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INFLUENCE OF PRE HARVEST APPLICATION OF HEXANAL AND SALICYLIC ACID AT DIFFERENT STORAGE TEMPERATURES ON FRUIT QUALITY AND SHELF LIFE OF STRAWBERRY (*FRAGARIA ANANASSA*) CV. WINTER DAWN

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ABSTRACT

The experiment entitled "Influence of pre harvest application of Hexanal and Salicylic acid at storage temperatures on fruit quality and shelf life of strawberry (*Fragaria ananassa*) cv. Winter Dawn" was carried out at Dr. YSRHU-College of Horticulture, Andhra Pradesh during the year 2023-24. The experiment was laid out in a factorial completely randomized design (FCRD) with three replications consisting of ten treatment combinations having two factors *viz.*, pre harvest chemicals spray at five levels (P_1: Control (Tap water), P_2: Hexanal @ 2mM, P_3: Hexanal @ 4mM, P_4: Salicylic acid @ 2mM and P_5: Salicylic acid @ 4mM and different storage temperatures at two levels (S_1: 3 ºC temperature and S_2: 6 ºC temperature). Results were significant among the treatment combinations for shelf life, fruit qualities The maximum shelf life (20.33 days), less physiological loss in weight (4.53%), TSS (8.17 ºBrix), maximum ascorbic acid content (45.26mg/100g), less total anthocyanin content (56.64 mg/100g), more phenolic content (282.33 mg GE/100g) and highest antioxidant activity (63.64 % DPPH Inhibition) were recorded in fruits sprayed with 4mM Hexanal and stored at 6 ºC temperature on 12th days of storage. Hence, pre harvest application of Hexanal @ 4mM followed by 6 ºC storage temperature could be the best to enhance fruit quality and shelf life of strawberry.

***Key words*: Strawberry, Shelf life, Fruit quality, Hexanal, Temperature.**

Introduction

Strawberry (*Fragaria ananassa*) is one of the most liked fruits in the world due to its pleasant color, shape and aroma. Strawberries are vital source of many health promoting nutritious compounds such as proteins, vitamins, organic acids, phytonutrients like anthocyanins and antioxidant compounds. Strawberry has ranked as top sources of phenolics and have 2-10 times higher phenolic conent than other fruits (Giampieri *et al.*, 2012). The antioxidants and polyphenolic compounds in strawberries can be useful in curing various types of cancers, cardiovascular diseases. Though the strawberry has very high demand from health aspect, it has shelf life only upto 4-5 days at normal room temperature. Fruits are highly perishable. Moreover, loss in fruit quality exaggerates due to high cellular metabolic activities and sensitivity to fungus such as *Botrytis cinerea* that cause gray mold (Munoz *et al.*, 2006). Chemical treatments like Hexanal and Salicylic acid could be used to preserve the quality attributes and shelf life of fruits.

Hexanal, a GRAS chemical of eco-friendly nature, is produced during the lipoxygenase pathway and released from plants during tissue damage (Paliyath *et al.*, 2008 and Mohan *et al.*, 2017). It is an has an imperative role in extending the freshness of fruits and vegetables through the inhibition of the enzyme phospholipase-D (PLD) (Paliyath and Murr, 2007). Salicylic acid (SA) is a simple phenolic compound and it is recognized as a plant growth regulator, because of its foliar effects on many plant growth physiological processes (Zavala *et al.*, 2004). It has shown to exhibit a high potential in delaying ripening, quality enhancing and controlling post-harvest losses (Asghari and Aghdam, 2010). It is related to inhibition of ethylene in ripening process of fruit (Benati *et al*., 2021). Hence, for extending the postharvest life and fruit quality of strawberry, it was proposed to conduct the experiment.

Material and Methods

The experiment was laid out in a factorial completely randomized design (FCRD) with three replications consisting of ten treatment combinations having two factors *viz*., pre harvest chemicals spray at five levels P_1: Control (Tap water), P_2: Hexanal @ 2mM, P_3: Hexanal @ 4mM, P_4: Salicylic acid @ 2mM and P_5: Salicylic acid @ 4mM and different storage temperatures at two levels (S_1: 3°C temperature and S_2: 6°C temperature). Pre harvest application of chemicals were done two times at 15 and 7 days before harvest.

