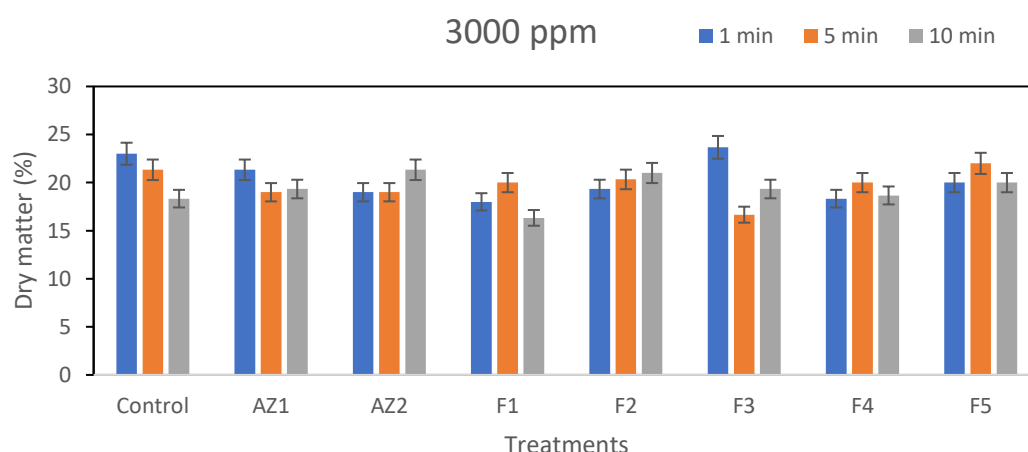


Figure 22. Dry matter in “Ataulfo” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

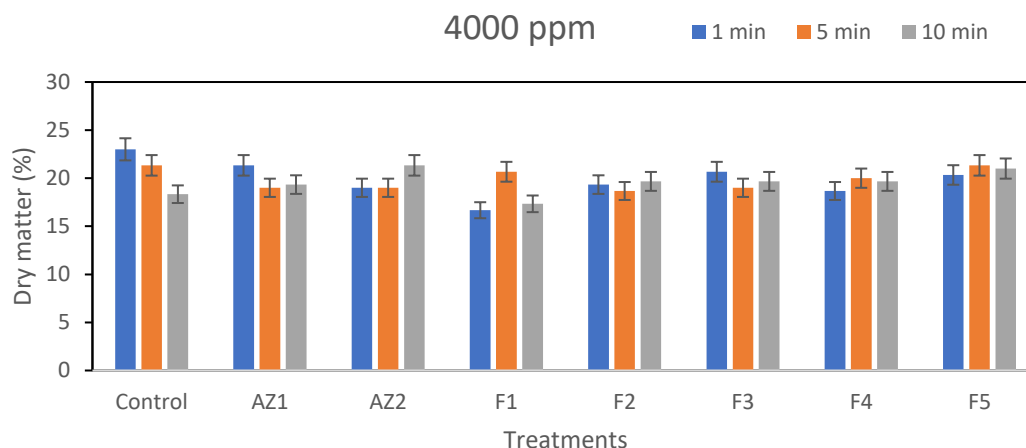


Figure 23. Dry matter in “Ataulfo” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

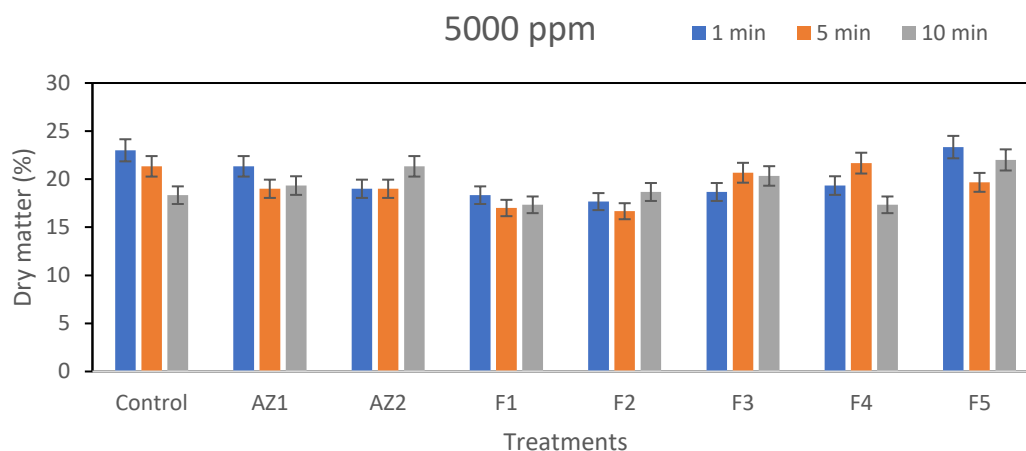


Figure 24. Dry matter in “Ataulfo” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

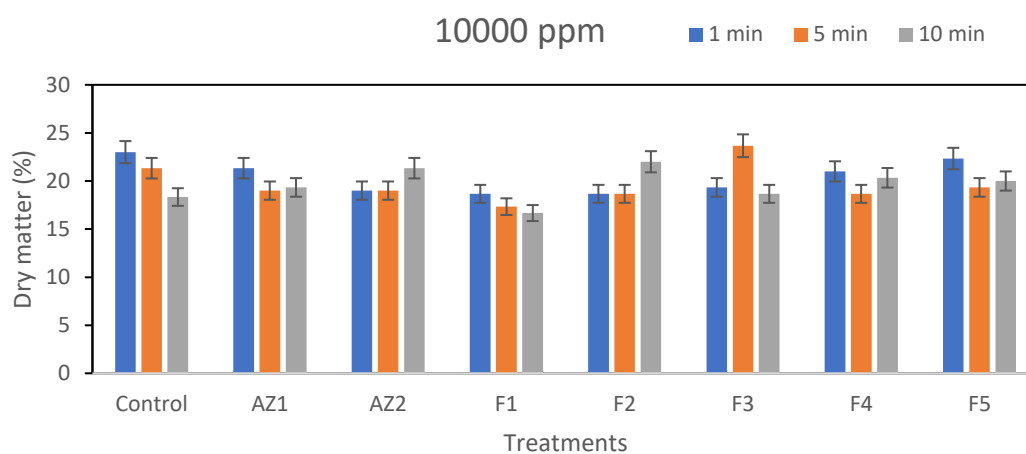


Figure 25. Dry matter in “Ataulfo” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

POSTHARVEST QUALITY OF “TOMMY ATKINS” MANGO

Total soluble solids (° Brix): The control fruits (control) showed a content of total soluble solids between 15.4 and 16.4 ° Brix. Compared with the control, all the treatments of the formulations (F1, F2, F3, F4 and F5) and the treatments with Azoxystrobin, showed similar TSS contents in each of the concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and immersion times (1, 5 and 10 min), so that no treatment effects were observed on the TSS content (Figures 26-30).

Color (Hue): The control fruits showed hue values of 79 to 82, whose values indicate yellow tones; values close to 90 indicate more yellow tones. At all concentrations (2000, 3000, 4000, 5000 and 10000 ppm) it was observed that all treatments were in the range of hue values of the control fruits. Only in the concentration of 3000 ppm at 5 min of immersion, the F2 formulation registered a hue value of 84. It was not found that the immersion time of the treatments altered the color or that the values were outside the range of the control fruits of significantly (Figures 31-35).

Firmness: The firmness in the control fruits was in the range of 18 to 27 N. The fruits of the fungicides obtained mostly lower firmness than the control, AZ1 (13-22 N) and AZ2 (15-31 N). At 2000 ppm the treatments F5 (10 min), AZ2 (1 min) and F4 (5 min) showed the highest firmness with 40, 32 and 29 N respectively. Formulations F1 and F3 (1 and 10 min), as well as F2 and F4 (1 min) presented the lowest firmness with values between 6 and 10 N. At 3000 ppm the formulation F3 (5 min), F5 and F4 (10 min), and F2 (1 min) presented the lowest firmness in a range of 8.5 to 13 N. The highest firmness, including the control, was presented by F1 at 5 min (43 N) and F3 at 10 min (42 N). At 4000 ppm the formulations F4 and F2 (1 and 10 min), F1 (1 and 5 min) and F3 (10 min) had the least firmness in a range of 6 to 11 N. The greatest firmness was presented by F1 at 10 min (39 N) and F5 at 5 min (32 N). Regarding 5000 ppm, formulations F4 (1 and 5 min), F1 (1 and 10 min), F5 (10 min), and F3 and F2 (1 min) showed the least firmness with 7-12 N. The highest firmness was obtained by treatments F3 (1 and 5 min), F4 (10 min) and F5 (1 min) with 48, 40, 38 and 36 N respectively. Finally, at 10,000 ppm, formulations F5 and F4 (5 min), F2 (1, 5 and 10 min) and F3 (1 and 5 min) showed the least firmness with 6-12 N. In turn, the F4 treatments (10 min), F1 (10 min) and AZ2 (1 min) obtained the highest firmness (34, 31.7 and 31.5 N) (Figures 36-40). In this variable there were differences between treatments, and it cannot be clearly determined if there was an effect of treatments on the decrease or increase of firmness.

Weight loss: The control fruits showed weight losses of between 5 and 7%. On the other hand, the weight loss between treatments was similar in the five concentrations and the three immersion times. Compared with the control, the percentage of weight loss of the formulations at 2000 ppm was between 5 and 7, in 3000 ppm (5-7), 4000 ppm (5-8), 5000 ppm (5-7) and

10000 ppm (5-7) (Figures 41-45). In this variable, no effect of treatments was observed on weight loss.

Dry matter content: The dry matter content of the control fruits was between 38 and 45%. The rest of the treatments, including chemical fungicides and biopesticide formulations, obtained similar values in the dry matter content compared to the control fruits, in the five concentrations and the three immersion times. Formulation F1 in some of its concentrations and immersion times showed lower percentages of dry matter than the control, and the range of dry matter was between 30 and 41% (Figures 46-50).

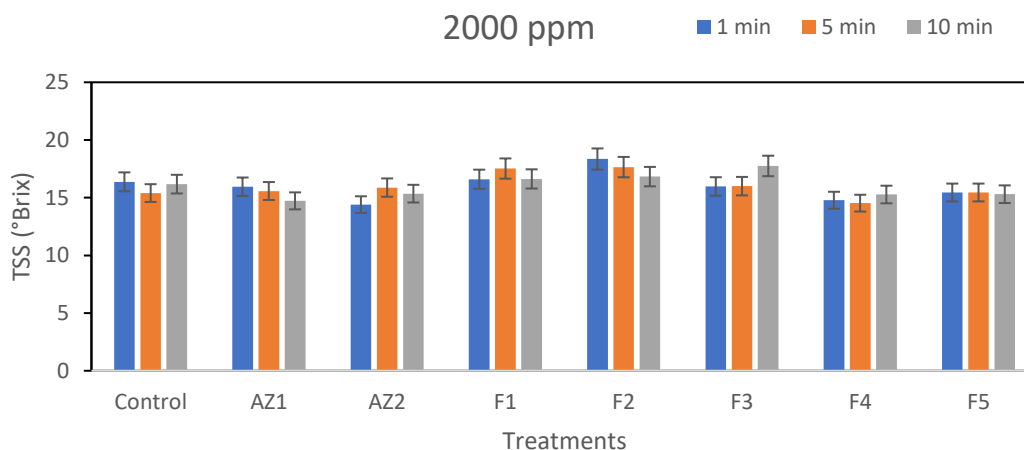


Figure 26. Total Soluble Solids (° Brix) in “Tommy Atkins” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

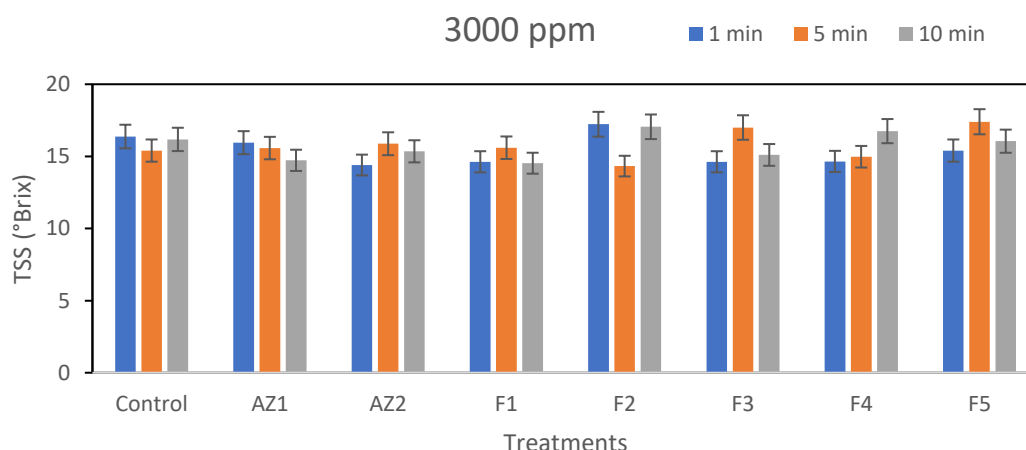


Figure 27. Total Soluble Solids (° Brix) in “Tommy Atkins” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

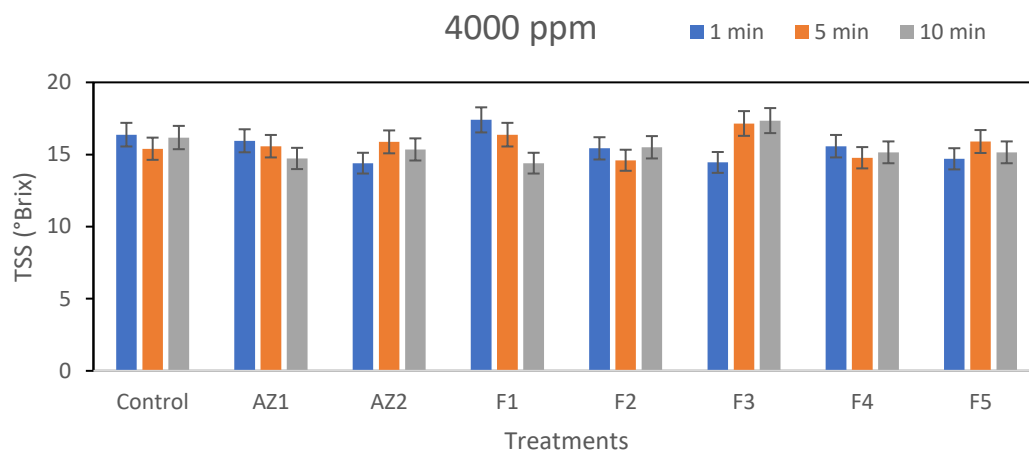


Figure 28. Total Soluble Solids (° Brix) in “Tommy Atkins” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

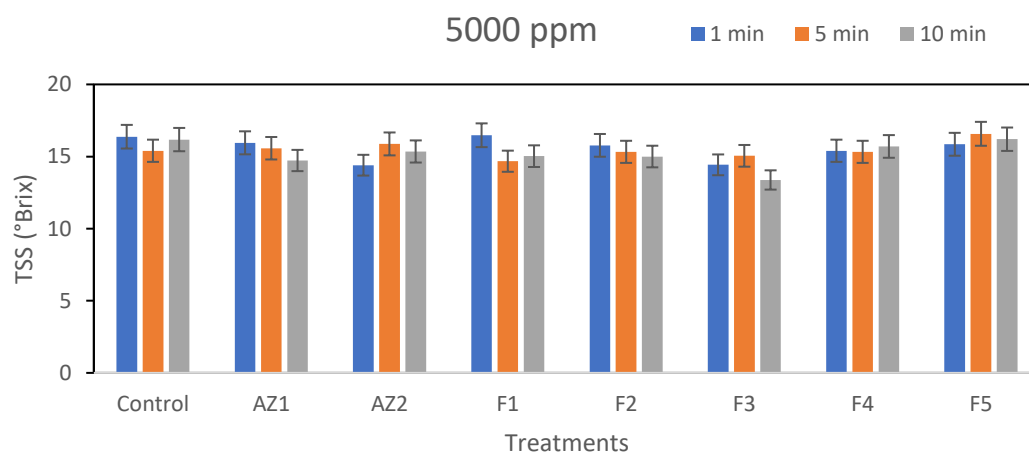


Figure 29. Total Soluble Solids (° Brix) in “Tommy Atkins” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

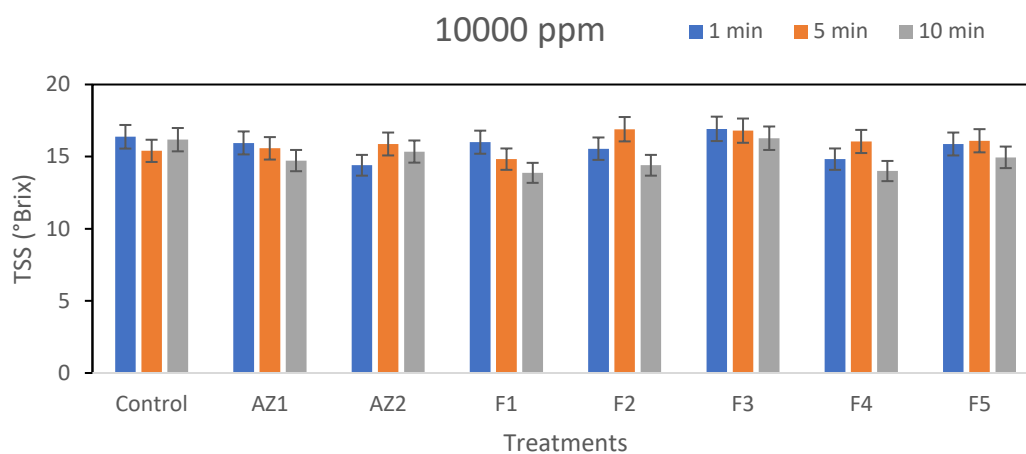


Figure 30. Total Soluble Solids (° Brix) in “Tommy Atkins” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

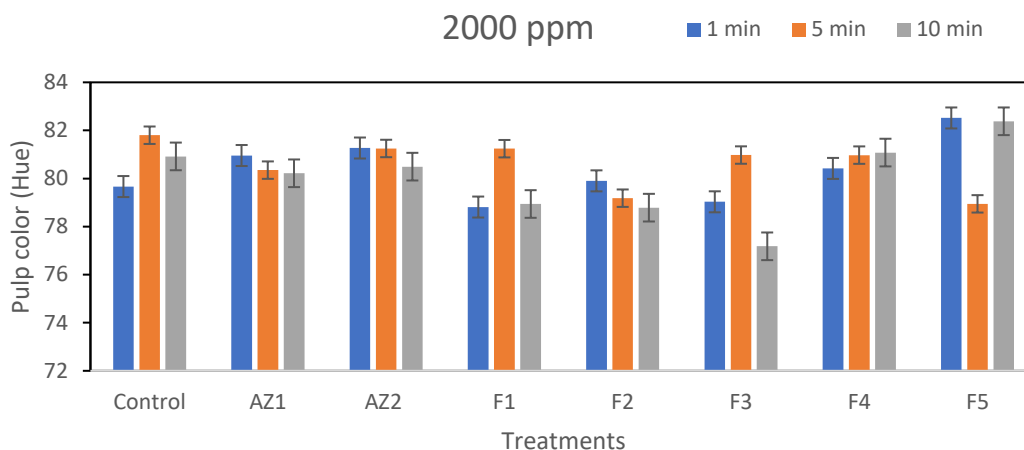


Figure 31. Color (Hue) in “Tommy Atkins” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

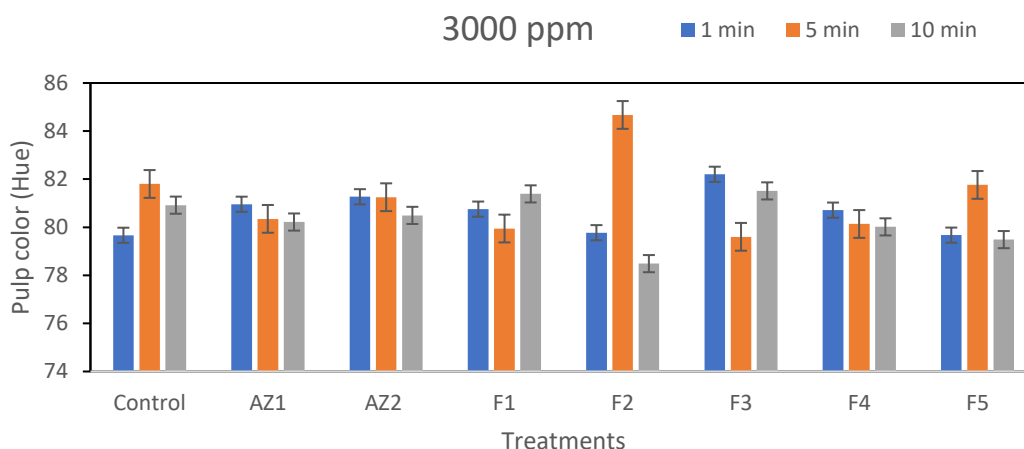


Figure 32. Color (Hue) in “Tommy Atkins” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

