

## REDUCING SUNBURN INCIDENCE IN MD2 PINEAPPLE USING CHEMICAL PRE-HARVEST TREATMENT TO OVERCOME POST-HARVEST LOSSES IN MALAYSIA

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### ABSTRACT

Pineapple has been identified as a new source of wealth and occupies third place in the world tropical fruits production after bananas and mangos respectively. Pineapple variety MD2 now is the most popular variety where it is being traded globally and occupied 50%-55% of world market mainly due to its excellent taste, sweetness, attractive golden flesh, golden skin color, lifespan, ripeness and its perfect cylindrical shape. While the pineapple industry is growing rapidly, post-harvest losses seems to be one of factors slowing it down and sunburn incidence are one of them. In Malaysia, during strong sunlight time often leads to severe fruit sunburn incidence rate up to 50%. An experiment has been conducted at Kluang, Johor (3rd Agro-climatic zone) which is pre-harvest treatment using chemical; T1 (water only), T2 (Calcium foliar), T3 (Boron foliar) and T4 (Calcium+Magnesium+Boron mixed foliar). Results show that, T4 is the best treatment which only 2% sunburn incidence rate with highest fruit total soluble solids (TSS) score 22°brix and 2,302 grams total fruit weight followed by T2, T3 and T1 with the results 15% sunburn incidence with 20°brix and 2,093 grams total weight fruit, 25% sunburn incidence with 19°Brix and 1,719 total fruit weight, and lastly 50% sunburn incidence with 17°Brix and 1,614 grams total fruit weight respectively. Therefore, pre-harvest treatment using chemical foliar mixture of Calcium, Magnesium and Boron are suggested but further research have to be conducted at different agro-climatic zone to confirm that this treatment can be apply to every agro-climatic zone in Malaysia.

Key words: MD2 pineapple, pre-harvest treatment, sunburn, chemical foliar, agro-climatic zone

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## INTRODUCTION

Pineapple has been identified as a new source of wealth and occupies third place in the world tropical fruits production after bananas and mangos respectively. Pineapple variety MD2 now is the most popular variety where it is being traded globally and occupied 50%-55% of world market mainly due to its excellent taste, sweetness, attractive golden flesh, golden skin color, lifespan, ripeness and its perfect cylindrical shape. While the pineapple industry is growing rapidly, post-harvest losses seems to be one of factors slowing it down and sunburn incidence are one of them. In Malaysia, during strong sunlight time often leads to severe fruit sunburn incidence rate up to 50%.

MD2 pineapple is the highest demand pineapple in the world and even in Malaysia alone, 20 tonnes of fresh MD2 pineapple is needed for export every week. However, the main constraints faced are the quality of the fruit and the aesthetic value of the fruit which is damaged due to injuries such as sunburn and mechanical injuries during transportation from the farm to the factory and packaging area as well as during storage. This is due to the physiological characteristics of MD2 pineapple which is thin and less dense. The use of Calcium element is to strengthen the cell wall which is more focused on strengthening the skin of the fruit. The Boron element is to compress the fruit and the Magnesium (Mg) is required for a range of plant functions that are directly linked to production, transportation, and utilization of photoassimilates and the mitigation of stress factors in plants such as heat and high radiation stress. All these significant effects of magnesium ultimately affect crop productivity and quality.

Our industries players need an instant solution to overcome their post-harvest losses and one of the causes are sunburn incidence. Because of sudden changes in climate, sunburn incidence on MD2 pineapple fruit increase to more than 50% and if we can solve this problem our country income could increase dramatically and pineapple industries development in Malaysia can rapidly develop. Because by solving the post-harvest losses of pineapple fruits will increase export numbers for pineapple especially MD2 variety.

## MATERIALS AND METHODS

1. Pineapple plants that have even growth and even flowering were chosen to avoid errors of different sizes and maturity of fruit because fruit injury due to sunburn is affected by surface area and fruit ripening maturity.
2. Pre-harvest treatment foliar application was carried out on 100 days after flowering induction pineapple plant or more precisely at the stage of the complete flowering phase.
3. Pre-harvest treatment was done by using an 18-liter knapsack sprayer in the early morning before 9 am to prevent the treatment material from being evaporated by the sunlight. The application of each treatment was done 3 times every 3 weeks interval.
4. Meteorological data such as rainfall distribution, sunlight distribution, wind speed, temperature, and humidity during the study period were taken to see the influence of weather to the study.

## RESULTS AND DISCUSSION

Hypothesis of this experiment is to reduce sunburn incidence on MD2 pineapple fruit. From the table below, treatment that showed the lowest sunburn incidence is pre-harvest treatment T4 using Calcium+Magnesium+Boron (CaMgB) foliar. The result shows sunburn incidence for T4 (CaMgB foliar) is only 2% compared to control (T1) with 50% sunburn incidence (Table 1). Followed by treatment T2 (Calcium foliar) and T3 (Boron foliar) with the results 15% and 25% sunburn incidence respectively. From this result we confirm that application of Calcium, Magnesium and Boron can reduce the sunburn incidence from 50% to only 2% because as we mention before the function of Calcium, Magnesium and Boron element are for strengthen the cell wall which is more focused on strengthening the skin of the fruit, strengthen the fruit's immune system during storage to prevent the onset of diseases and pests and compress the fruit respectively.