Preparation of Hexanal Formulation

Stock hexanal formulation was prepared by mixing pure hexanal (1% V/V), geraniol (1%), α- tocopherol (1% W/V), ascorbic acid (1% W/V) and tween 20 (10% V/V) (Plate 3.3). The final volume was prepared upto 100 ml with distilled water. 0.2 ml of stock hexanal solution was dissolved in 1 litre water prior to spraying to provide hexanal concentration of 2mM/0.02 % EFF (Enhanced Fresh Formulation). Similarly, 0.4 ml of stock hexanal solution was dissolved in 1 liter water prior to spraying to provide hexanal concentration of 4mM/0.04 % EFF (Enhanced Fresh Formulation) (Paliyath *et al*., 2010).

Preparation of different concentrations of Salicylic acid

276.24 mg of salicylic acid was dissolved in 1litre of 0.1N NaoH to give strength of 2 mM SA solution and 552.48 mg of salicylic acid was dissolved in 1litre of 0.1N NaoH to give strength of 4 mM SA solution. The powdered form of salicylic acid does not dissolve in water so firstly, it was dissolved in 0.1N NaoH solution (Kaviani *et al*., 2012).

Shelf life (Days)

Shelf life of fruits was determined by recording the number of days fruits remained in good condition. Fifty percent decay incidence indicated the end of shelf life of each treatment.

Physiological loss in weight (%)

The weight of the fruits in each treatment was recorded at four days interval and subtracted from the initial weight (recorded before the application of treatment). The loss of weight in grams in relation to initial weight was calculated and expressed as percentage by using formula (Bakshi *et al*., 2014).

$$\text{Physiological loss in weight (\%)} = \frac{\text{Initial weight (g) - Final weight (g)}}{\text{Initial weight (g)}} \times 100$$

Total soluble solids (°Brix)

Fruits were squeezed smoothly for juice extraction. The juice was used for determining the total soluble solids by using "digital refractometer" with 0-32 range. The values were expressed as degree brix. The refractrometer was thoroughly cleaned with distilled water after recording each observation.

Ascorbic acid content (mg/100g)

Ascorbic acid content of fruit samples was determined by 2,6- dichlorophenol indophenol visual titration method described by Ranganna (1986).

Total Anthocyanin content (mg/100g)

The anthocyanin was extracted and estimated by the method of Lees and Francis (1972). 1 gram fruit was blended in 10 ml ethanolic HCL (95% ethanol and 1.5 N HCL in 85:15 ratio) with the help of pestle mortar. It was then transferred in 50 ml conical flask by using 10 ml ethanolic HCL for washing. The solution was stored in dark overnight at 4. Then the solution was filtered with Whatman No. 1 paper. The bottle and residue on filter paper were washed repeatedly with ethanolic HCL and the volume was made up to 100 ml. It was again stored in dark for 2 hrs. O.D. is taken at 535 nm.

$$\text{Total Anthocyanin (mg/100g)} = \frac{\text{O.D. Dilution} \times \text{Total volume made up}}{\text{Weight of the Sample} \times e} \times 100$$

Where,

e = 98.2 (absorbance of solution containing 0.1 mg/ ml anthocyanin)

Total Phenolic content (mg GE/100g)

Phenols were estimated according to the procedure given by Malik and Sing (1980). One gm of sample was crushed in 10 ml of 80 % ethanol and centrifuged for 15 minutes at 10,000 rpm. To 0.1 µl of supernatant, 2.9 ml of water was added, followed by 0.5 ml of 0.2 N Folin-ciocalteau reagent and incubated for 5 minutes at room temperature followed by addition of 2ml of 20 % Na_2Co_3. Vortexed to mix the sample thoroughly and left for 60 min at dark and absorbance was taken at 760 nm. The total phenol content was expressed in mg of gallic acid equivalents (mg GE/100g) of extract.