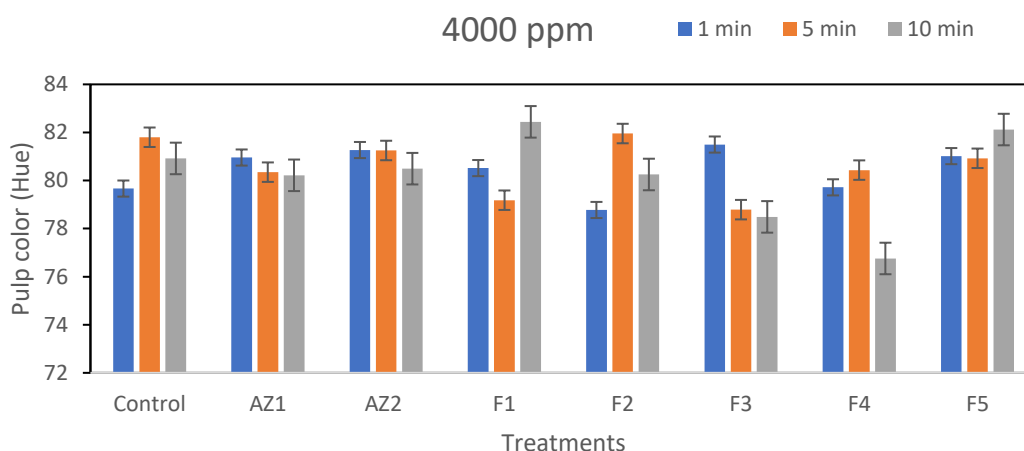


Figure 33. Color (Hue) in “Tommy Atkins” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

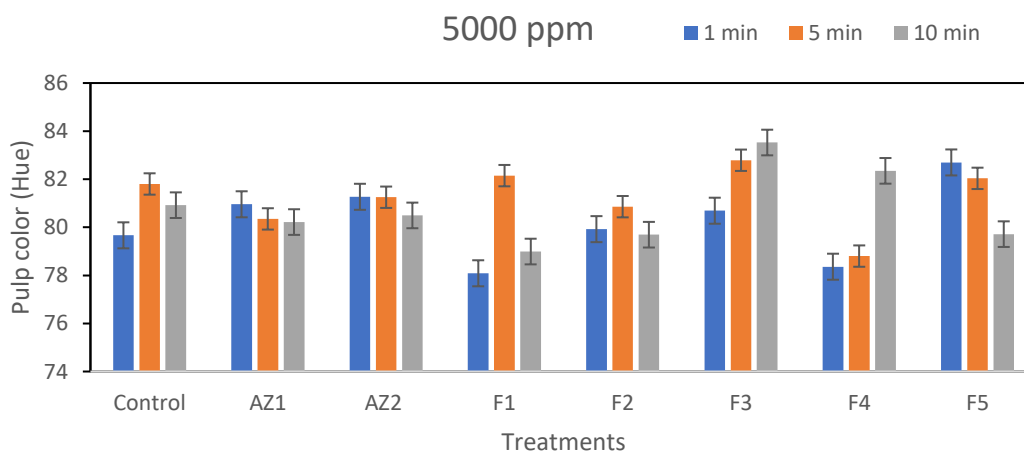


Figure 34. Color (Hue) in “Tommy Atkins” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

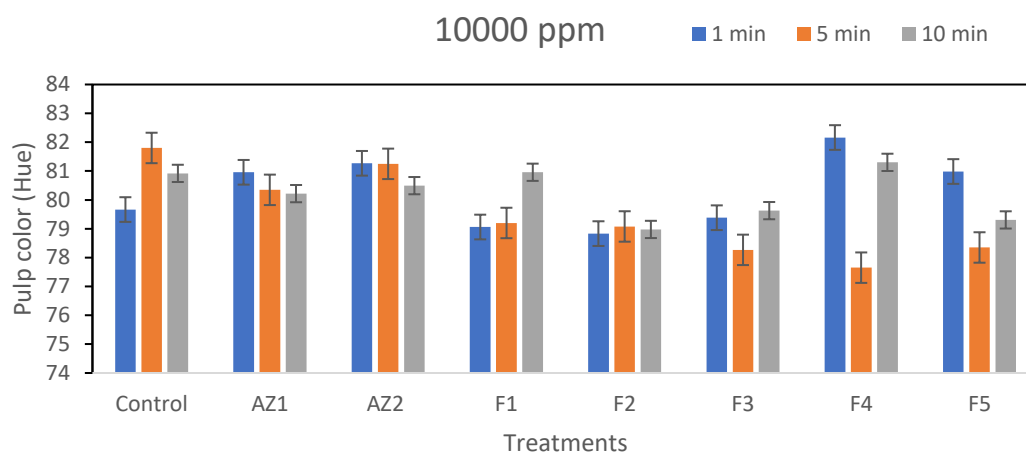


Figure 35. Color (Hue) in “Tommy Atkins” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

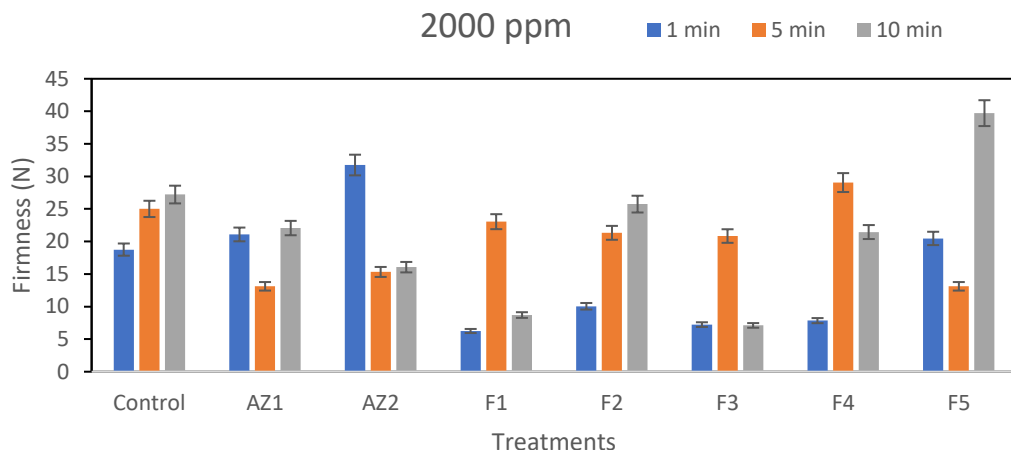


Figure 36. Firmness (N) in postharvest “Tommy Atkins” mango fruits at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

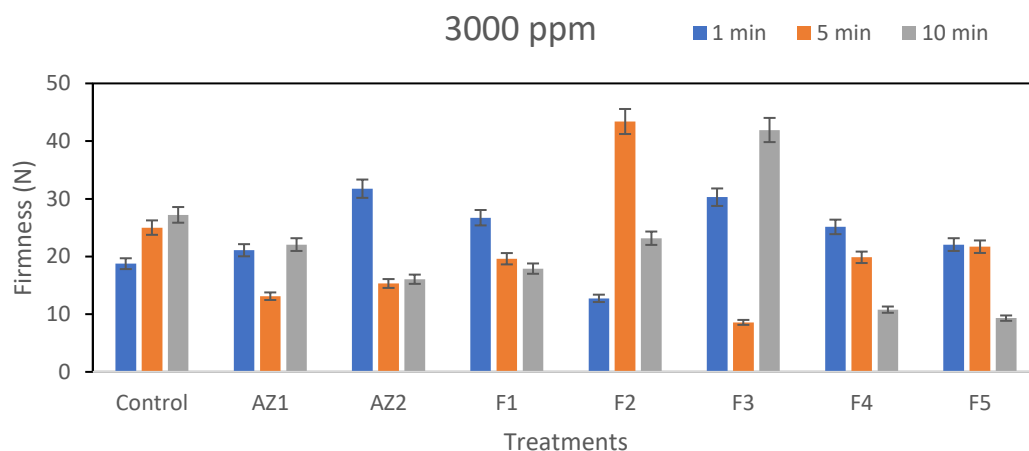


Figure 37. Firmness (N) in postharvest “Tommy Atkins” mango fruits at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

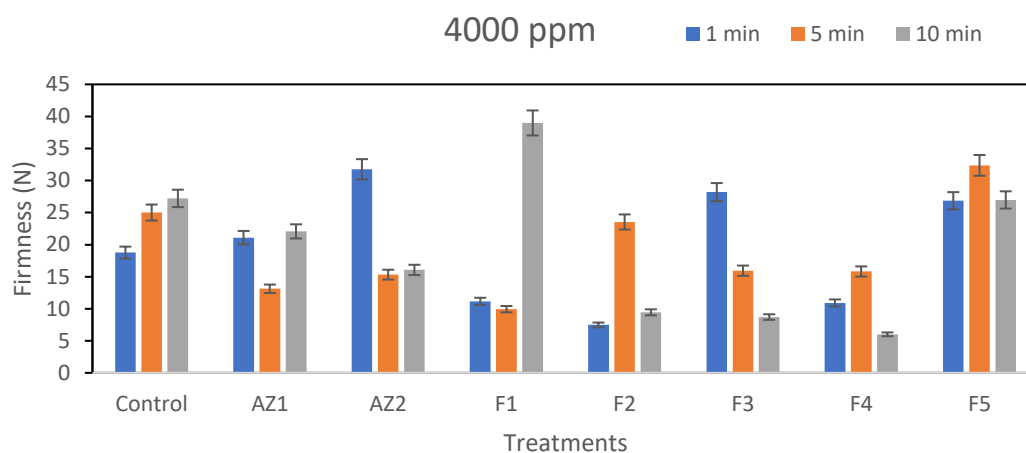


Figure 38. Firmness (N) in postharvest “Tommy Atkins” mango fruits at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

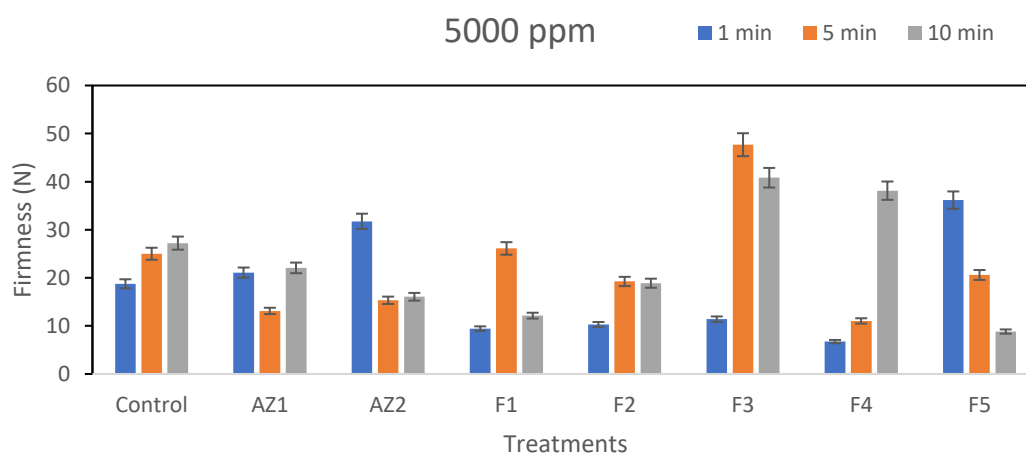


Figure 39. Firmness (N) in postharvest “Tommy Atkins” mango fruits at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

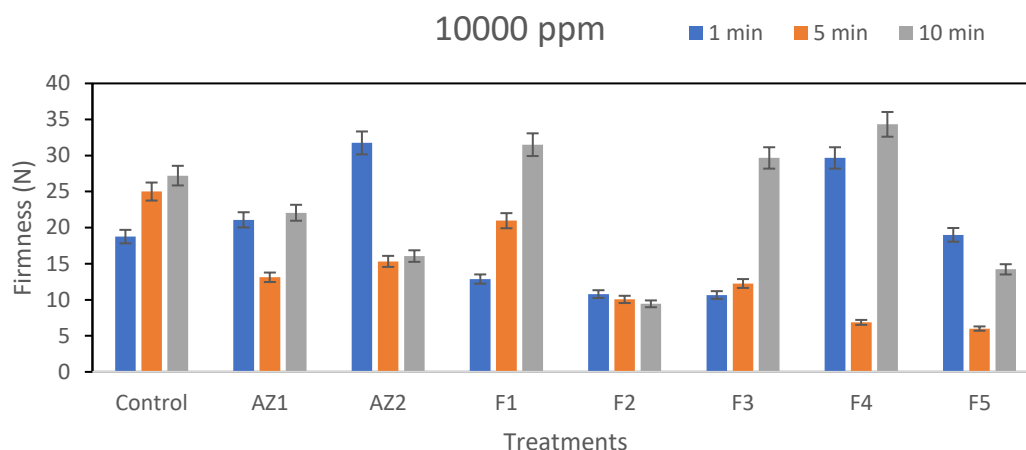


Figure 40. Firmness (N) in postharvest “Tommy Atkins” mango fruits at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

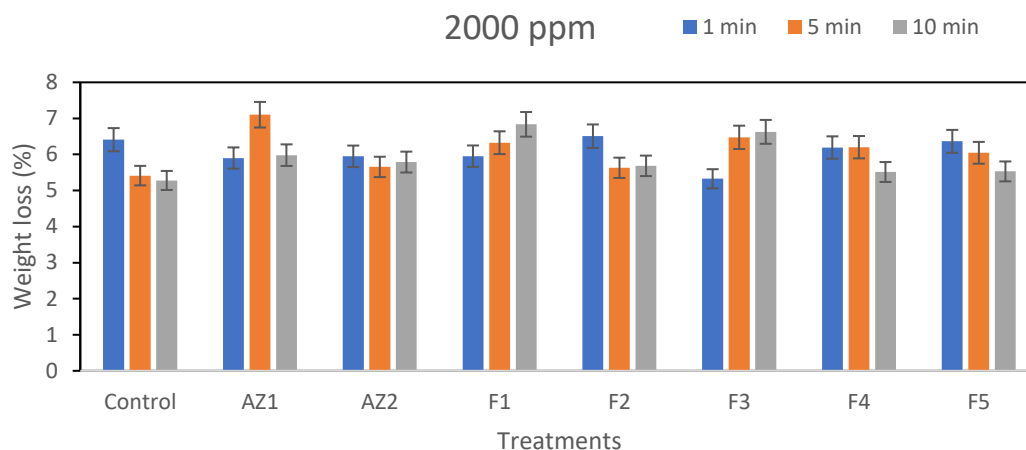


Figure 41. Weight loss in "Tommy Atkins" mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

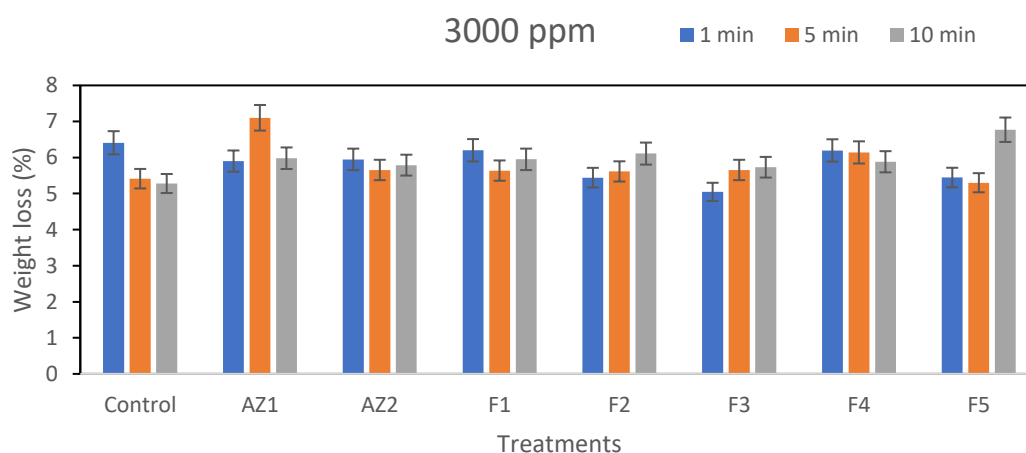


Figure 42. Weight loss in "Tommy Atkins" mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

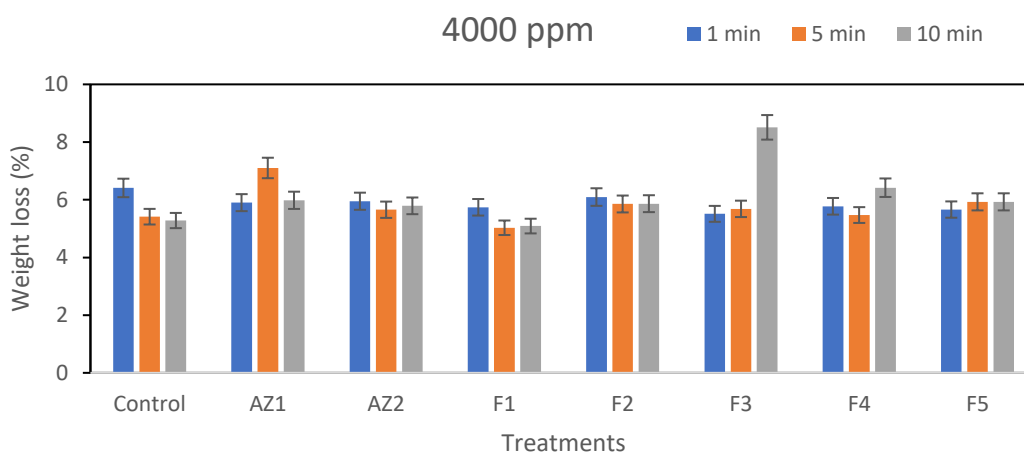


Figure 43. Weight loss in "Tommy Atkins" mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

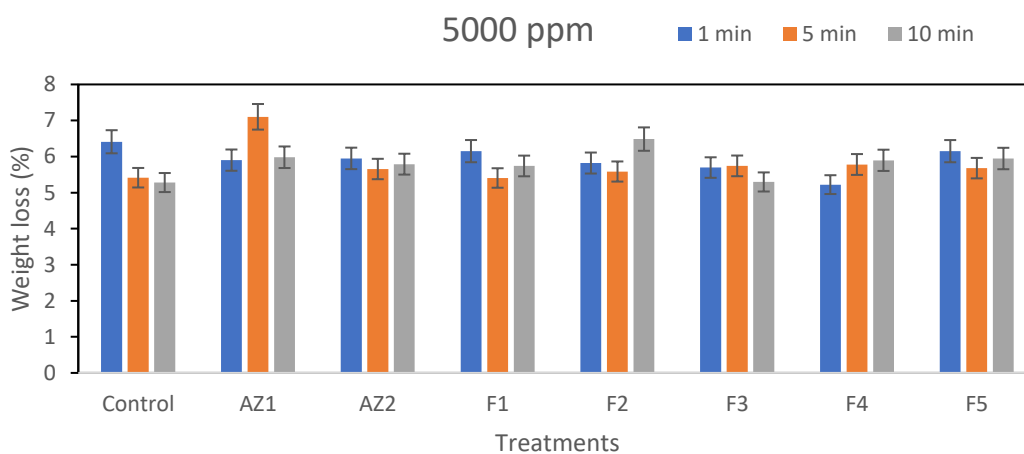


Figure 44. Weight loss in "Tommy Atkins" mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

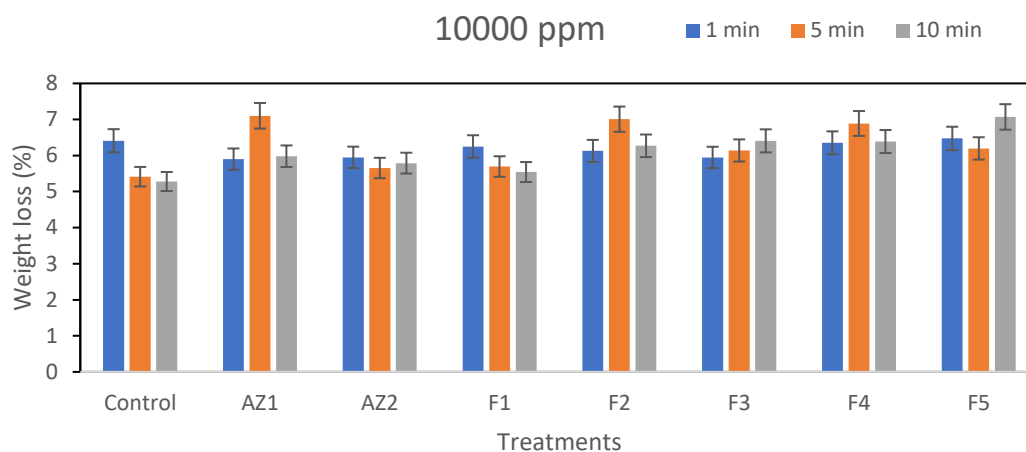


Figure 45. Weight loss in "Tommy Atkins" mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