Table 1. Effect of different chemical pre-harvest treatment to sunburn incidence on MD2 pineapple

Treatment	Flowering (%)	Fruiting (%)	Sunburn incidence (%)
T1 = Water (control)	100	100	50
T2 = Calcium foliar	100	100	15
T3 = Boron foliar	100	100	25
<b>T4 = CaMgB foliar</b>	<b>100</b>	<b>100</b>	<b>2</b>

Apart from the sunburn incidence assessment of MD2 pineapple fruit, to determine the best treatment, physical quality data is also very important to ensure that the application of pre-harvest treatment has a positive effect on the physical quality of the fruit rather than a negative effect. This can be assessed from the results of the study in table 2. Four types of chemical pre-harvest treatments were examined to obtain the best fruit physical quality of MD2 pineapple. Based on Table 2, T4 (CaMgB foliar) significantly showed the highest total weight (2,302 grams) and the highest fruit weight without crown (1,920 grams). Followed by T2, T3, and T1 with the results 2,093 grams total weight and 1,730 grams fruit weight without crown, 1,719 grams total fruit weight and 1,360

grams fruit weight without crown, 1,614 grams total fruit weight and 1,250 grams fruit weight without crown respectively. Treatment 4 also gives the longest fruit length 17.4cm compared to T2, T3, and T1 with results 16.8cm, 14.6cm, and 13.0cm respectively. From table 2 also we can conclude that chemical pre-harvest treatment only affected fruit either total fruit weight, fruit weight without crown, and fruit length.

Table 2. Effect of different chemical pre-harvest treatment to fruit physical quality of MD2 pineapple

Treatment	Fruit weight (g)	Fruit length (cm)	Fruit width (cm)	Crown weight (g)	Crown length (cm)	Crown width (cm)	Total weight (g)
T1 = water (control)	1250	13.0	12.8	364	25.2	15.2	1614
T2 = Calcium foliar	1730	16.8	13.8	363	25.0	14.0	2093
T3 = Boron foliar	1360	14.6	13.4	359	23.0	13.8	1719
<b>T4 = CaMgB foliar</b>	<b>1920</b>	<b>17.4</b>	<b>14.0</b>	<b>382</b>	<b>24.2</b>	<b>15.0</b>	<b>2302</b>

After sunburn incidence assessment and physical quality assessment, to determine the best chemical pre-harvest treatment, fruit nutrient quality is the most important observations to ensure that the best treatment will give us the best quality of fruit. Total soluble solids (TSS) usually used to determine the best quality of taste. Therefore, from table 3 treatment T4 shows the highest TSS (22°Brix) and followed by T2, T3, and T1 with the result 20°Brix, 19°Brix, and 17°Brix respectively. While total titratable acidity (TTA) and ascorbic acid are not significantly different. Table 3 also shows calcium, magnesium and boron element that occurs in the fruit nutrient quality slightly high in T4 than others. It means, all the elements absorbed by the fruit and effected the TSS reading.

Table 3. Effect of different chemical pre-harvest treatment to fruit nutrient quality of MD2 pineapple

Treatment	TTA (%)	TSS (°Brix)	Ca (mg/100g cm)	Mg (mg/100g cm)	B (mg/100g cm)	Ascorbic acid (mg/100g)
T1 = water (control)	0.46	17	5.98	11.52	0.01	42.03
T2 = Calcium foliar	0.47	20	23.12	13.44	0.13	42.69
T3 = Boron foliar	0.47	19	14.55	13.84	0.27	44.00
<b>T4 = CaMgB foliar</b>	<b>0.46</b>	<b>22</b>	<b>22.65</b>	<b>18.24</b>	<b>0.23</b>	<b>44.72</b>

## CONCLUSION

From this experiment, one chemical pre-harvest treatment has been identified as the best pre-harvest treatment to reduce sunburn incidence on MD2 pineapple and all at once overcome post-harvest losses. Results show that, T4 is the best treatment which only 2% sunburn incidence rate with highest fruit total soluble solids (TSS) score 22°brix and 2,302grams total fruit weight followed by T2, T3 and T1 with the results 15% sunburn incidence with 20°brix and 2,093grams total weight fruit, 25% sunburn incidence with 19°Brix and 1,719 total fruit weight, and lastly 50% sunburn incidence with 17°Brix and 1,614grams total fruit weight respectively. Therefore, pre-harvest treatment using chemical foliar mixture of Calcium, Magnesium and Boron are suggested but further research have to be conducted at different agro-climatic zone to confirm that this treatment can be apply to every agro-climatic zone in Malaysia. By reducing sunburn incidence on MD2 pineapple fruits will increase export numbers and eventually will develop pineapple industries rapidly because by reducing sunburn incidence means reducing of post-harvest losses rate and increasing MD2 fresh fruit production rate.

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