Antioxidant activity (%)

The percentage of 2,2-diphenyl-1- picrylhydrazyl (DPPH) radical scavenging activity of the samples was

Table 1: Influence of pre harvest application of chemicals and storage temperatures on Shelf life of strawberry cv. Winter Dawn.

Treatment Combinations	Shelf life (Days)
Control (Tap water) + 3º C temperature (P1S1)	11.00
Control (Tap water) + 6º C temperature (P1S2)	11.66
Hexanal 2mM + 3º C temperature (P2S1)	15.33
Hexanal 2 mM + 6º C temperature (P2S2)	17.00
Hexanal 4mM + 3º C temperature (P3S1)	15.66
Hexanal 4mM + 6º C temperature (P3S2)	20.33
Salicylic acid 2mM + 3º C temperature (P4S1)	15.33
Salicylic acid 2mM + 6º C temperature (P4S2)	15.66
Salicylic acid 4mM + 3º C temperature (P5S1)	15.33
Salicylic acid 4mM + 6º C temperature (P5S2)	15.66
S Em ±	0.394
CD at 5 %	1.163

determined by a method described by Eghdami and Sadeghi (2010). 0.1 ml of methanolic fruit sample was mixed with 3.9 ml of a 25 mg/L methanolic solution of DPPH. 4 ml of DPPH solution was used as control and pure methanol was used as blank. The mixture was vortexed thoroughly for one minute and stored at 37! for 30 minutes in dark and then the spectrophotometer absorbance was read against blank at 517 nm.

DPPH free radical scavenging activity (%) was calculated by using the following formula.

$$\text{\% DPPH inhibition activity} = \frac{A_{517nm}\text{ of control} - A_{517nm}\text{ of sample}}{A_{517nm}\text{ of control}} \times 100$$

A = Absorbance

Results and Discussion

Shelf life

Significant results were recorded for shelf life among the treatments (Table 1 and Fig. 1). The highest shelf life (20.33 days) was observed in fruits treated with Hexanal @ 4mM and stored at 6ºC temperature which was eight days more compared to control followed by Hexanal @ 2mM and storage temperature 6ºC (17.00 days) whereas, the least shelf life of 11.00 days was observed in control. Hexanal application induced a clear reduction in the transcript level of two Phospholipase D genes and other key enzymes involved in cell wall degradation and indicated that ripening in strawberry is associated with the expression of specific genes and the modulation of this gene expression by hexanal supports its role in increasing the fruit shelf-life (El Kayal *et al*., 2017). The results are in concord with the results of Paliyath *et al*., (2010) in sweet cherry, Misran *et al*., (2015) in strawberry.

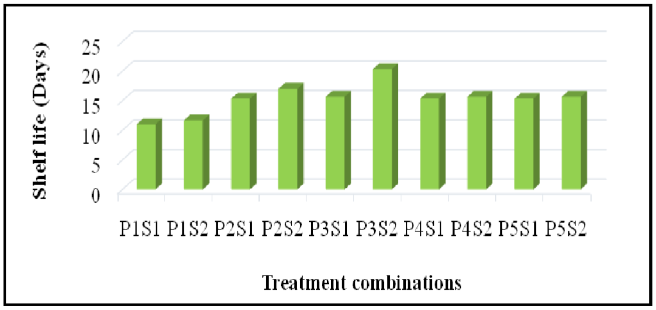

Fig. 1: Influence of pre harvest application of chemicals and storage temperatures on Shelf life of strawberry cv. Winter Dawn.

Table 2: Influence of pre harvest application of chemicals and storage temperatures on Physiological loss in weight (%) of strawberry cv. Winter Dawn.