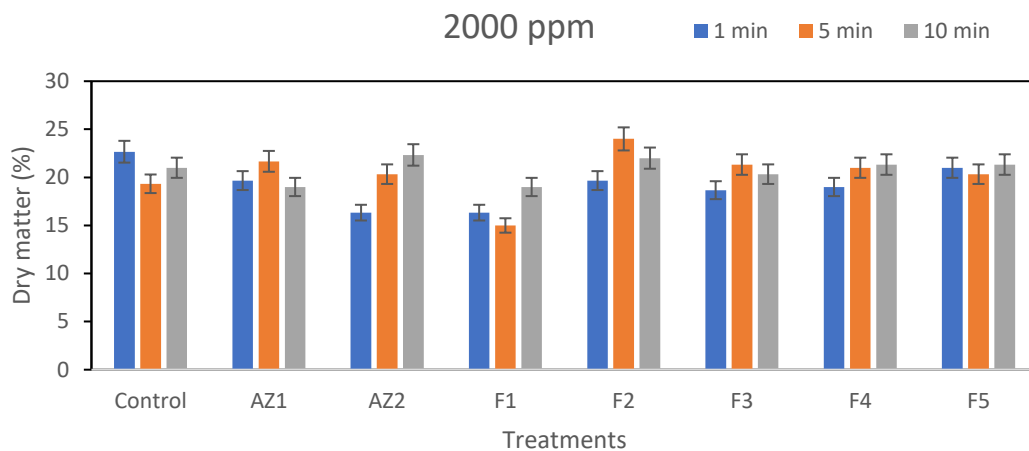


Figure 46. Dry matter in “Tommy Atkins” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

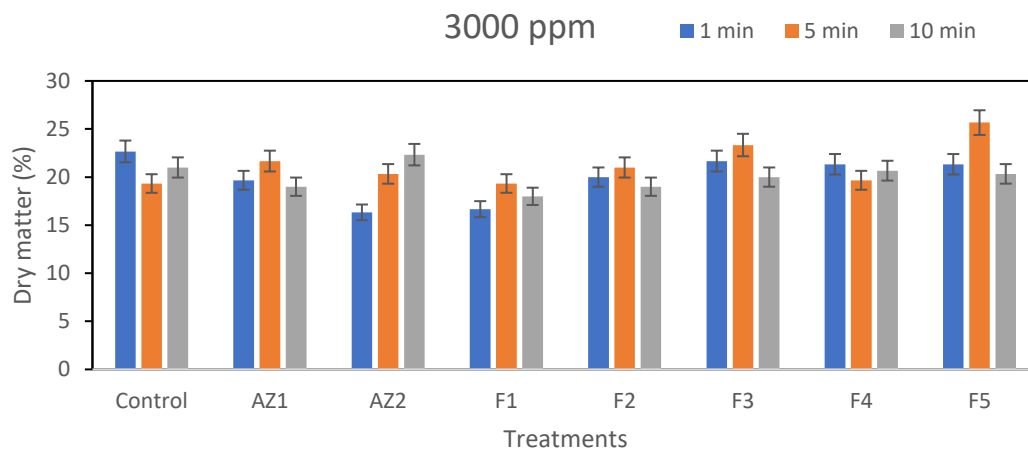


Figure 47. Dry matter in “Tommy Atkins” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

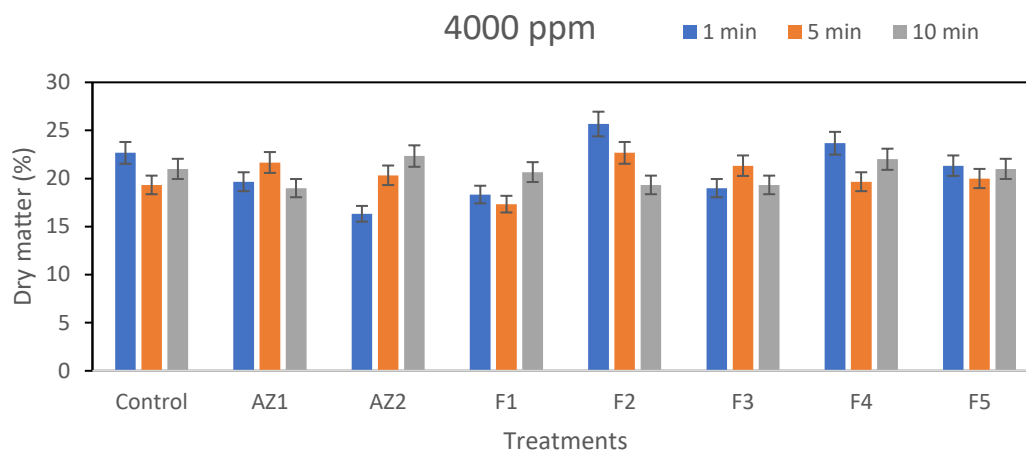


Figure 48. Dry matter in “Tommy Atkins” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

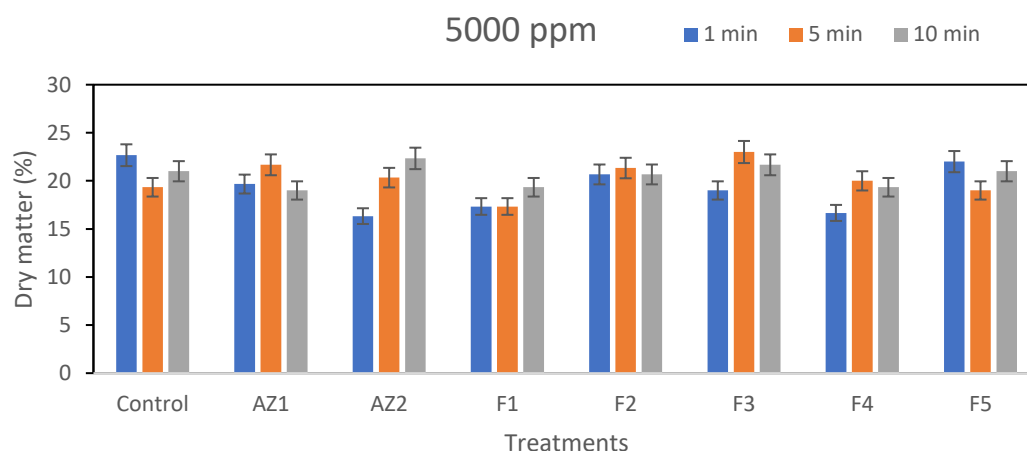


Figure 49. Dry matter in “Tommy Atkins” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

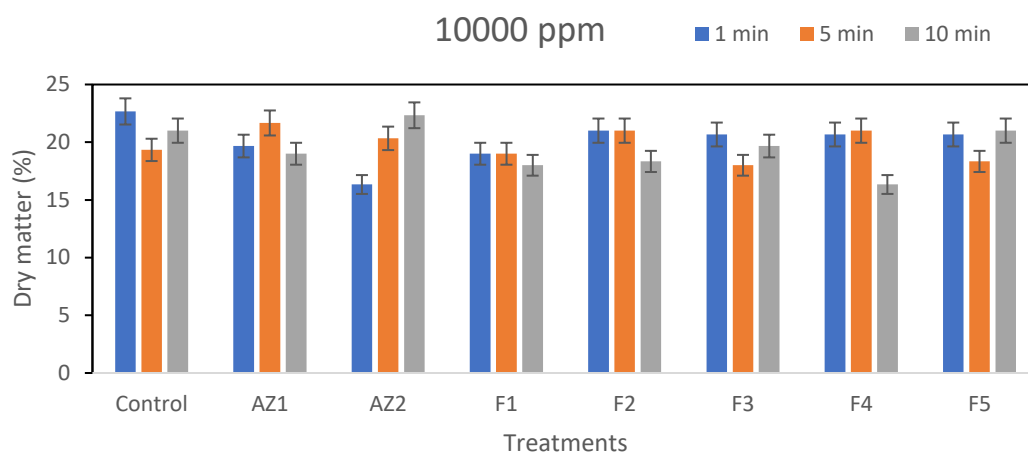


Figure 50. Dry matter in “Tommy Atkins” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

POSTHARVEST QUALITY OF MANGO "KENT"

Total soluble solids (° Brix): The control fruits (control) showed a content of total soluble solids between 17 and 20 ° Brix. Compared with the control, all the treatments of the formulations (F1, F2, F3, F4 and F5) and the treatments with Azoxystrobin, showed similar TSS contents in each of the concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and immersion times (1, 5 and 10 min), so no treatment effects were observed on the TSS content (Figures 51-55).

Color (Hue): The control fruits showed hue values between 77 and 83, which indicate yellow tones; values close to 90 indicate more yellow tones. In most of the concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and immersion times, it was observed that all the treatments were in the range of hue values of the control fruits. The treatment with Azoxystrobin (AZ2) registered the highest value of hue (86), while the formulations F4 at 3000 ppm in 1 min of immersion and F1 at 4000 ppm in 10 min showed the lowest values of hue with 75 (Figures 56 -60). It was not observed that the concentrations and the immersion times of the treatments altered the color or that the values went outside the range of the control fruits in a significant way

Firmness: The firmness in the control fruits was in the range of 17 to 21 N. The fruits of the fungicides AZ1 in 1 and 10 min of immersion registered lower firmness than the control (15 and 9 N), while AZ2 in 5 and 10 min of immersion obtained higher firmness (38 and 28 N). In general, there were variations in firmness between treatments at different concentrations. At 2000 ppm, treatments F1 and F5 at 5 min presented the lowest firmness (10 and 15 N), while F2 at 1 and 10 min obtained the highest with 42 N. At 3000 ppm the formulation F4 (1, 5 and 10 min) presented the lowest firmness in a range of 6 to 14 N. The highest firmness was obtained by F3 in 5 and 10 min (25 and 34 N) and F5 in 1 and 5 min (25 and 32 N). With regard to 4000 ppm, formulations F2 (10 min) and F5 (1 and 5 min), showed the least firmness with 7-10 N. On the other hand, the highest firmness was recorded by treatments F3 in 1 and 10 min (36 and 27 N) and F2 in 1 and 5 min (33 and 28 N). At 5000 ppm the lowest firmness was determined in treatments F5 (1 min), F3 (1 and 10 min) and F4 (5 min) with a range of 9 to 12 N, while the highest firmness was obtained in F4 (1 min), F2 (1 and 5 min), F3 (5 min) and F1 (5 min) with firmness between 24 and 32 N. Finally, at 10,000 ppm, the formulation F4 at 1 min obtained the lowest firmness (7 N), while the largest were determined in F2 and F5 (1 min), F1 (5 min) and F3 (5 min) with a range of 27 to 31 N (Figures 61-65). In the firmness of fruits, the effect of treatments was observed in its decrease or increase.

Weight loss: The control fruits showed weight losses of between 6 and 7%. The weight loss of the chemical fungicides had a percentage between 6 and 7. The weight loss between treatments were similar in the five concentrations and the three immersion times. Compared with the control, the percentage of weight loss of the formulations at 2000 ppm was between 6

and 8, at 3000 ppm (6 and 9), 4000 and 5000 ppm (6 and 8), and 10000 ppm (5 and 8) (Figures 66-70). In this variable, no significant effects of treatments were observed on weight loss.

Dry matter content: The dry matter content of the control fruits was between 19 and 23%. The rest of the treatments, including chemical fungicides and biopesticide formulations, obtained similar values in the dry matter content compared to the control fruits, in the five concentrations and the three immersion times. Formulation F1 in some of its concentrations and immersion times showed lower percentages of dry matter than the control, and the range of dry matter was between 30 and 41% (Figures 71-75).

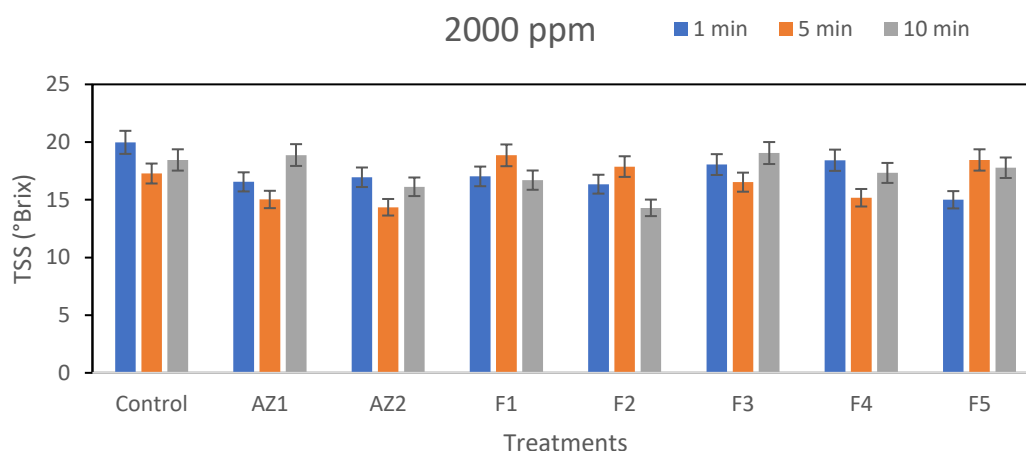


Figure 51. Total Soluble Solids (° Brix) in “Kent” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

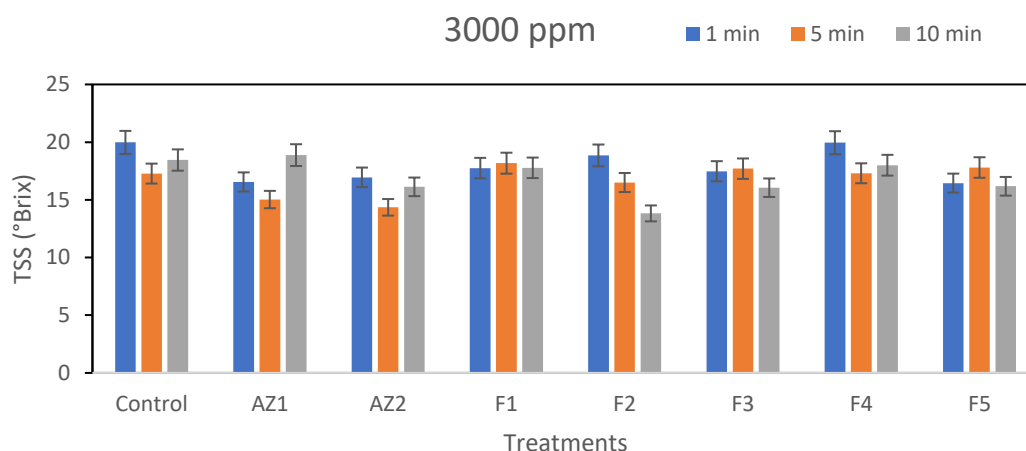


Figure 52. Total Soluble Solids (° Brix) in “Kent” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

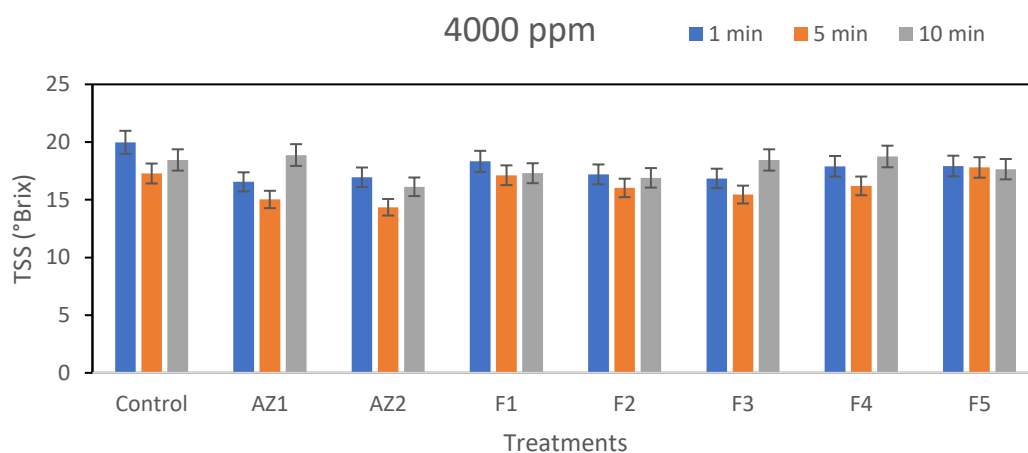


Figure 53. Total Soluble Solids (° Brix) in “Kent” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

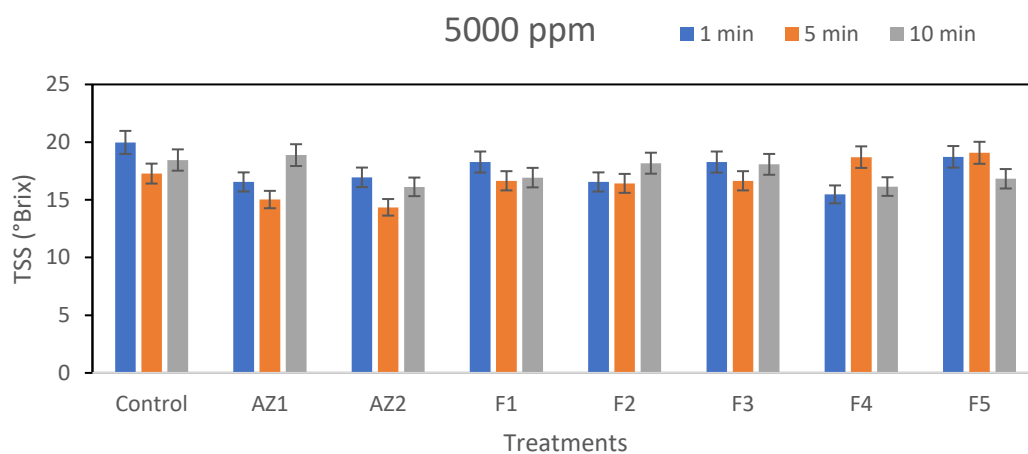


Figure 54. Total Soluble Solids (° Brix) in “Kent” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

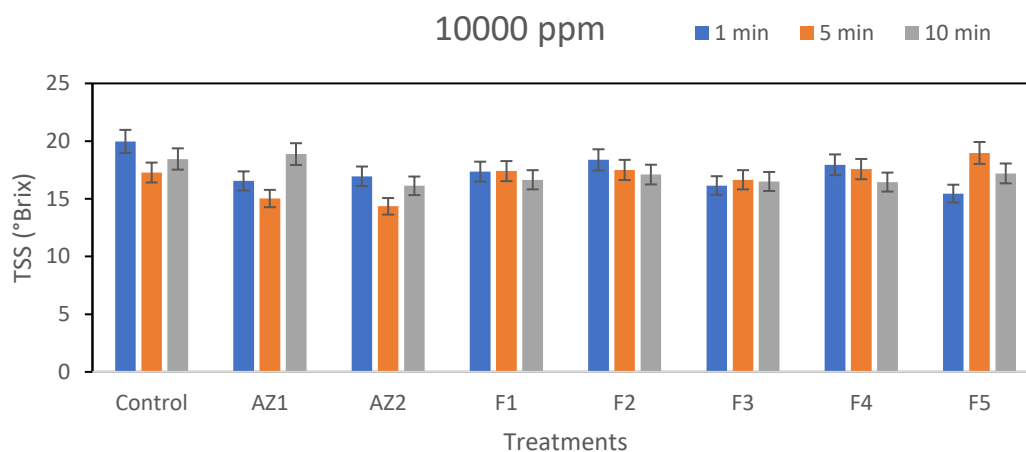


Figure 55. Total Soluble Solids (° Brix) in “Kent” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

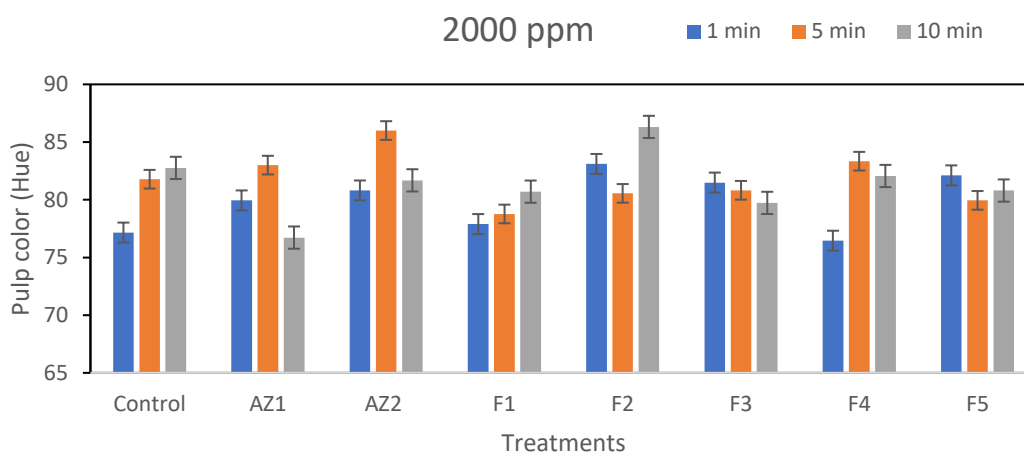


Figure 56. Color (Hue) in “Kent” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

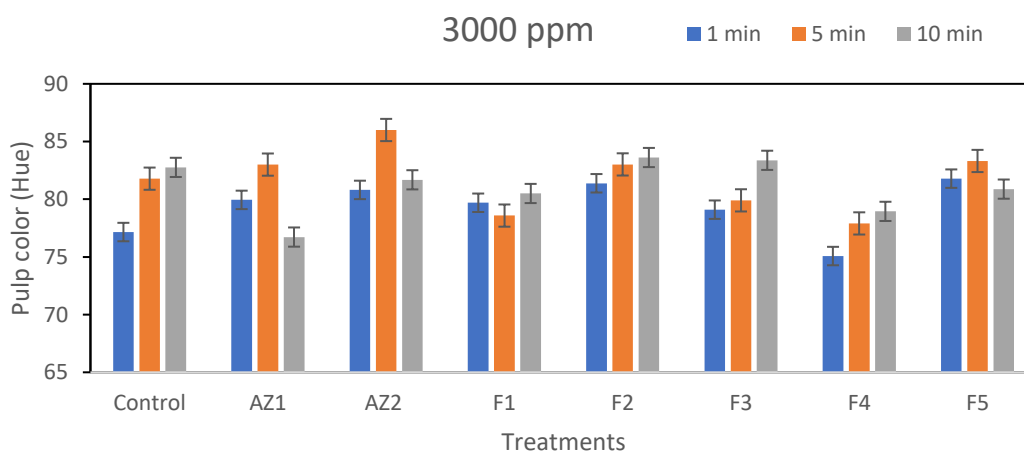


Figure 57. Color (Hue) in “Kent” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

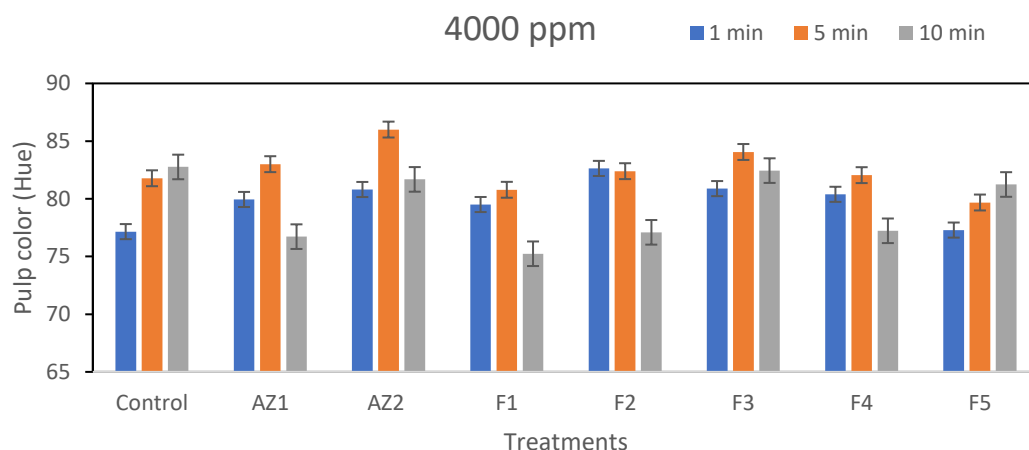


Figure 58. Color (Hue) in “Kent” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

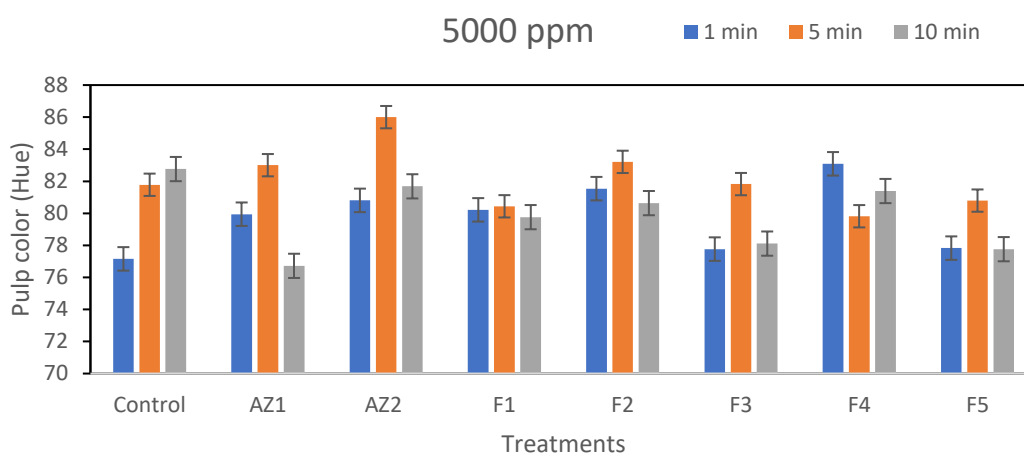


Figure 59. Color (Hue) in “Kent” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

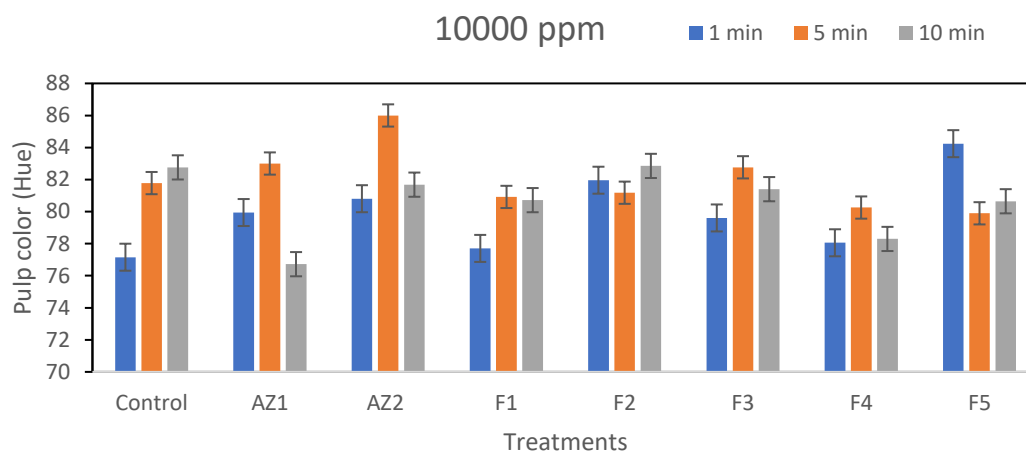


Figure 60. Color (Hue) in “Kent” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

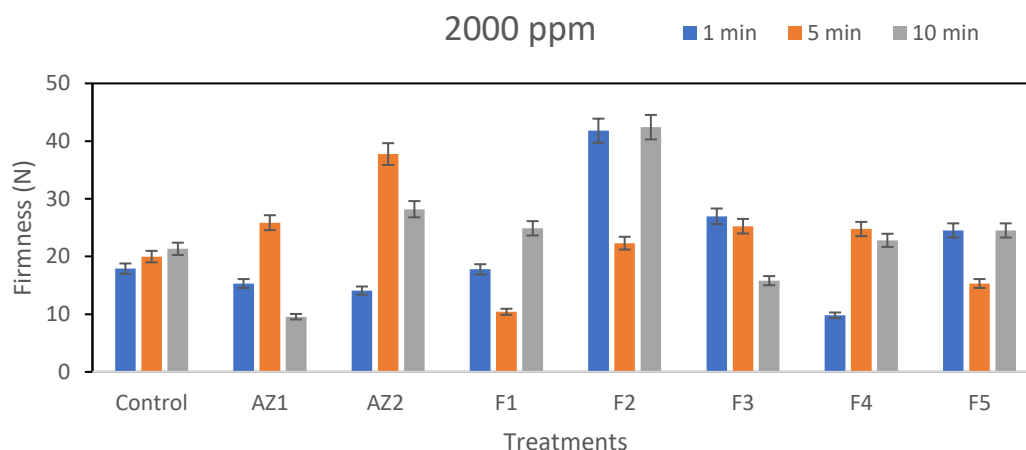


Figure 61. Firmness (N) in postharvest “Kent” mango fruits at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

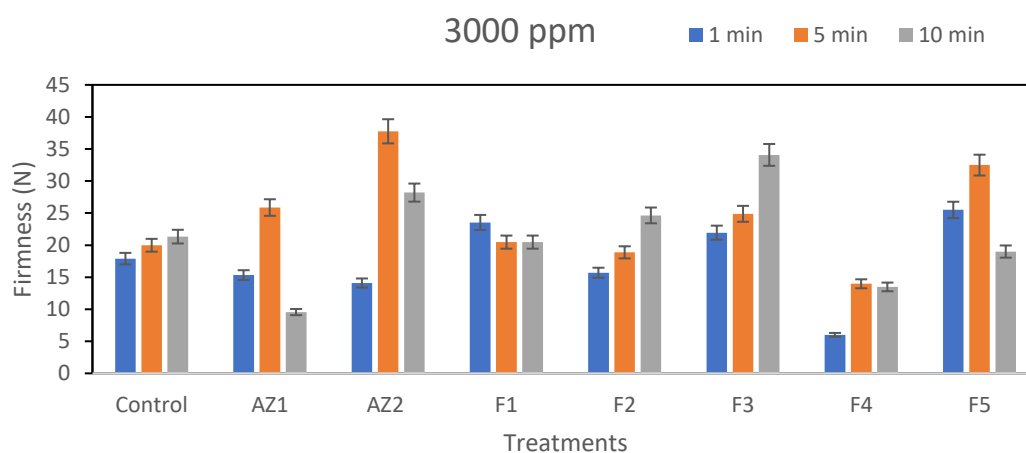


Figure 62. Firmness (N) in postharvest “Kent” mango fruits at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

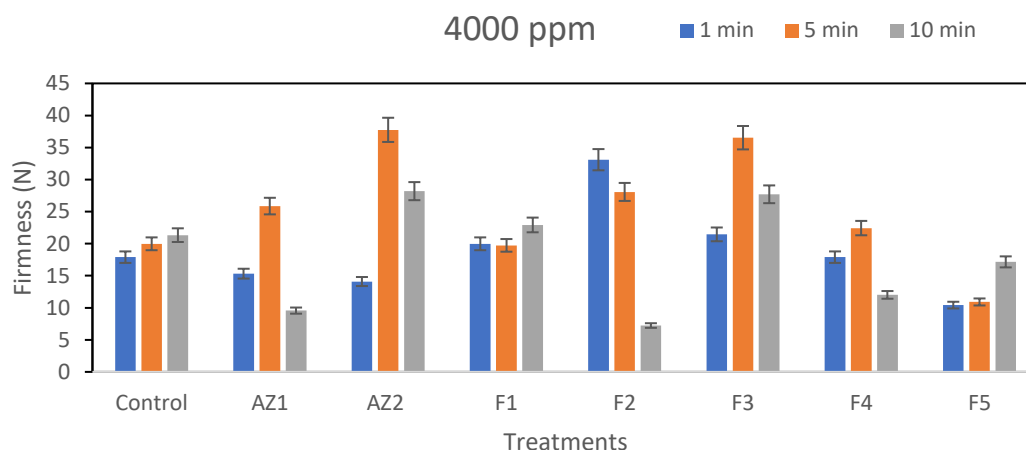


Figure 63. Firmness (N) in postharvest “Kent” mango fruits at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

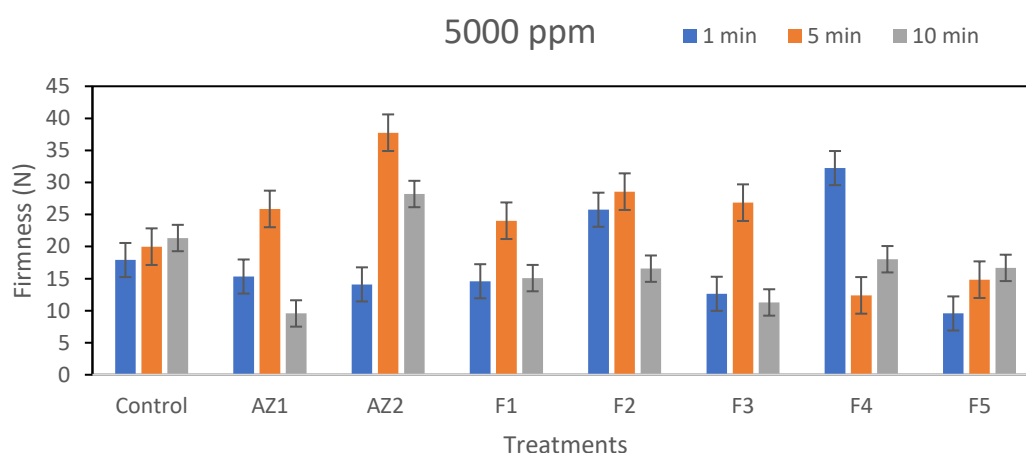


Figure 64. Firmness (N) in postharvest “Kent” mango fruits at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

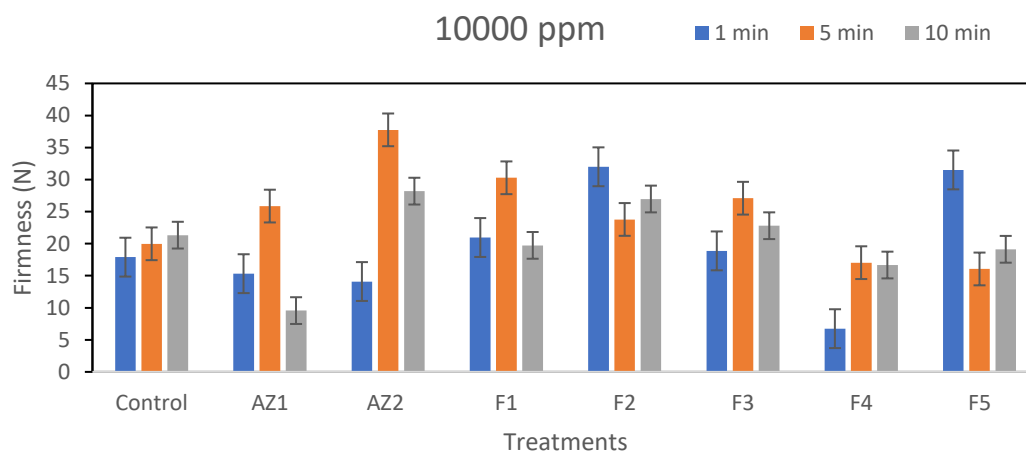


Figure 65. Firmness (N) in postharvest “Kent” mango fruits at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

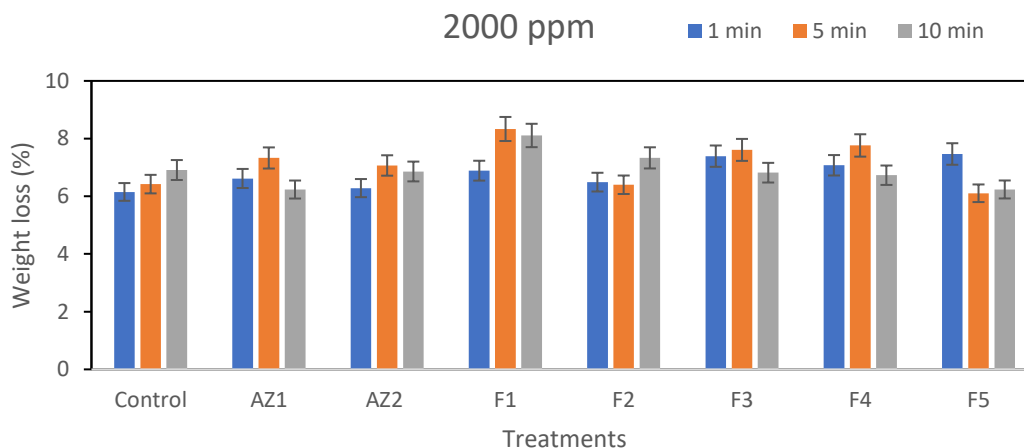


Figure 66. Weight loss in "Kent" mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

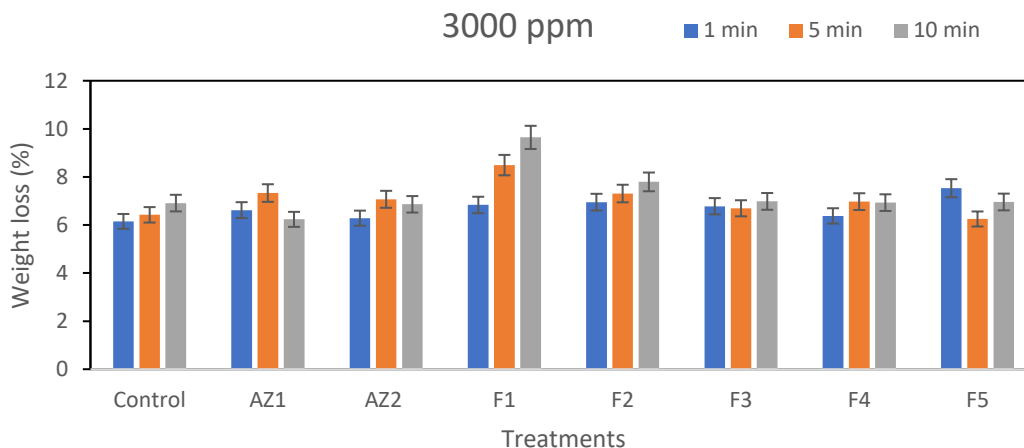


Figure 67. Weight loss in "Kent" mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

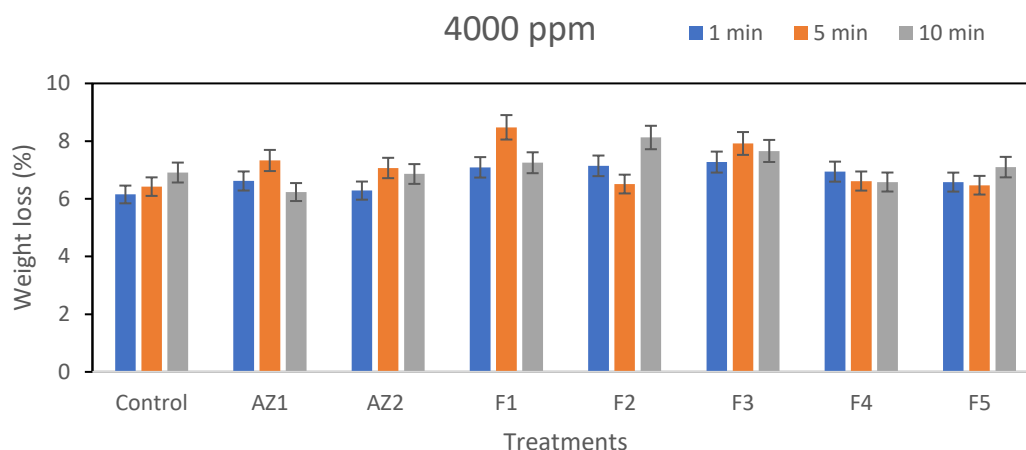


Figure 68. Weight loss in "Kent" mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

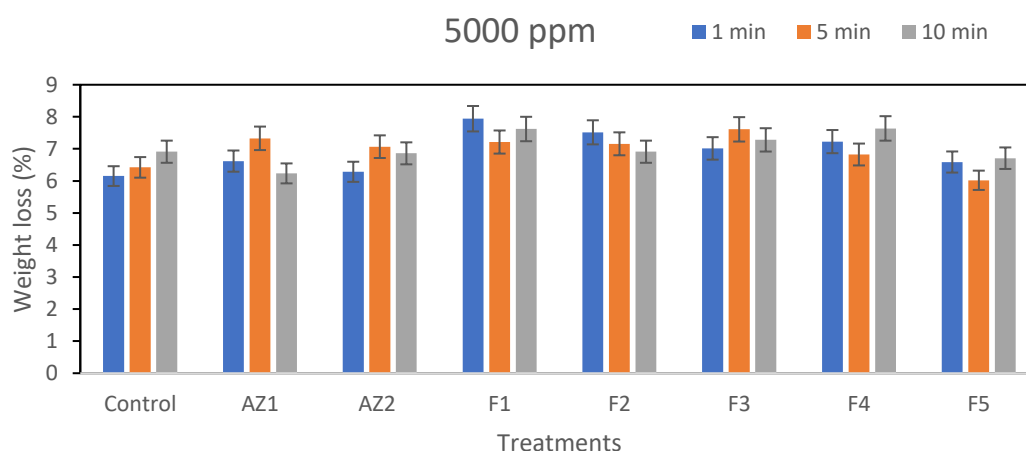


Figure 69. Weight loss in "Kent" mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

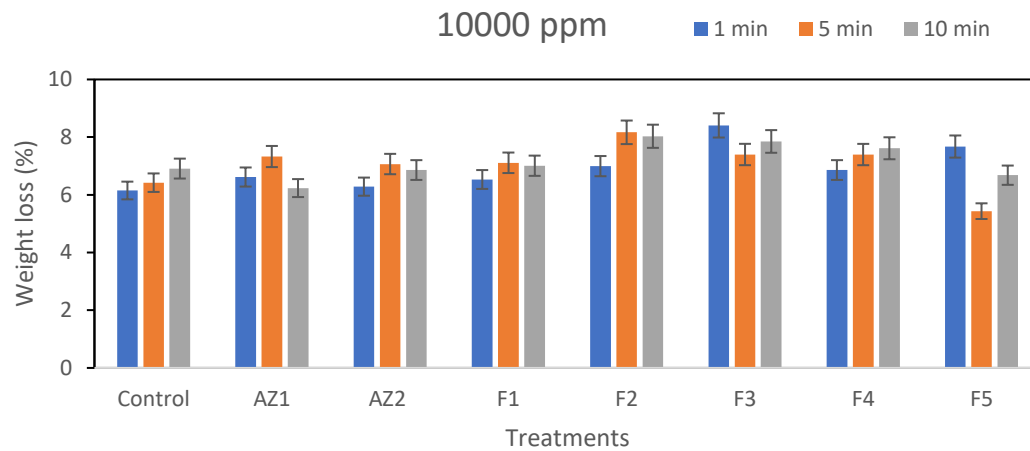


Figure 70. Weight loss in "Kent" mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