Treatment Combinations	4th day	8th day	12th day
Control (Tap water) + 3ºC temperature (P1S1)	3.25	6.35	9.23
Control (Tap water) + 6ºC temperature (P1S2)	3.22	5.25	7.21
Hexanal 2mM + 3ºC temperature (P2S1)	2.98	4.95	7.01
Hexanal 2 mM + 6ºC temperature (P2S2)	2.15	2.74	4.75
Hexanal 4mM + 3ºC temperature (P3S1)	2.64	3.45	5.72
Hexanal 4mM + 6ºC temperature (P3S2)	1.90	2.45	4.53
Salicylic acid 2mM + 3ºC temperature (P4S1)	2.92	4.74	6.89
Salicylic acid 2mM + 6ºC temperature (P4S2)	2.77	3.65	5.83
Salicylic acid 4mM + 3ºC temperature (P5S1)	2.94	4.84	6.94
Salicylic acid 4mM + 6ºC temperature (P5S2)	2.84	3.66	5.87
S Em ±	0.006	0.010	0.016
CD at 5 %	0.018	0.030	0.048

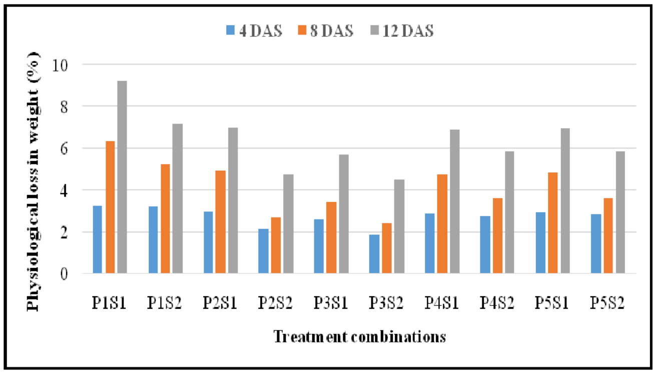

Fig. 2: Influence of pre harvest application of chemicals and storage temperatures on Physiological loss in weight (%) of strawberry cv. Winter Dawn.

Table 3: Influence of pre harvest application of chemicals and storage temperatures on Total soluble solids (ºBrix)of strawberry cv. Winter Dawn.

Treatment Combinations	4th day	8th day	12th day
Control (Tap water) + 3ºC temperature (P1S1)	7.50	8.36	7.92
Control (Tap water) + 6ºC temperature (P1S2)	7.46	8.36	7.88
Hexanal 2mM + 3ºC temperature (P2S1)	7.38	7.86	8.32
Hexanal 2 mM + 6ºC temperature (P2S2)	7.14	7.69	8.18
Hexanal 4mM + 3ºC temperature (P3S1)	7.16	7.73	8.13
Hexanal 4mM + 6ºC temperature (P3S2)	7.12	7.67	8.17
Salicylic acid 2mM + 3ºC temperature (P4S1)	7.27	7.79	8.28
Salicylic acid 2mM + 6ºC temperature (P4S2)	7.18	7.76	8.23
Salicylic acid 4mM + 3ºC temperature (P5S1)	7.33	7.82	8.30
Salicylic acid 4mM + 6ºC temperature (P5S2)	7.24	7.76	8.24
S Em ±	0.019	0.006	0.025
CD at 5 %	0.056	0.017	0.074

Table 4: Influence of pre harvest application of chemicals and storage temperatures on Ascorbic acid content (mg/100g) of strawberry cv. Winter Dawn.

Treatment Combinations	4th day	8th day	12th day
Control (Tap water) + 3ºC temperature (P1S1)	46.20	42.96	37.46
Control (Tap water) + 6ºC temperature (P1S2)	46.60	43.12	38.23
Hexanal 2mM + 3ºC temperature (P2S1)	46.82	44.14	41.24
Hexanal 2 mM + 6ºC temperature (P2S2)	49.23	46.72	43.74
Hexanal 4mM + 3ºC temperature (P3S1)	49.23	46.22	43.24
Hexanal 4mM + 6ºC temperature (P3S2)	50.24	48.42	45.26
Salicylic acid 2mM + 3ºC temperature (P4S1)	48.18	45.18	42.16
Salicylic acid 2mM + 6ºC temperature (P4S2)	48.52	45.60	42.58
Salicylic acid 4mM + 3ºC temperature (P5S1)	47.84	44.15	41.45
Salicylic acid 4mM + 6ºC temperature (P5S2)	48.20	45.45	42.42
S Em ±	0.032	0.019	0.006
CD at 5 %	0.094	0.056	0.017