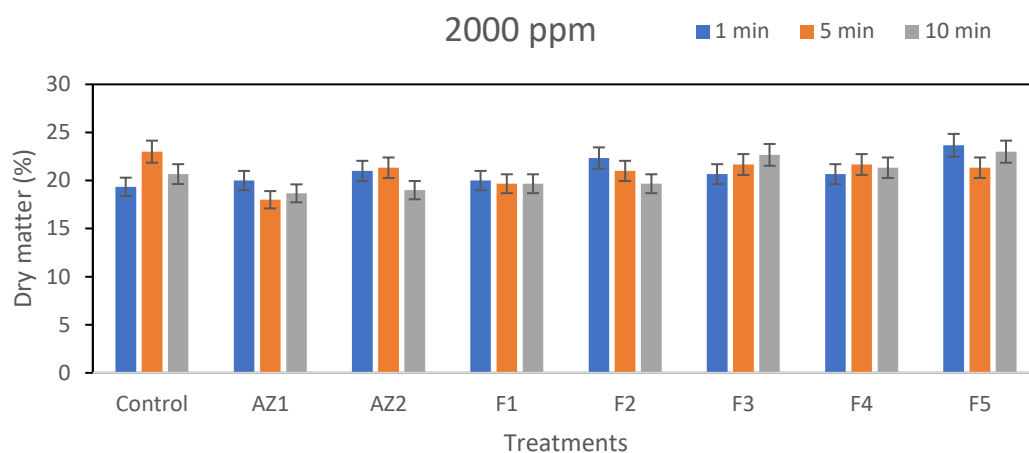


Figure 71. Dry matter in “Kent” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

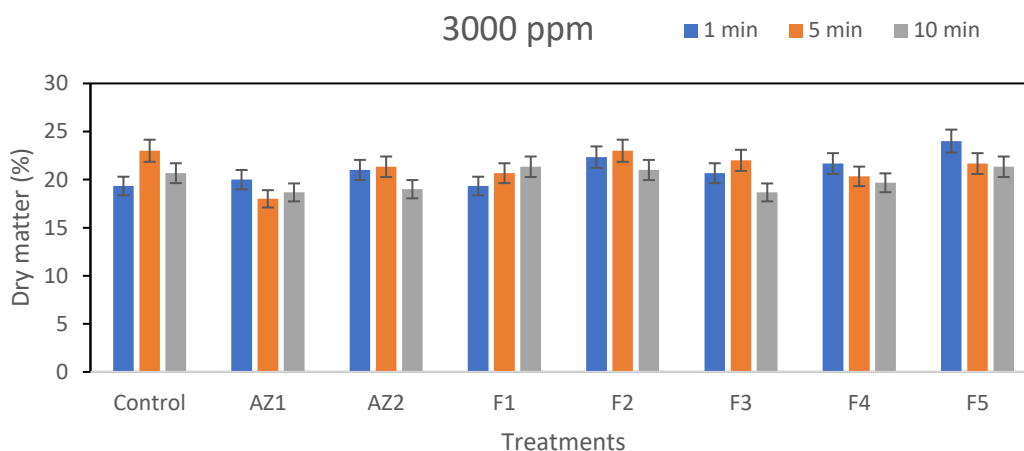


Figure 72. Dry matter in “Kent” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

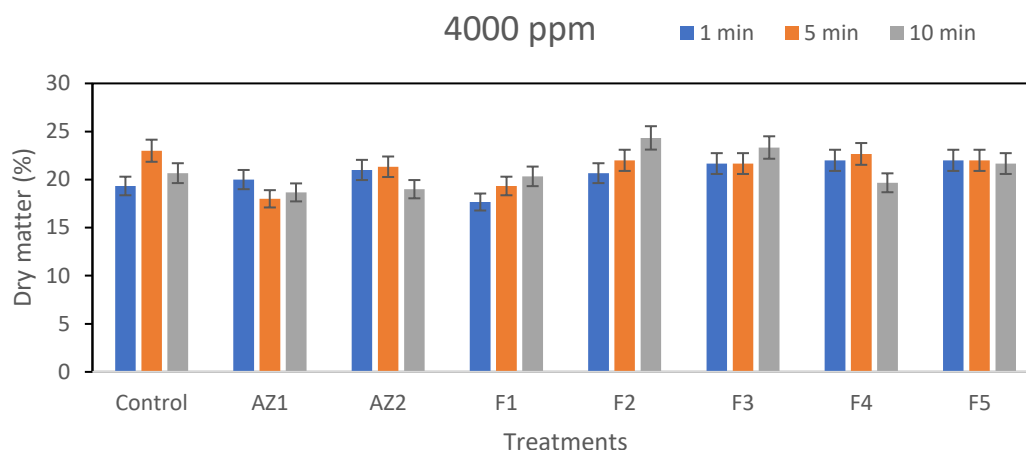


Figure 73. Dry matter in “Kent” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

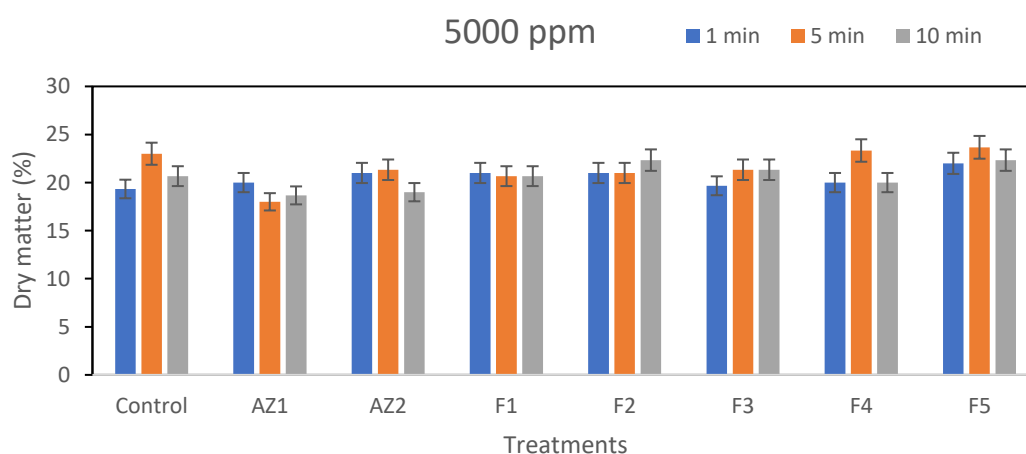


Figure 74. Dry matter in “Kent” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

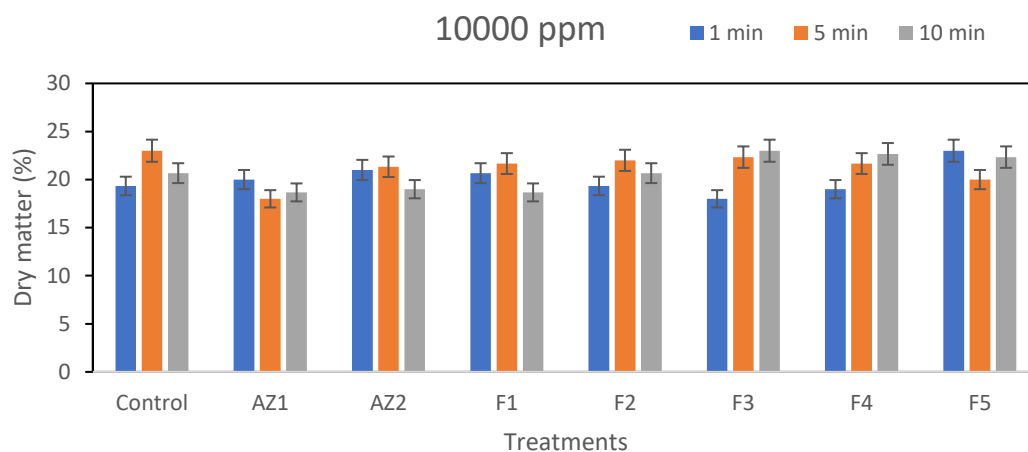


Figure 75. Dry matter in “Kent” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

POSTHARVEST QUALITY OF “KEITT” MANGO

Total soluble solids (° Brix): The control fruits (control) showed a content of total soluble solids between 13 and 15 ° Brix. Compared with the control, all the treatments of the formulations (F1, F2, F3, F4 and F5) and the treatments with Azoxystrobin, showed similar TSS contents in each of the concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and immersion times (1, 5 and 10 min), so no significant effects of treatments were observed on the content of TSS (Figures 76-80).

Color (Hue): The control fruits showed hue values between 85 and 88, which indicated yellow tones; values close to 90 show more yellow hues. In most concentrations (2000, 3000, 4000, 5000 and 10000 ppm) and immersion times (1, 5 and 10 min) it was observed that all the treatments, including the fruits treated with Axozystrobin, were in the range of values hue from 80 to 86 (Figures 81-85). It was not observed that the concentrations and the immersion times of the treatments altered the color or that the values went outside the range of the control fruits in a significant way

Firmness: The firmness in the control fruits was in the range of 25 to 41 N. The fruits of the AZ1 fungicides in the three immersion times (1, 5 and 10 min) registered lower firmness than the control (between 9 and 10 N), while AZ2 in the three immersion periods was from 8 to 14 N. The firmness was very similar between treatments with biopesticides and the chemical fungicide, however, only some immersion times were in the firmness range of the control fruits. At 2000 ppm the treatments F1 (1 min), F2 (10 min) and F5 (1 min) had firmness of 29, 34 and 25 N. At 3000 ppm the formulation F1 (1 min) presented a firmness of 29 N. With Regarding 4000 ppm, the formulations F1 (10 min) and F2 (1 min) and F4 (10 min) showed firmness with 28, 25 and 25 N. At 5000 ppm the firmness of F1 (10 min) registered 36 N At the last concentration, at 10000 ppm, formulation F2 at 10 min obtained 25 N of firmness. The rest of the treatments, both biopesticides and chemical fungicides, registered firmness in the range of 7 to 14 N (Figures 86-90). This variable effect of treatments was observed in the decrease or increase of the firmness.

Weight loss: The control fruits showed weight losses of between 9 and 10%. On the other hand, the weight loss between treatments was similar in the five concentrations and the three immersion times. Compared with the control, the percentage of weight loss of the formulations at 2000 ppm was between 7 and 10, in 3000 ppm (8-11), 4000 ppm (8-11), 5000 ppm (7-11) and 10000 ppm (8-10) (Figures 91-95). In this variable, no effect of treatments was observed on weight loss.

Dry matter content: The dry matter content of the control fruits was between 20 and 24%. The rest of the treatments, including chemical fungicides and biopesticide formulations, obtained similar values in the content of dry matter compared to the control fruits, in the five concentrations and the three immersion times (Figures 96-100). No differences were found between treatments and the control in the percentage of dry matter.

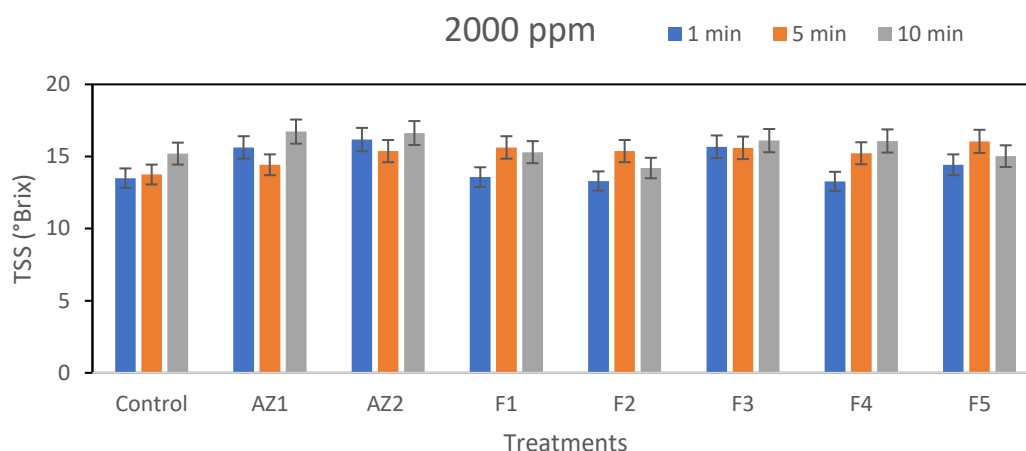


Figure 76. Total Soluble Solids (° Brix) in “Keitt” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

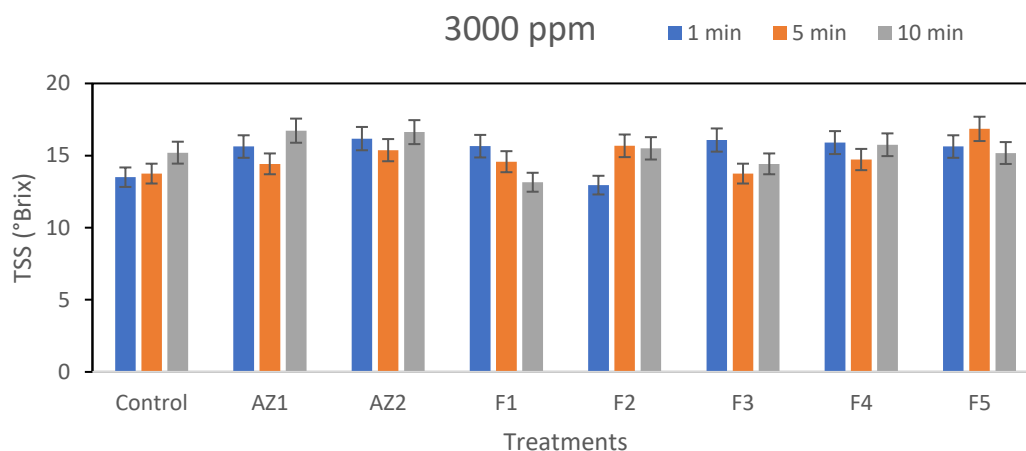


Figure 77. Total Soluble Solids (° Brix) in “Keitt” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

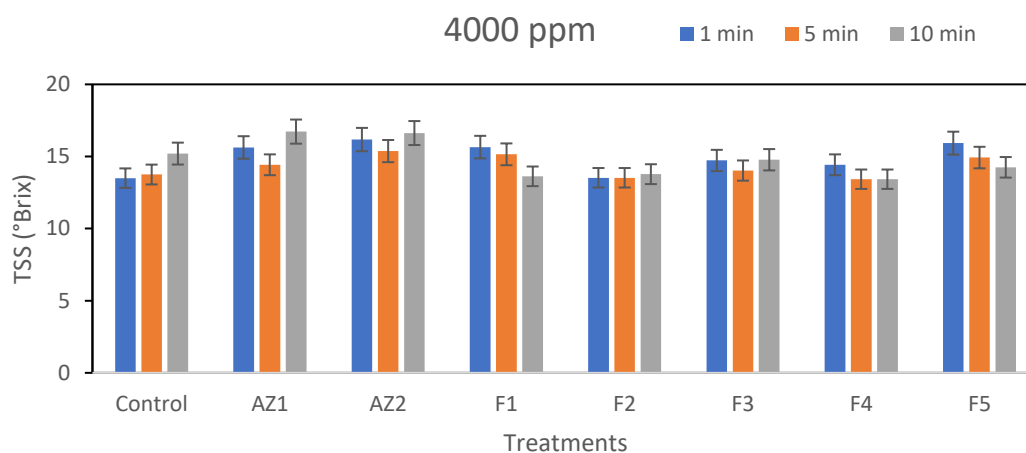


Figure 78. Total Soluble Solids (° Brix) in “Keitt” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

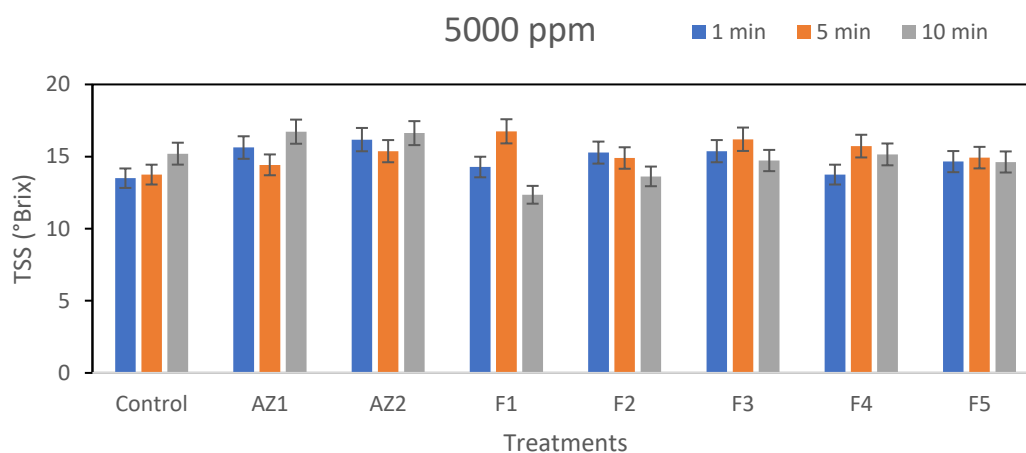


Figure 79. Total Soluble Solids (° Brix) in “Keitt” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

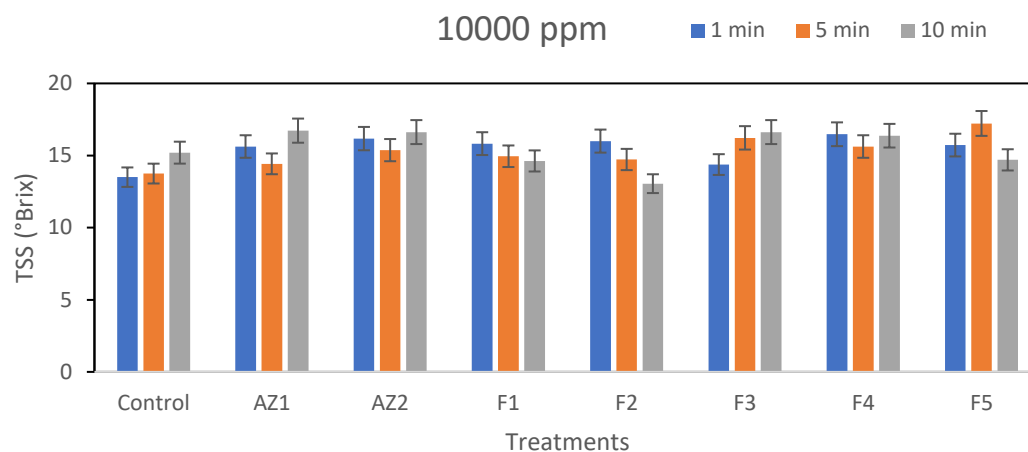


Figure 80. Total Soluble Solids (° Brix) in “Keitt” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

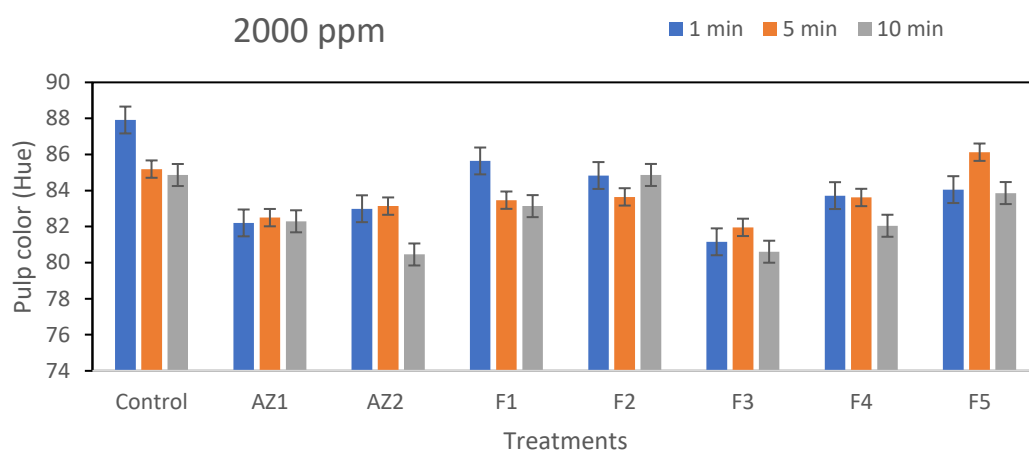


Figure 81. Color (Hue) in “Keitt” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

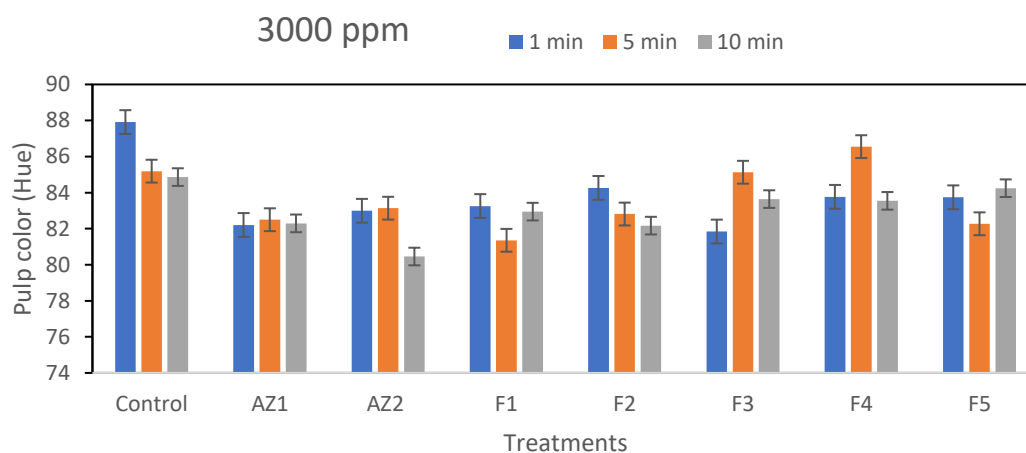


Figure 82. Color (Hue) in “Keitt” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

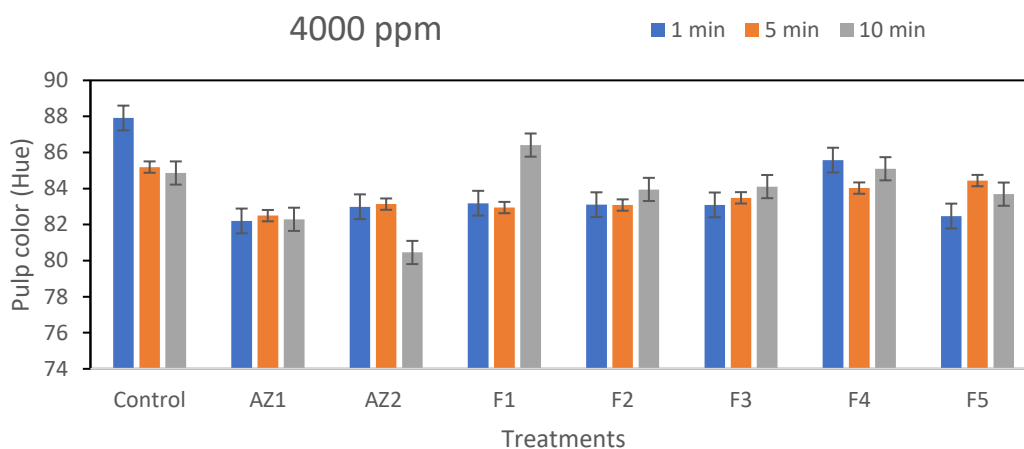


Figure 83. Color (Hue) in “Keitt” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

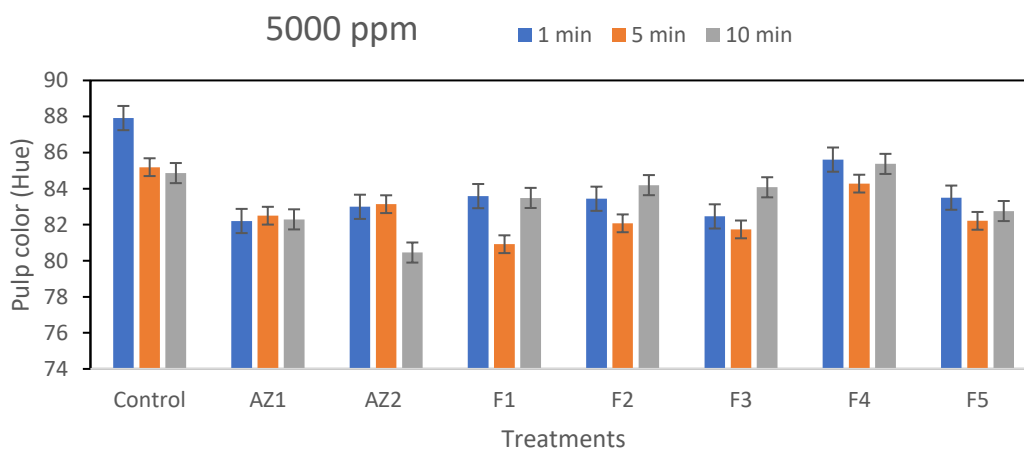


Figure 84. Color (Hue) in “Keitt” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

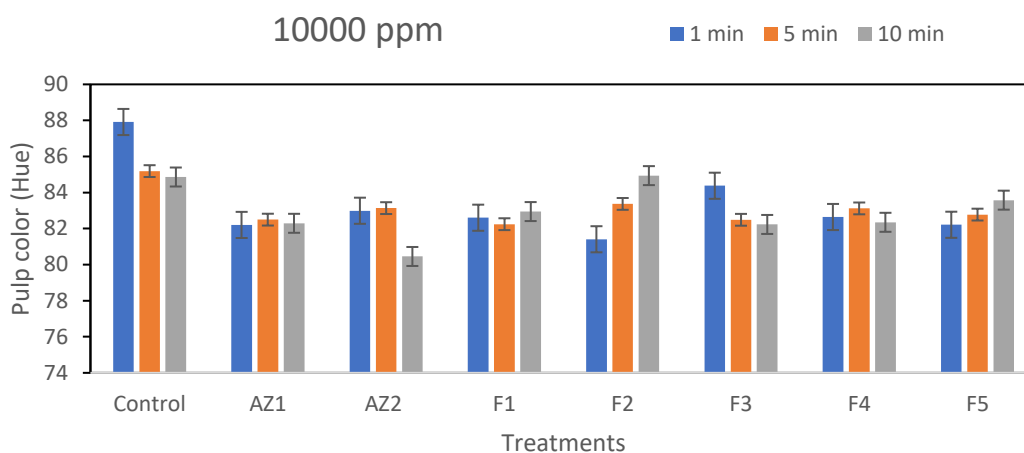


Figure 85. Color (Hue) in “Keitt” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

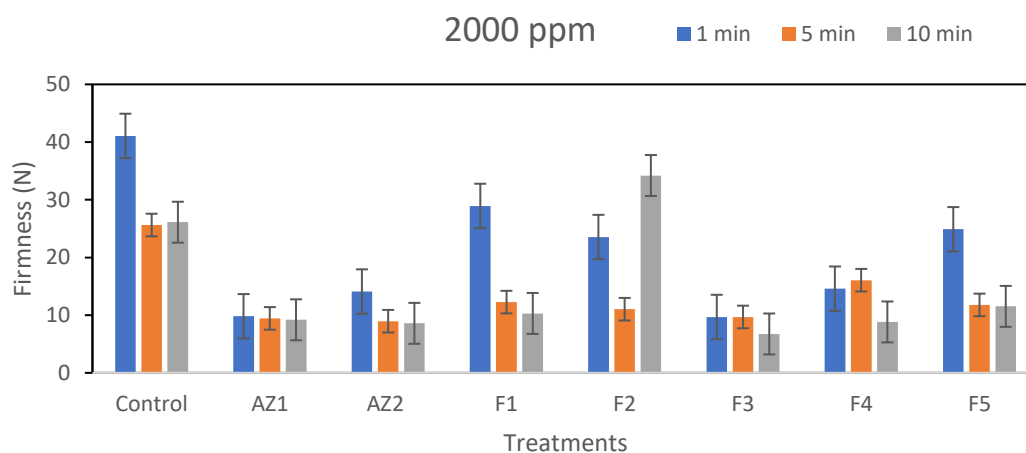


Figure 86. Firmness (N) in postharvest “Keitt” mango fruits at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

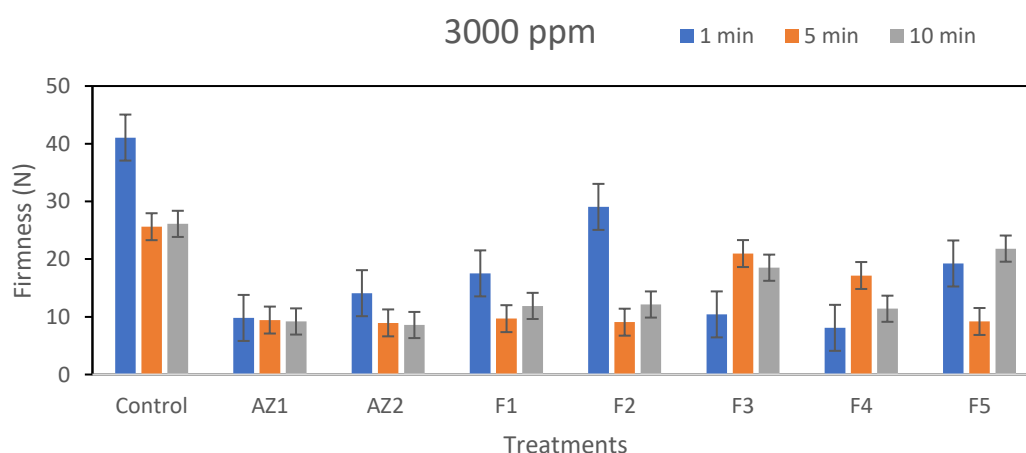


Figure 87. Firmness (N) in postharvest “Keitt” mango fruits at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

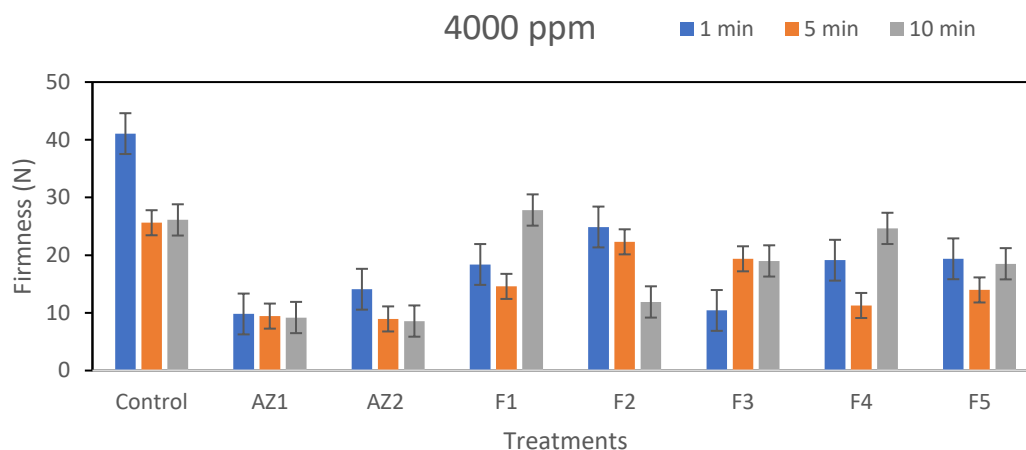


Figure 88. Firmness (N) in postharvest “Keitt” mango fruits at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

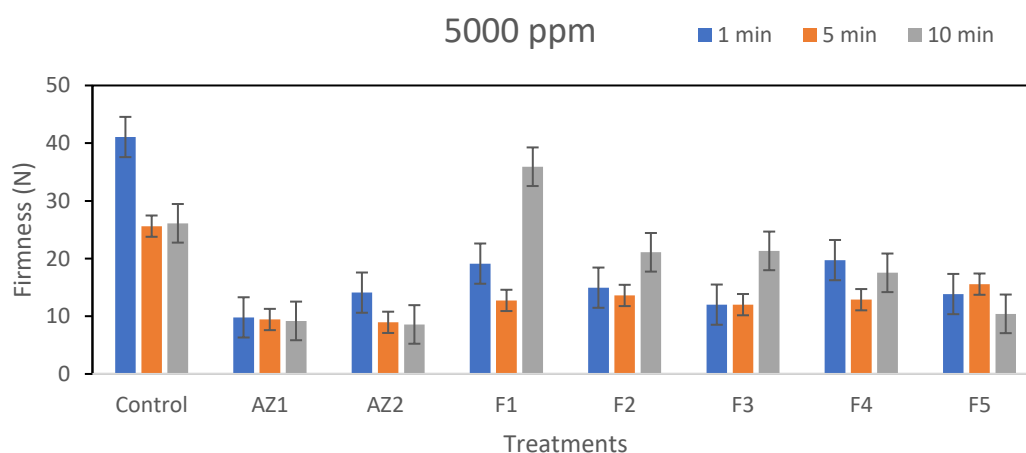


Figure 89. Firmness (N) in postharvest “Keitt” mango fruits at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

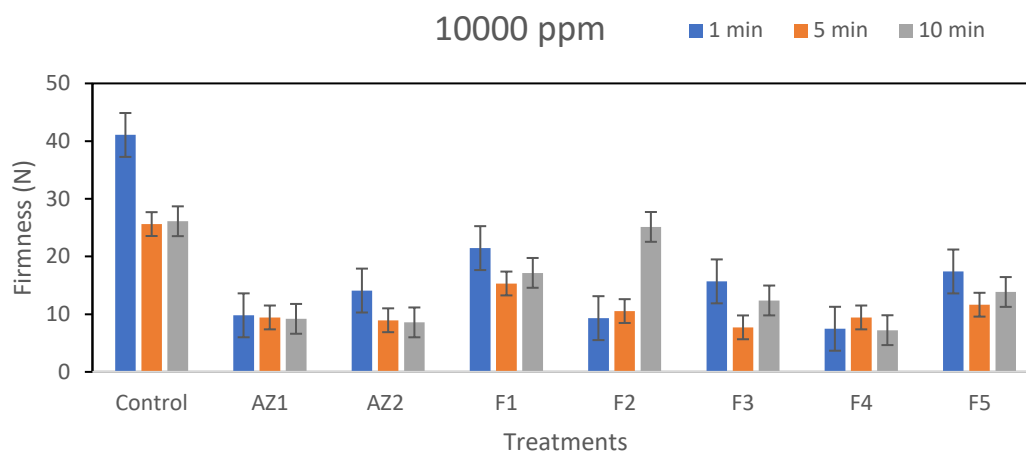


Figure 90. Firmness (N) in postharvest “Keitt” mango fruits at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

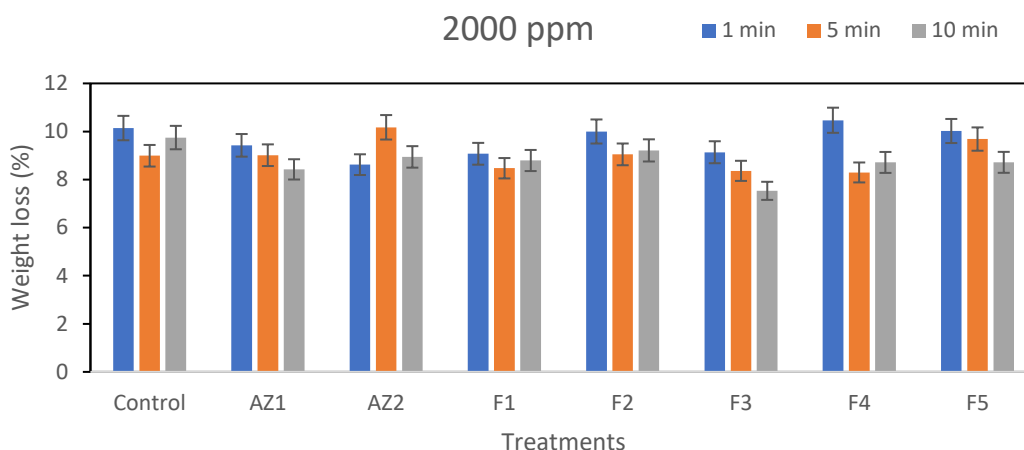


Figure 91. Weight loss in "Keitt" mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

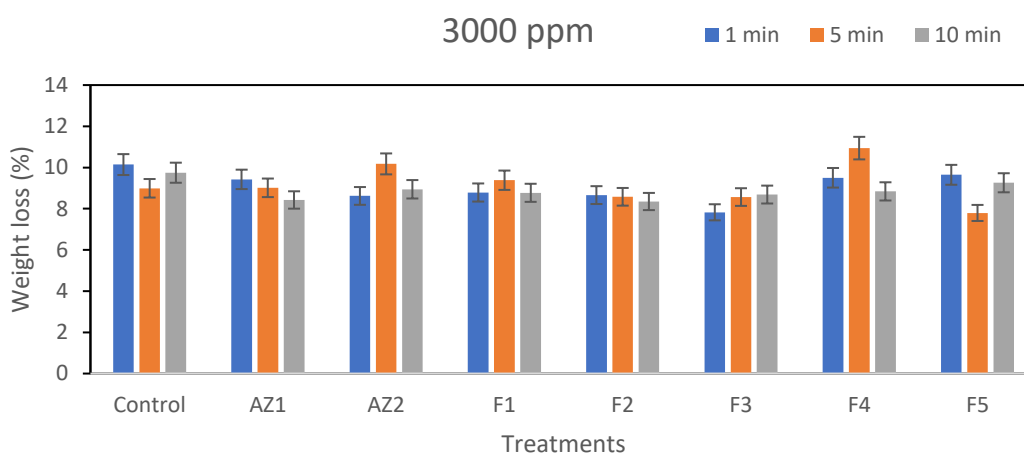


Figure 92. Weight loss in "Keitt" mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

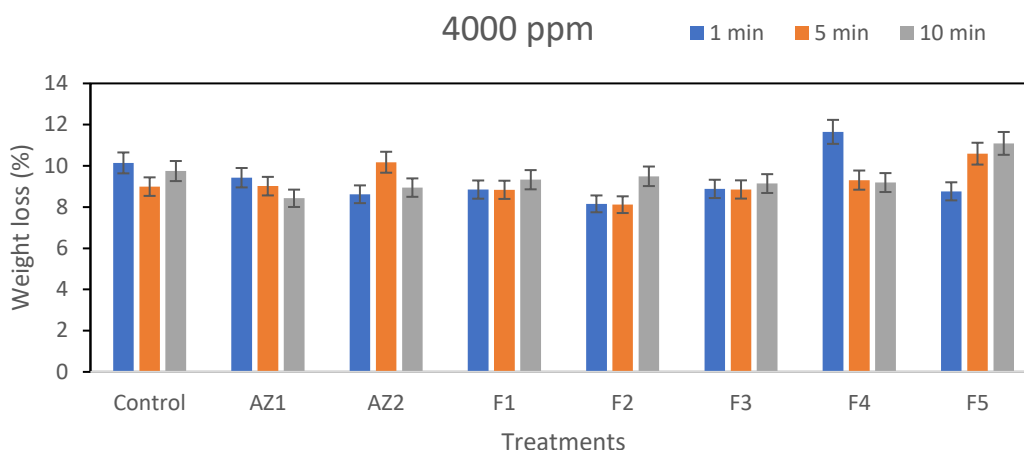


Figure 93. Weight loss in "Keitt" mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

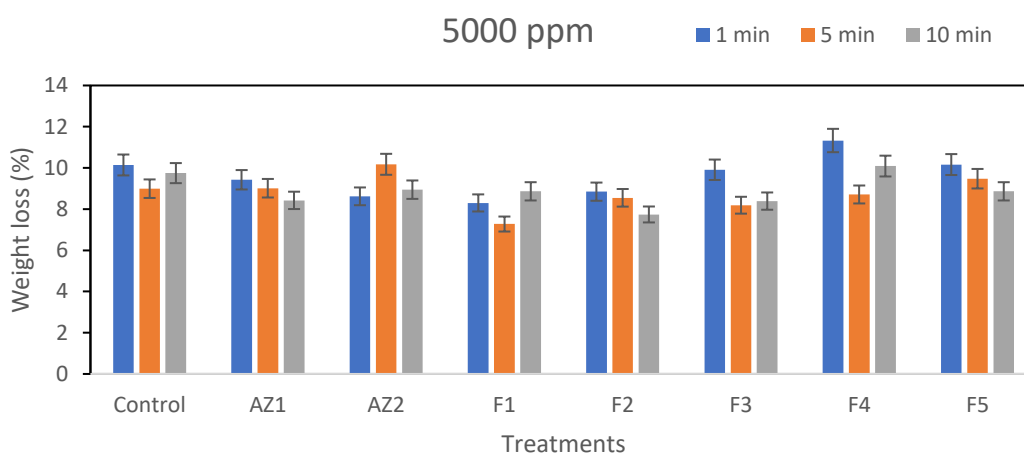


Figure 94. Weight loss in "Keitt" mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