Physiological loss in weight (%)

Overall, there was loss of weight in all the treatments after storage (Table 2 and Fig. 2). At the end of the experiment, fruits sprayed with Hexanal @ 4mM and stored at 6ºC temperature significantly recorded least weight loss (4.53%) followed by fruits sprayed with Hexanal @ 2mM and stored at 6ºC temperature (4.75%). However, the maximum loss was recorded by control (9.23%). Loss in weight of fruits was increased with increase in storage period. It might be due to continuous moisture loss during storage. Moisture loss occurs through transpiration and respiration which affects the saleable weight and makes unfit for consumers (Salunkhe and Desai, 1984). Fruits treated with hexanal recorded minimum loss in weight which might be due to retardation effect in respiration and transpiration. The results are in the line with the findings of Preethi *et al*., (2018) in mango, Gangwar *et al*., (2012) in aonla.

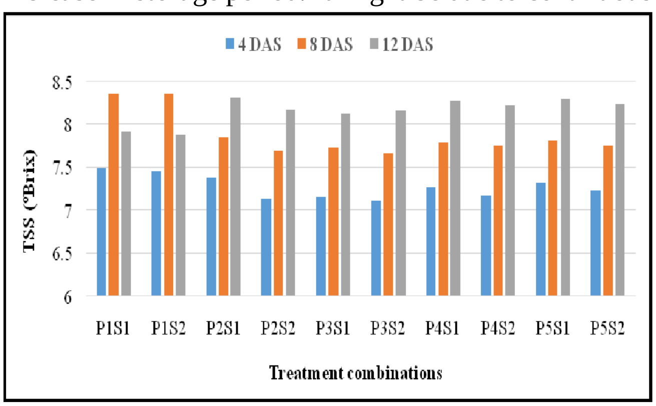

Fig. 3: Influence of pre harvest application of chemicals and storage temperatures on Total soluble solids (ºBrix) of strawberry cv. Winter Dawn.

Total Soluble Solids (ºBrix)

The results revealed that TSS increased in all treated fruits with increase in storage period except control where it increased rapidly at 8th day and then decreased (Table 3 and Fig. 3). At the end of the experiment, the lowest TSS 7.88 ºBrix was recorded in control. It might be due to complete consumption of sugars for respiration hence recorded the least shelf life. The highest TSS 8.32 ºBrix was found in fruits treated with hexanal @ 2mM and stored at 3ºC temperature. Increase in TSS is due to water loss or conversion of organic acids into sugars. Futher, decline in TSS means use of sugars as primary source of energy for respiration. Chemical sprayed treatments recorded slow increase in TSS could be due to slow metabolic process. The results are in conformity with the findings of Salari *et al*., (2012) in strawberry,

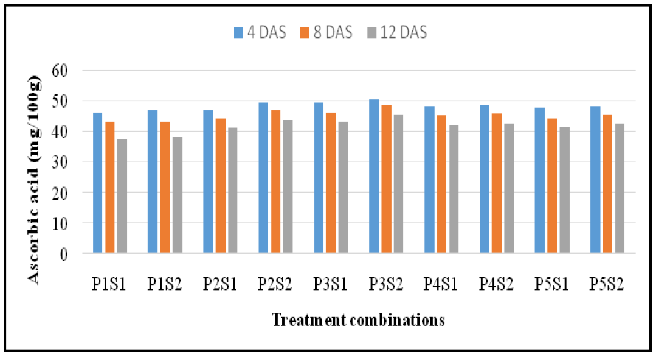

Fig. 4: Influence of pre harvest application of chemicals and storage temperatures on Ascorbic acid content (mg/100g) of strawberry cv. Winter Dawn.

Upadhyaya and Dixit (1996) in aonla and Rajesh *et al.*, (2014) in guava.

Ascorbic acid content (mg/100g)

There was a significant effect of treatments for ascorbic acid content during the entire storage period (Table 4 and Fig. 4). At the end of experiment, the highest ascorbic acid 45.26 mg/100g was recorded in fruits treated with Hexanal @ 4mM and stored at 6ºC temperature (P_3S_2) followed by Hexanal @ 2mM at same temperature of 43.74 mg/100g and the lowest ascorbic acid of 37.46 mg/100g was recorded in control. Ascorbic acid conent of fruits was gradually decreased with increase in storage period. It might be due its utilization during the process of respiration. It is also antioxidative in nature where it may be used for free radicals scavenging. Ascorbic acid undergoes oxidation and converts into dehydroascorbic acid in the presence of ascorbate oxidase enzyme (Mapson, 1970). Hexanal treated fruits recorded maximum ascorbic acid content which might be due to its role in delaying of enzyme acitivity which converts ascorbic acid into dehydroascorbic acid and also retards transpiration and respiration rates. The results are in the line with the findings of Karlidag *et al.*, (2009) and Salari *et al.*, (2012) in strawberry.

Total Anthocyanin content (mg/100g)

There was significant effect of treatments on total anthocyanin content of strawbery fruits (Table 5 and Fig. 5). At 4th, 8th and 12th day of storage the lowest anthocyanin content of 40.21 mg/100g, 48.12 mg/100g and 56.64 mg/100g was recorded respectively in fruits treated with Hexanal @ 4mM + 6ºC temperature followed by Hexanal @ 2mM + 6ºC temperature and the highest anthocyanin content of 44.42 mg/100g, 56.16 mg/100g and 74.76 mg/100g was recorded in control. Total anthocyanin content of fruits was increased gradually with increase in storage period in all treatments. It might be due to gradual ripening and senescence of fruits.

Table 5: Influence of pre harvest application of chemicals and storage temperatures on Total Anthocyanin content (mg/100g) of strawberry cv. Winter Dawn.

Treatment Combinations	4th day	8th day	12th day
Control (Tap water) + 3ºC temperature (P1S1)	44.42	56.11	74.76
Control (Tap water) + 6ºC temperature (P1S2)	44.40	56.20	73.98
Hexanal 2mM + 3ºC temperature (P2S1)	42.48	50.84	60.72
Hexanal 2 mM + 6ºC temperature (P2S2)	40.24	48.55	56.68
Hexanal 4mM + 3ºC temperature (P3S1)	40.32	48.45	56.72
Hexanal 4mM + 6ºC temperature (P3S2)	40.21	48.12	56.64
Salicylic acid 2mM + 3ºC temperature (P4S1)	42.36	50.74	60.53
Salicylic acid 2mM + 6ºC temperature (P4S2)	42.33	50.43	60.34
Salicylic acid 4mM + 3ºC temperature (P5S1)	42.45	50.76	60.68
Salicylic acid 4mM + 6ºC temperature (P5S2)	42.34	50.62	60.49
SEm ±	0.006	0.030	0.160
CD at 5 %	0.017	0.091	0.473

Hexanal treated fruits recorded the lowest anthocyanin content at the end of the experiment. It might be because hexanal suppressed ripening process with slow pigment synthesis and also acts as a gas barrier thus modifying the internal atmosphere in the fruits (high level of CO_2 and low level of O_2) and this in turn may retard the biochemical reaction leading the anthocyanin synthesis. The results are supported by the findings of Tzoumaki *et al.*, (2009) in asparagus, Perez and Sanz (2001) and El Ghaouth *et al.*, (1991) in strawberry.