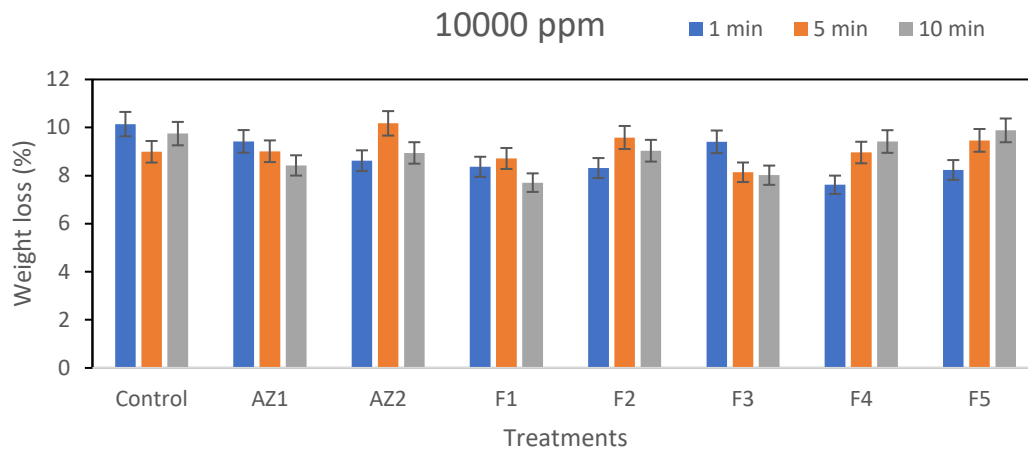


Figure 95. Weight loss in "Keitt" mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

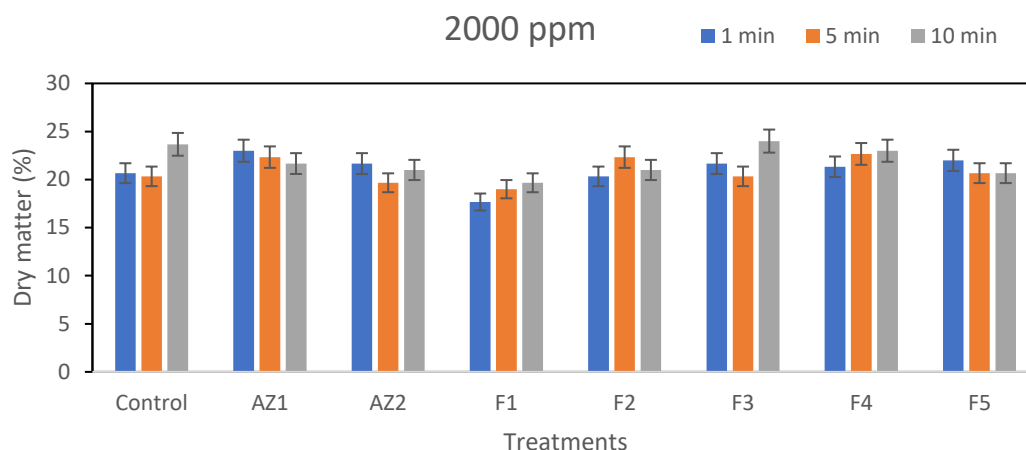


Figure 96. Dry matter in “Keitt” mango fruits in postharvest at 2000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

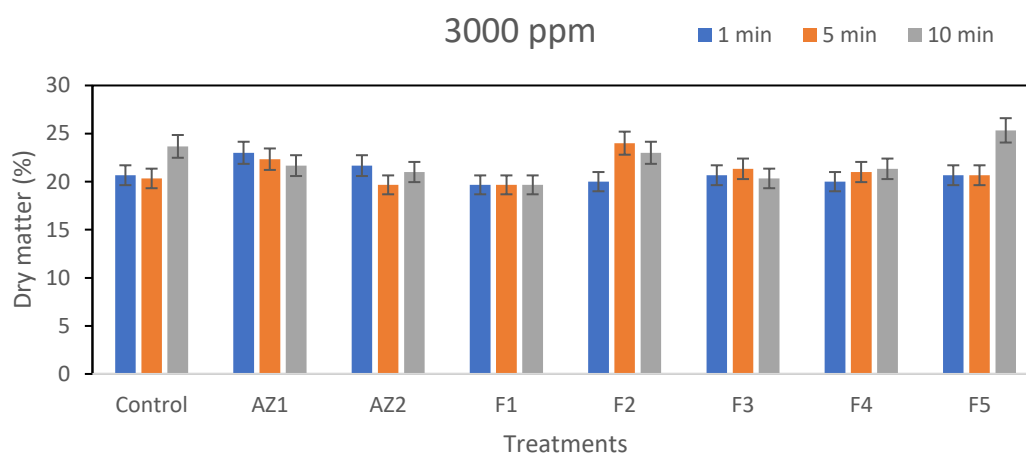


Figure 97. Dry matter in “Keitt” mango fruits in postharvest at 3000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

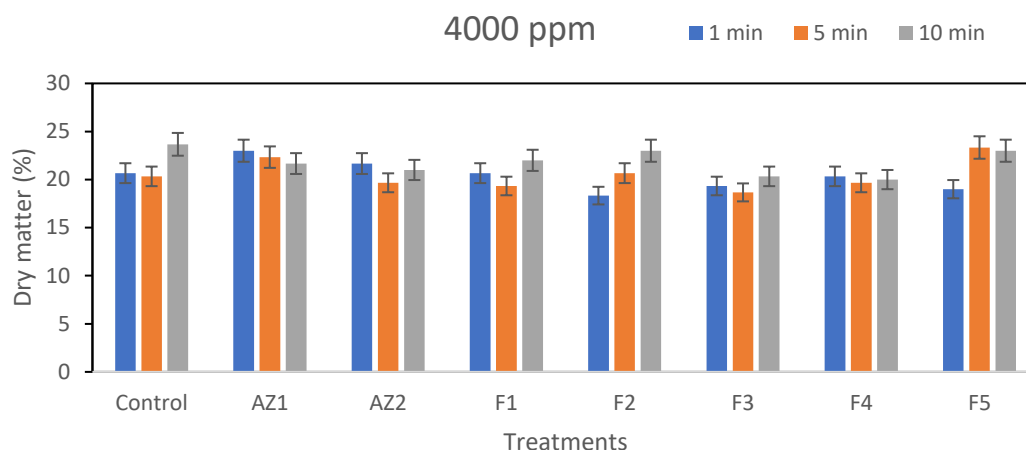


Figure 98. Dry matter in “Keitt” mango fruits in postharvest at 4000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

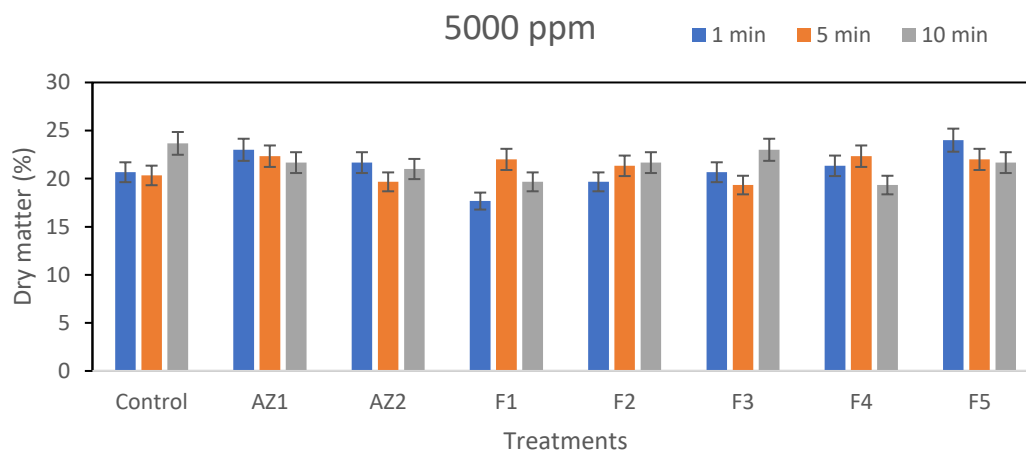


Figure 99. Dry matter in “Keitt” mango fruits in postharvest at 5000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

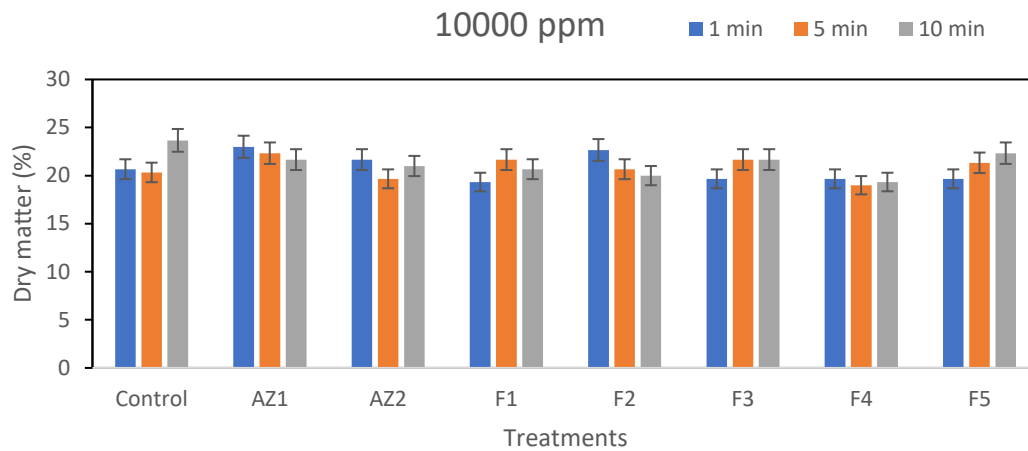


Figure 100. Dry matter in “Keitt” mango fruits in postharvest at 10000 ppm: Control) Control treatment; AZ1) Azoxystrobin 500 ppm; AZ2) Azoxystrobin 1000 ppm; F1) Peracetic Acid (30%) + Hydrogen Peroxide (30%) + Acetic Acid (10%); F2) Peracetic Acid (35%) + Hydrogen Peroxide (15%) + Acetic Acid (10%) + Chitosan (40%); F3) Hydrogen Peroxide (30%) + Peracetic Acid (15%) + Acetic Acid (10%); F4) Peracetic Acid (30%) + Hydrogen Peroxide (10%) + Extract of Governor (*Larrea tridentata*) (50%) + Thymol (3%); F5) Hydrogen Peroxide (50%) + Acetic Acid (15%) + Peracetic Acid (15%).

4. CONCLUSIONS

1. The chemical fungicide Azoxystrobin in its two concentrations (500 and 1000 ppm) and the biopesticide formulations in five concentrations (2000, 3000, 4000, 5000 and 10000 ppm), in the three immersion times (1, 5 and 10 min), showed similar behaviors in quality variables (total soluble solids, color, firmness and weight loss), percentage of dry matter and incidence of diseases and physical appearance of the fruit, in mango fruits of the varieties "Ataulfo, Tommy Atkins, Kent and Keitt" in postharvest.

2. Total soluble solids (° Brix): The fruits treated with the biopesticide formulations (F1, F2, F3, F4 and F5) and the fungicide Azoxystrobin, showed TSS contents similar to the control fruits in the four varieties of mango evaluated. No treatment effects were observed at the different concentrations and immersion times on the TSS content.

3. Pulp color (Hue): The fruits treated with the biopesticide formulations (F1, F2, F3, F4 and F5) and the fungicide Azoxystrobin, showed similar yellow tones to the control fruits in the four varieties of mango evaluated. No treatment effects were observed at the different concentrations and immersion times in the pulp color.

4. Firmness (N): The fruits treated with the biopesticide formulations (F1, F2, F3, F4 and F5) and the fungicide Azoxystrobin showed differences in the firmness of the fruits between treatments, and also with respect to the control fruits, in at least one of the concentrations and immersion times in the four varieties of mango evaluated. It was observed that, in all the treatments in at least one concentration or immersion time, the firmness was higher or lower than in the control fruits. There was no trend in the increase or decrease in firmness between treatments, so it cannot be concluded with certainty whether the variations in firmness were due to the effect of the treatments.

5. Weight loss: The fruits treated with the biopesticide formulations (F1, F2, F3, F4 and F5) and the fungicide Azoxystrobin, did not present significant weight loss between treatments and also with respect to the control in the four mango varieties evaluated. No treatment effects were observed on weight loss at the different concentrations and immersion times.

6. Percentage of dry matter: The fruits treated with the formulations of biopesticides (F1, F2, F3, F4 and F5) and the fungicide Azoxystrobin, obtained percentages of dry matter similar to the control fruits in the four varieties of mango evaluated. No treatment effects were observed at the different concentrations and immersion times on the percentage of dry matter.

7. Incidence of diseases and physical damage in the fruit: The fruits treated with the formulations of biopesticides (F1, F2, F3, F4 and F5) and the fungicide Azoxystrobin, did not show physical alterations in the epidermis or pulp of the fruits in the four varieties of mango evaluated. It was determined that the application of the five biopesticide formulations and the chemical fungicide Azoxystrobin did not induce phytotoxicity damage in fruits at the different concentrations and immersion times tested.

5. ANNEX

IMAGES OF THE TREATMENTS IN MANGO "ATAULFO"

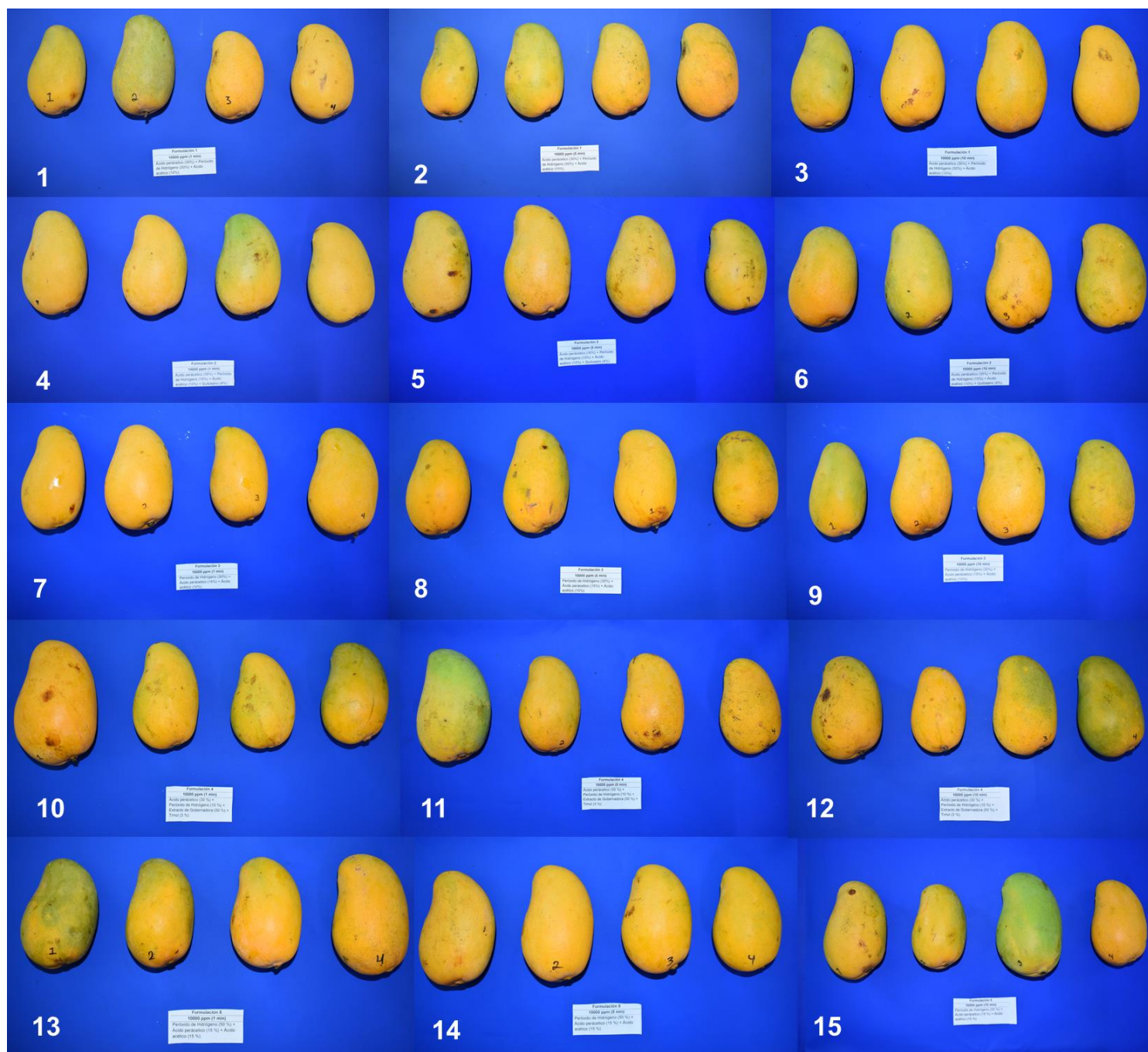


Figure 1. "Ataulfo" mango fruits treated with the formulations: F1 at 10000 ppm in 1, 5 and 10 min immersion (1-3); F2 at 10,000 ppm in 1, 5 and 10 min immersion (4-6); F3 at 10,000 ppm in 1, 5 and 10 min immersion (7-9); F4 at 10,000 ppm in 1, 5 and 10 min immersion (10-12); F5 at 10,000 ppm in 1, 5 and 10 min immersion (13-15).

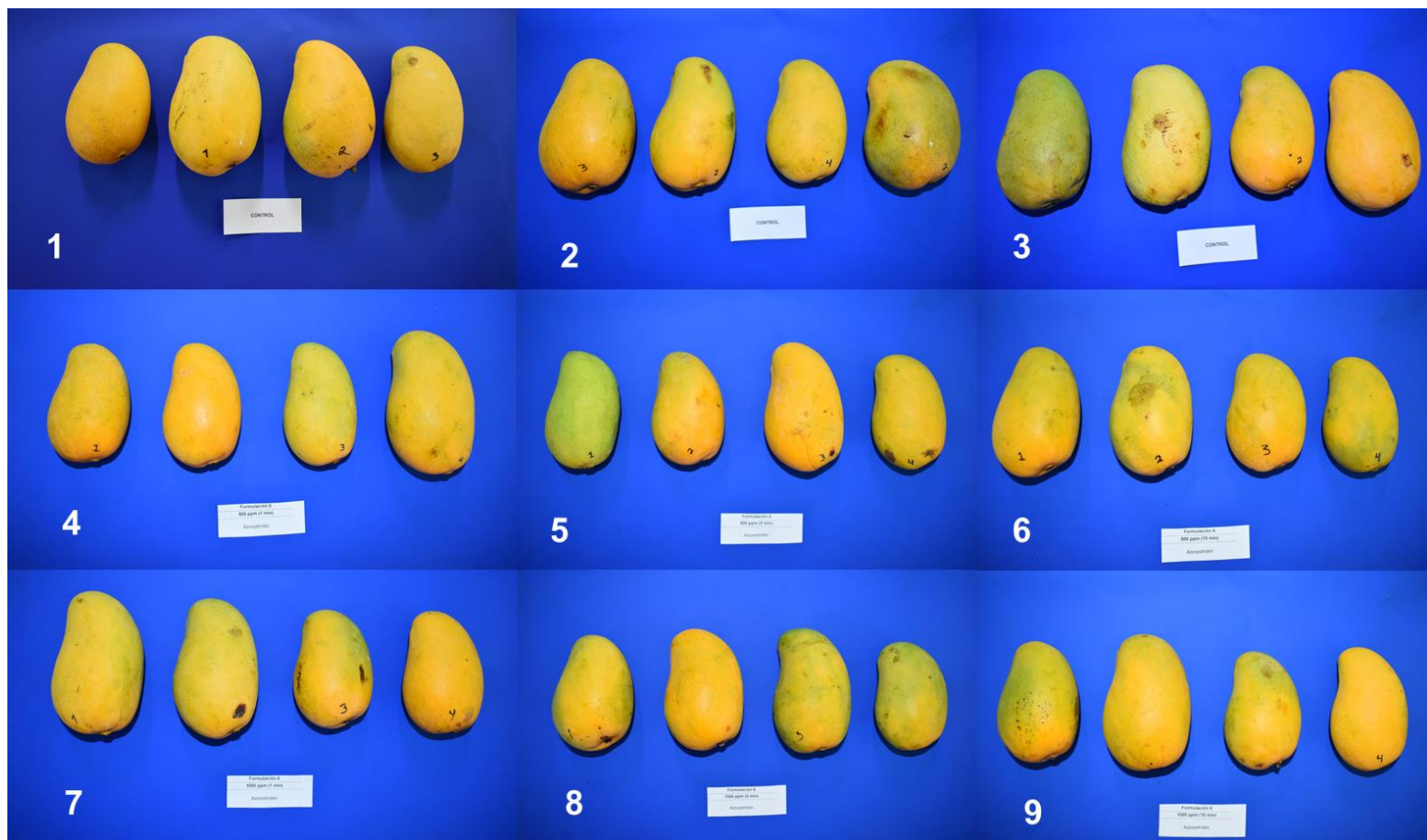


Figure 2. “Ataulfo” mango fruits treated with the formulations: Water (control fruits) at 1, 5 and 10 min immersion (1-3); AZ1 (Azoxystrobin) at 500 ppm in 1, 5 and 10 min immersion (4-6); AZ2 (Azoxystrobin) at 1000 ppm in 1, 5 and 10 min immersion (7-9).