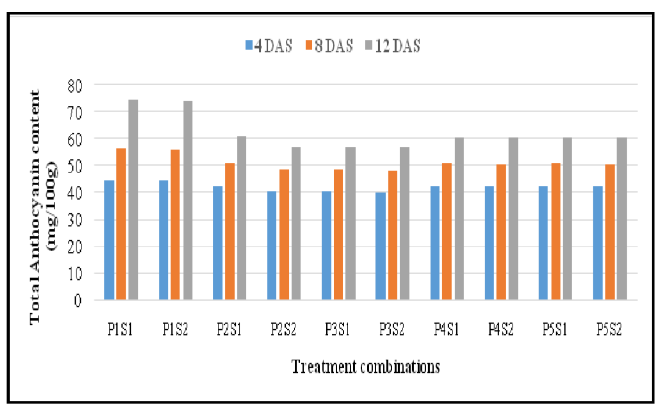

Fig. 5: Influence of pre harvest application of chemicals and storage temperatures on Total Anthocyanin content (mg/100g) of strawberry cv. Winter Dawn.

Table 6: Influence of pre harvest application of chemicals and storage temperatures on Total Phenolic content (mg GE/100g) of strawberry cv. Winter Dawn.

Treatment Combinations	4th day	8th day	12th day
Control (Tap water) + 3ºC temperature (P1S1)	287.66	281.66	254.33
Control (Tap water) + 6ºC temperature (P1S2)	289.33	283.33	253.33
Hexanal 2mM + 3ºC temperature (P2S1)	293.00	282.00	259.00
Hexanal 2 mM + 6ºC temperature (P2S2)	308.00	298.33	281.66
Hexanal 4mM + 3ºC temperature (P3S1)	299.66	289.00	268.33
Hexanal 4mM + 6ºC temperature (P3S2)	310.00	300.33	282.33
Salicylic acid 2mM + 3ºC temperature (P4S1)	293.00	284.33	262.33
Salicylic acid 2mM + 6ºC temperature (P4S2)	295.00	286.66	267.00
Salicylic acid 4mM + 3ºC temperature (P5S1)	293.00	284.00	261.00
Salicylic acid 4mM + 6ºC temperature (P5S2)	294.00	286.00	264.33
S Em ±	0.658	0.816	1.054
CD at 5 %	1.942	2.409	3.110

Table 7: Influence of pre harvest application of chemicals and storage temperatures on Total antioxidant activity (% DPPH Inhibition) of strawberry cv. Winter Dawn.

Treatment Combinations	4th day	8th day	12th day
Control (Tap water) + 3ºC temperature (P1S1)	70.31	56.43	48.32
Control (Tap water) + 6ºC temperature (P1S2)	70.98	56.45	49.14
Hexanal 2mM + 3ºC temperature (P2S1)	71.94	64.17	60.16
Hexanal 2 mM + 6ºC temperature (P2S2)	75.25	68.18	63.62
Hexanal 4mM + 3ºC temperature (P3S1)	74.56	67.12	61.61
Hexanal 4mM + 6ºC temperature (P3S2)	76.28	68.24	63.64
Salicylic acid 2mM + 3ºC temperature (P4S1)	71.98	64.35	60.20
Salicylic acid 2mM + 6ºC temperature (P4S2)	72.16	64.54	60.24
Salicylic acid 4mM + 3ºC temperature (P5S1)	71.97	64.26	60.18
Salicylic acid 4mM + 6ºC temperature (P5S2)	72.12	64.52	60.22
S Em ±	0.349	0.316	0.330
CD at 5 %	1.030	0.933	0.972

Total Phenolic content (mg GE/100g)

Results pertaining to the total phenolic content of strawberry fruits treated with various chemicals were significant and presented in (Table 6 and Fig. 6). At 4th, 8th and 12th day of storage the highest phenolic content of 310.00 mg GE/100g, 300.33 mg GE/100g and 282.33 mg GE/100g was recorded respectively in fruits treated with Hexanal @ 4mM stored at 6ºC temperature followed by Hexanal @ 2mM and the lowest phenolic content of 287.66 mg GE/100g, 281.66 mg GE/100g and 254.33 mg GE/100g was recorded in control at 3ºC temperature respectively. Total phenolic content of fruits decreased gradually with increase in storage period in all the treatments. Phenolic compounds are antioxidative in nature and it might be used to to neutralize various free radicals and reactive oxygen species. Hexanal treated fruits recorded the highest phenolic content which might be because hexanal increased phenylalanine ammonia lyase (PAL) activity which results in increase of various phenolic compounds like pelargonidin-3-glucoside, pelargonidin-3- malonylglucoside (Azizah *et al*., 2014).

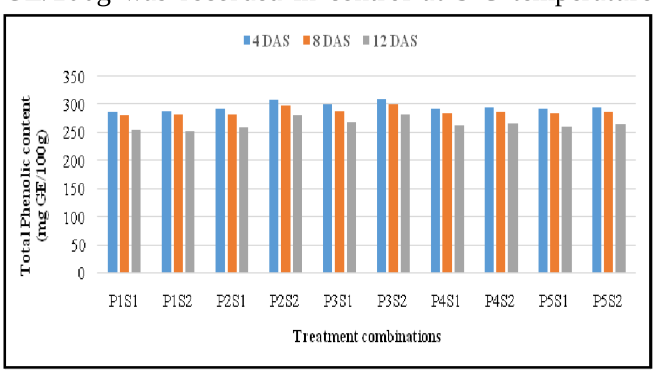

Fig. 6: Influence of pre harvest application of chemicals and storage temperatures on Total Phenolic content (mg GE/100g) of strawberry cv. Winter Dawn.

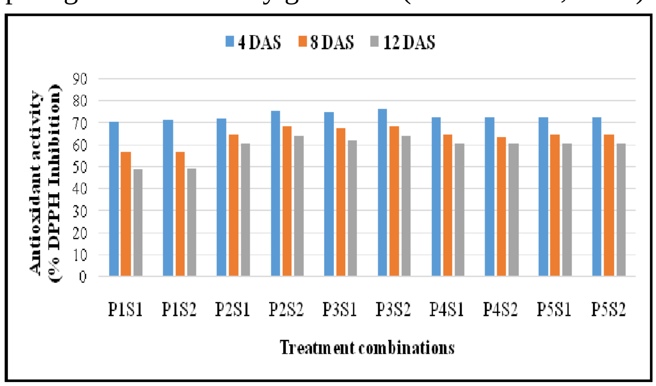

Fig. 7: Influence of pre harvest application of chemicals and storage temperatures on Total antioxidant activity (% DPPH Inhibition) of strawberry cv. Winter Dawn.

Our results are in agreement with Ali *et al*., (2021a) in strawberry, Gill *et al*., (2016) in guava.

Total antioxidants (% DPPH Inhibition)

The data (Table 7 and Fig. 7) registered on total antioxidants was significantly influenced by all the treatments. At 4th, 8th and 12th day of storage the highest antioxidants of 76.28%, 68.24% and 63.64% was recorded respectively in fruits treated with Hexanal @ 4mM stored at 6ºC temperature followed by Hexanal @ 2mM at 6ºC temperature. The lowest antioxidants of 70.31%, 56.43% and 48.32% was recorded in control at 3 ºC storage temperature on 4th, 8th and 12th day of storage respectively. All treatments significantly influenced the total antioxidants of strawberry during storage. A decrease in total antioxidants was observed with subsequent storage intervals. However, hexanal treatment was conducive for higher retention of antioxidants till storage. This might be due to the higher Superoxide Dismutase (SOD) enzyme activity that is triggered by hexanal and also the resulting higher retention of total phenols. Cheema *et al.*, (2018) have also demonstrated enhanced SOD activity in bell pepper due to exogenous hexanal application that is further manifested by higher phenols and higher total antioxidants activity.

Conclusion

In conclusion, Hexanal @ 4mM can be used as pre harvest spray with 6ºC storage temperature to enhance the fruit quality and shelf life of strawberry by conserving variou quality attributes such as physiological loss in weight, firmness, total soluble solids, total sugars, ascorbic acid content, total anthocyanin content, total phenolic content and total anioxidant activity. Hexanal also exihibated antifungal and antibiotic properties and hence prohibited the gray mold disease. Hence, pre harvest spray of hexanal @ 4mM and 6ºC storage temperature is recommended for fruit quality enhancement and shelf life extension of strawberry fruits.

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