IMAGES OF THE TREATMENTS IN MANGO "TOMMY ATKINS"

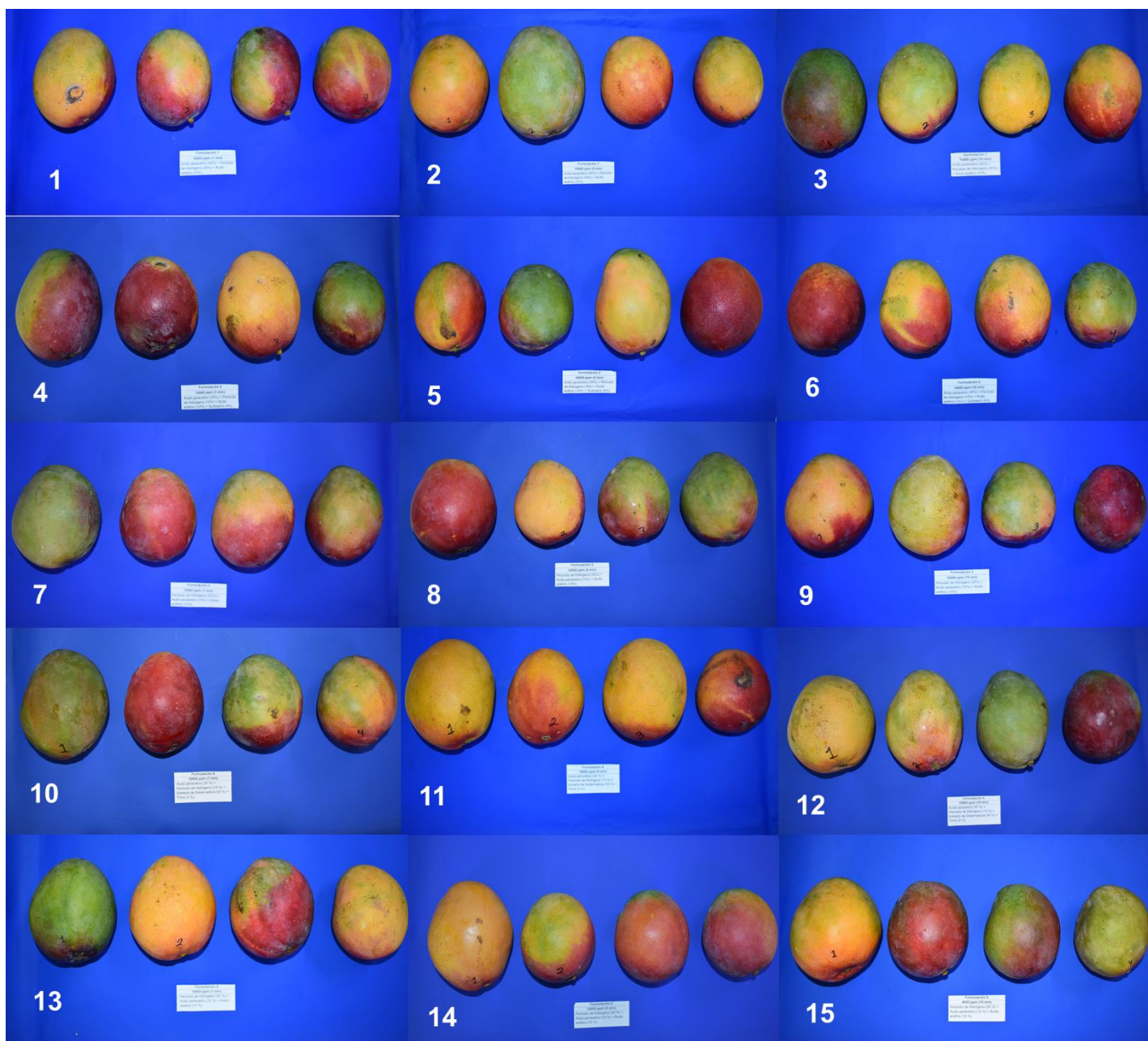


Figure 3. "Tommy Atkins" mango fruits treated with the formulations: F1 at 10,000 ppm in 1, 5 and 10 min immersion (1-3); F2 at 10,000 ppm in 1, 5 and 10 min immersion (4-6); F3 at 10,000 ppm in 1, 5 and 10 min immersion (7-9); F4 at 10,000 ppm in 1, 5 and 10 min immersion (10-12); F5 at 10,000 ppm in 1, 5 and 10 min immersion (13-15)

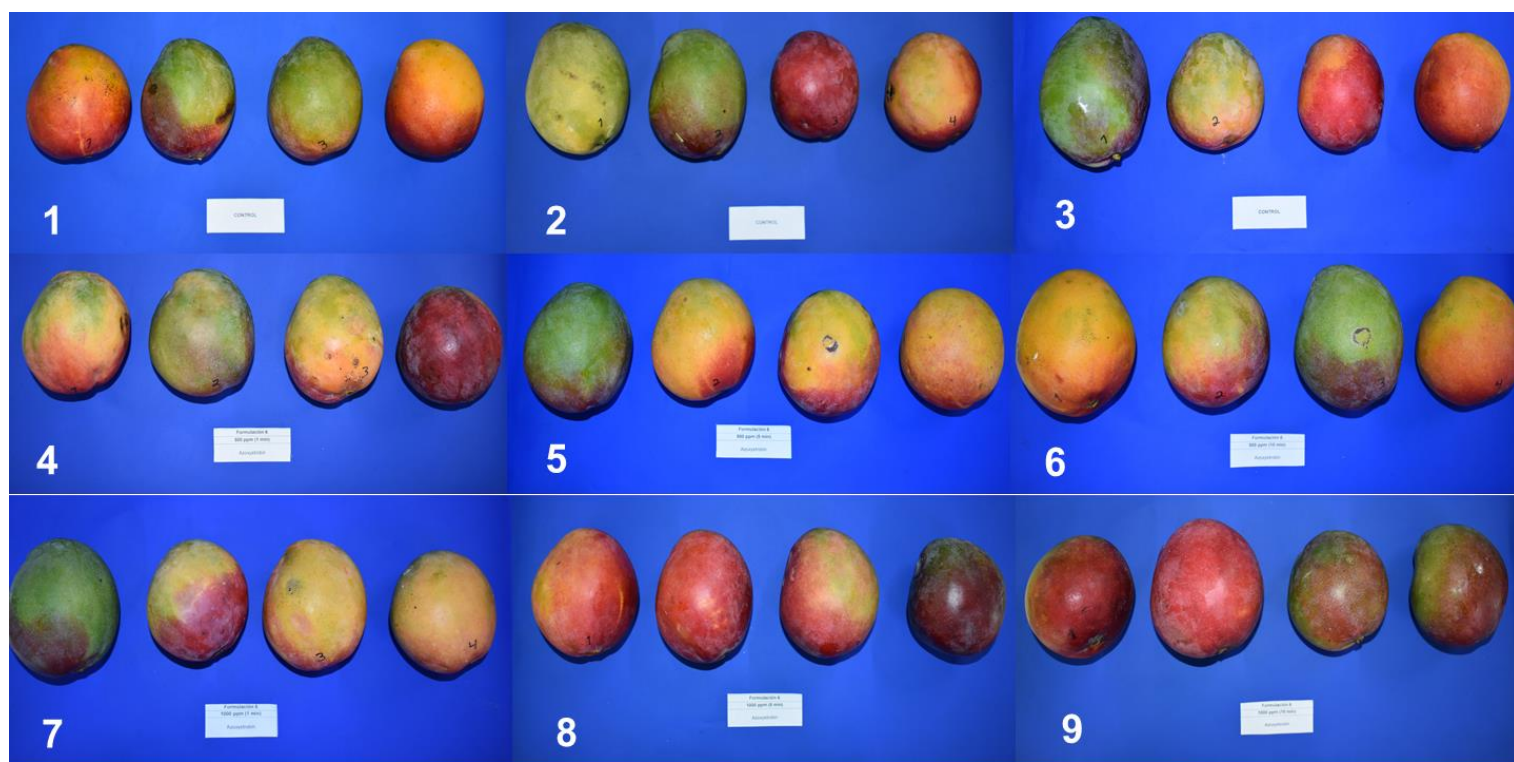


Figure 4. "Tommy Atkins" mango fruits treated with the formulations: Water (control fruits) at 1, 5 and 10 min immersion (1-3); AZ1 (Azoxystrobin) at 500 ppm in 1, 5 and 10 min immersion (4-6); AZ2 (Azoxystrobin) at 1000 ppm in 1, 5 and 10 min immersion (7-9).

IMAGES OF THE TREATMENTS IN MANGO "KENT"



Figure 5. "Kent" mango fruits treated with the formulations: F1 at 10000 ppm in 1, 5 and 10 min immersion (1-3); F2 at 10,000 ppm in 1, 5 and 10 min immersion (4-6); F3 at 10,000 ppm in 1, 5 and 10 min immersion (7-9); F4 at 10,000 ppm in 1, 5 and 10 min immersion (10-12); F5 at 10,000 ppm in 1, 5 and 10 min immersion (13-15).

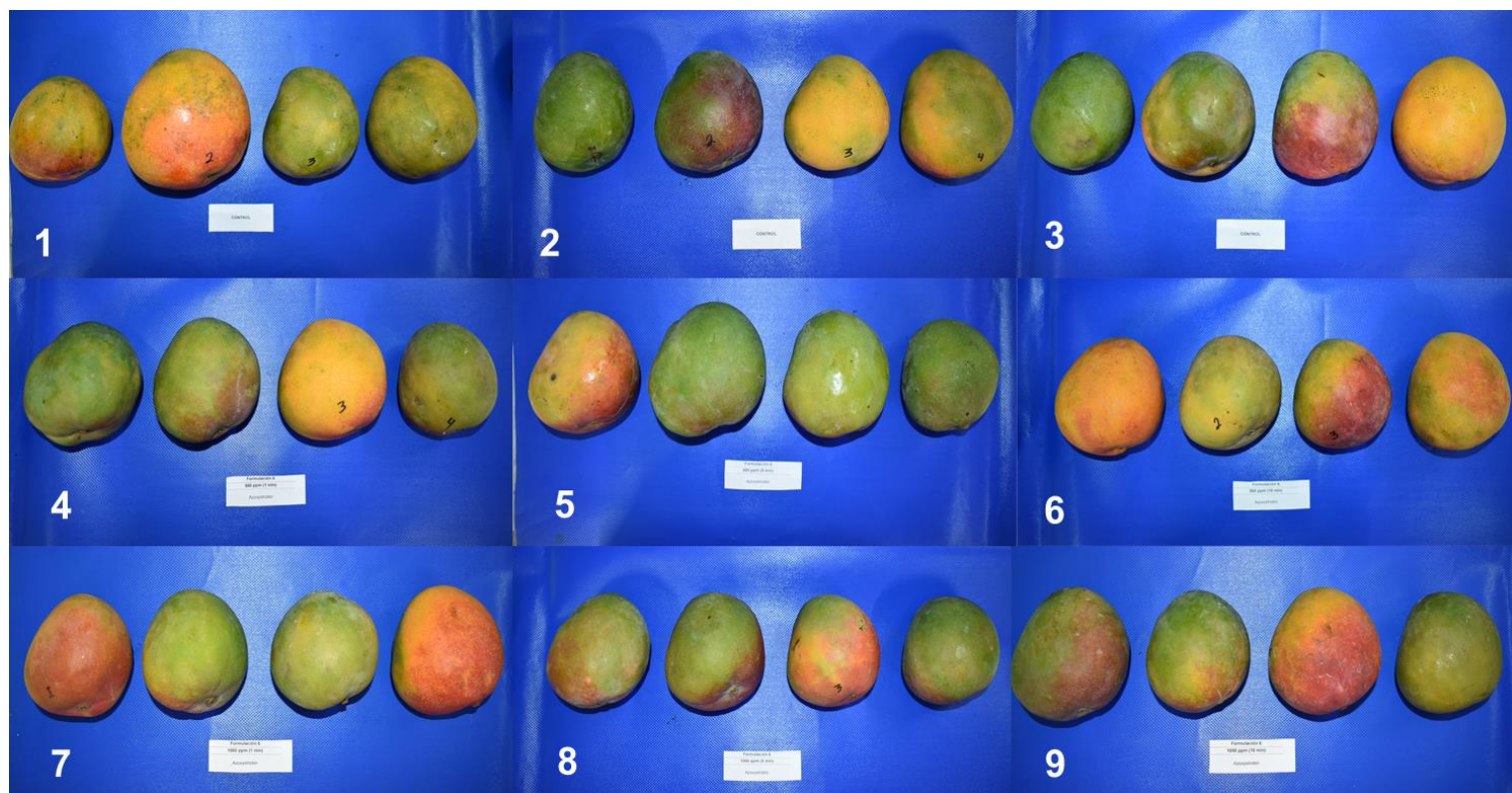


Figure 6. “Kent” mango fruits treated with the formulations: Water (control fruits) at 1, 5 and 10 min immersion (1-3); AZ1 (Azoxystrobin) at 500 ppm in 1, 5 and 10 min immersion (4-6); AZ2 (Azoxystrobin) at 1000 ppm in 1, 5 and 10 min immersion (7-9).

IMAGES OF THE TREATMENTS IN MANGO "KEITT"

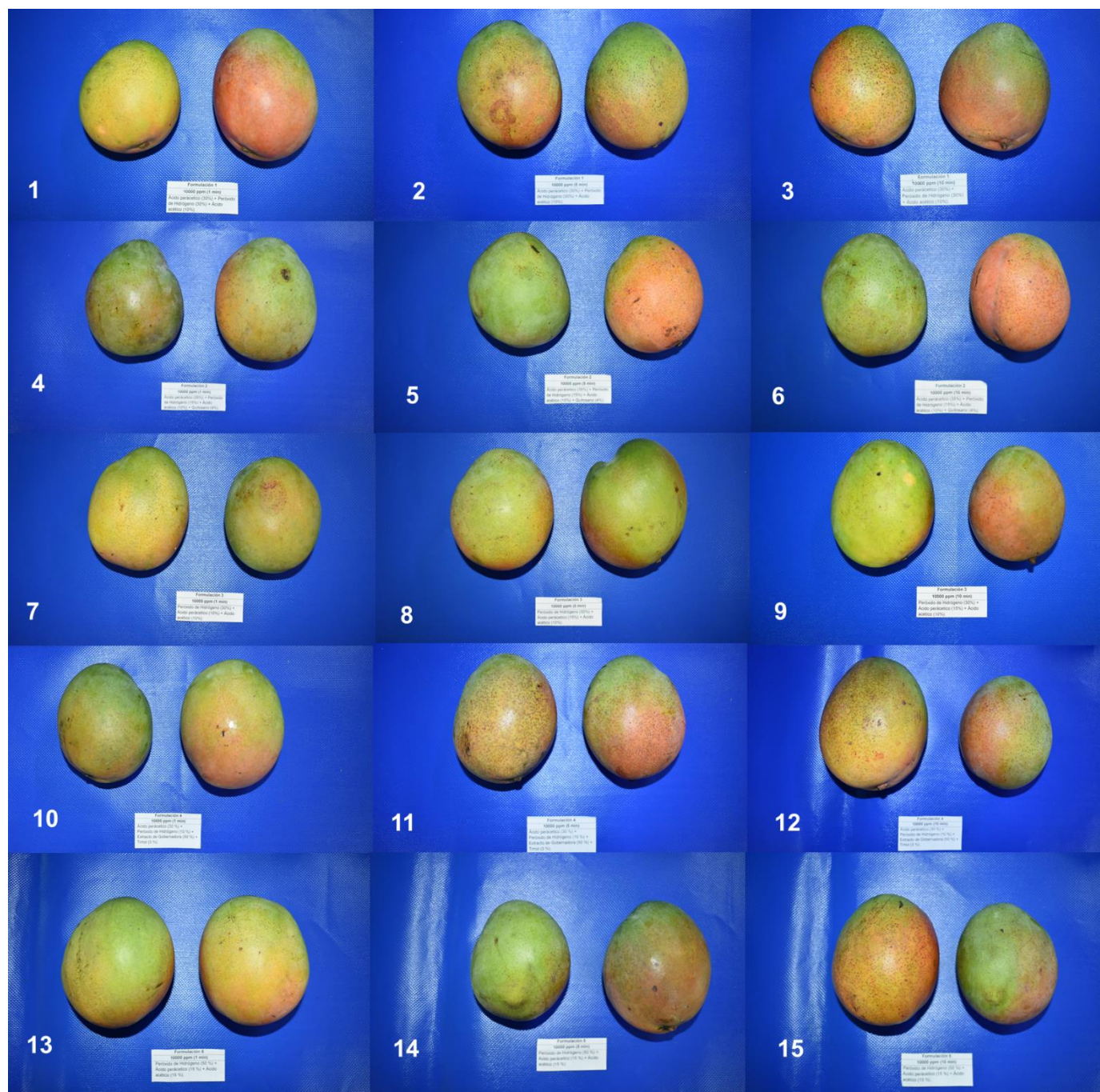


Figure 7. "Keitt" mango fruits treated with the formulations: F1 at 10,000 ppm in 1, 5 and 10 min immersion (1-3); F2 at 10,000 ppm in 1, 5 and 10 min immersion (4-6); F3 at 10,000 ppm in 1, 5 and 10 min immersion (7-9); F4 at 10,000 ppm in 1, 5 and 10 min immersion (10-12); F5 at 10,000 ppm in 1, 5 and 10 min immersion (13-15).

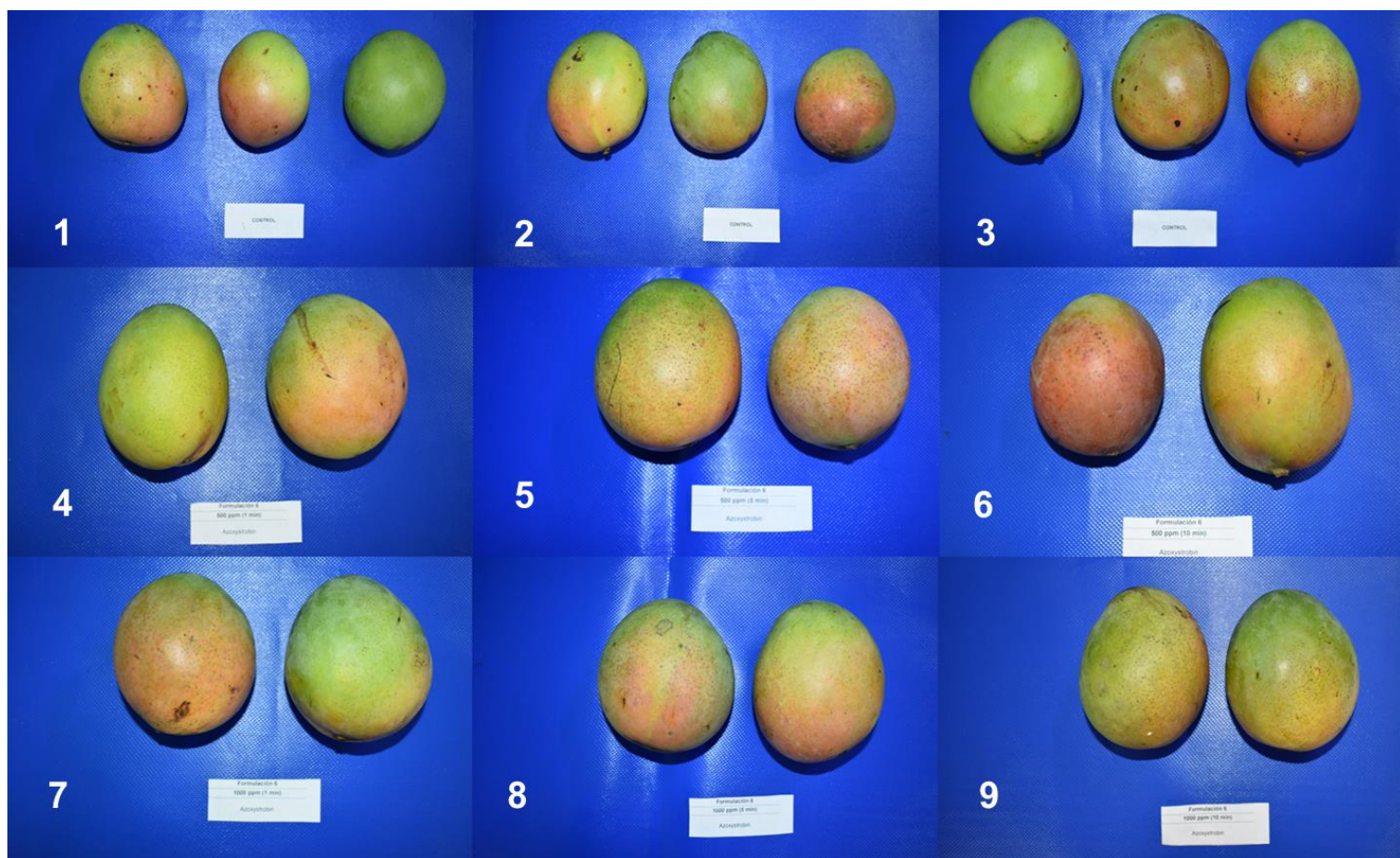


Figure 8. "Keitt" mango fruits treated with the formulations: Water (control fruits) at 1, 5 and 10 min immersion (1-3); AZ1 (Azoxystrobin) at 500 ppm in 1, 5 and 10 min immersion (4-6); AZ2 (Azoxystrobin) at 1000 ppm in 1, 5 and 10 min immersion (7-9).