

EFFECT OF POST-HARVEST APPLICATION OF DIPHENYLAMINE ON STORAGE LIFE AND QUALITY OF PUNJAB BEAUTY PEAR

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ABSTRACT: The study was conducted to assess the effect of antioxidant on post-harvest quality of pear fruits cv. Punjab Beauty with treatments of DPA (500, 1000 and 1500 ppm) during storage. After treatment the fruits were packed in corrugated fibre board (CFB) cartons and then stored in cold storage at 1-3°C temperature with 90-95% RH for 45, 60 and 75 days. The observations revealed that pear fruits treated with higher concentration of DPA i.e. 1500 ppm recorded lowest physiological loss in weight, spoilage losses, core browning and fruit colour degradation. Same concentration of diphenylamine (DPA) maintained higher fruit firmness, TSS, reducing sugars and acidity throughout storage period. With the prolongation of storage period physiological loss in weight (PLW%), spoilage percentage, core browning, fruit colour degradation, total soluble solids and reducing sugars followed an upward and acidity showed downward trend. Diphenylamine treated fruits could be cold stored for 75 days in CFB cartons with lowest weight loss, spoilage and better fruit quality. Fruits under control showed higher spoilage and shriveling due to loss of weight and firmness.

Keywords : Pear, post-harvest treatments, quality, diphenylamine

Pears are among the most popular fruits in the world. Pear stands next after apples as the important tree fruit in the world, grown in all the continents of the world. There are over 3000 varieties of pears grown around the world. About 72% of all commercially cultivated species of genus *Pyrus* are native to Asia. They are an excellent source of fibre and a good source of vitamin C and K. Pears are free from sodium, fats, and cholesterol and are packed with energy producing natural sugars, potassium, copper, boron and healthy carbohydrates to promote proper organ function.

The pears are economically grown in the states like Jammu, lower hills of Himachal Pradesh, Punjab, Haryana and Uttarakhand. In Punjab, area under low-chilling pears is increasing due to release of a new semi-soft pear cv. Punjab Beauty. Punjab Beauty pear fruits mature in the third week of July, when temperature and humidity are high, which interferes with post-harvest quality and marketability of the fruits. Pear fruits are capable of developing good dessert quality upon ripening only when they are harvested at proper maturity. Pear fruit harvested with improper maturity are more susceptible to physiological disorders and have a shorter storage-life. Immature pear fruit are more susceptible to superficial scald, shriveling and friction discolouration while over mature fruits tend to have higher incidence of core breakdown and CO₂ injury (Mellenthin and Wang, 8). Physical

changes and complex physiological reactions in pears depend upon fruit temperature. During storage, the tissue continues to respire and transpire during different metabolic processes, and loses a significant quantity of moisture and other chemical ingredients.

Diphenylamine (DPA) is commercially used in America and Europe on apple and pear cultivars as postharvest treatment against core browning and scald. DPA not only helpful in reducing weight loss, spoilage losses and core browning but also maintain fruit firmness, fruit colour and organoleptic rating (Singh, 9). Wax coatings containing diphenylamine (DPA) antioxidant in apples and pears significantly reduced rates of respiration, ethylene production, greener fruits and improved its external appearance (Farooqi and Hall, 4). In order to prevent the glut in the market and to curtail the post-harvest losses, quality storage of fruits is necessary. Therefore, efficacy of diphenylamine (DPA) on internal quality of Punjab Beauty pear grown under Punjab conditions was studied in order to improve its market quality and storage.

MATERIALS AND METHODS

The present studies were conducted at Department of Horticulture, Punjab Agricultural University, Ludhiana during session 2006 and 2007. Disease free fruits of pear cv. Punjab Beauty having uniform shape and size were harvested on 15th July

from New Orchard and post-harvest dip treatment in diphenylamine at three concentrations (500, 1000 and 1500 ppm) for 5 minutes was given. For the treatment as control, distilled water was used similarly as treated ones. Treatments were replicated thrice employing

Fruit firmness

The fruit firmness receded continuously with the storage days (Table 1). It was higher at the time of storage and decreased significantly after that up to 75 days where it was in low range. Among the different

Table 1: Effect of diphenylamine on physiological loss in weight and firmness of Punjab Beauty pear fruits.

Treatments	Physiological loss in weight (%)				Fruit firmness kg/Force				
	45 days	60 days	75 days	Mean	0 days	45 days	60 days	75 days	Mean
Control	2.63	4.44	6.79	4.62	6.0	4.50	4.05	3.42	3.99
DPA 500ppm	1.34	2.94	5.49	3.26	-	4.80	4.37	3.73	4.30
DPA 1000ppm	0.50	2.10	4.39	2.33	-	4.92	4.44	4.04	4.46
DPA 1500ppm	0.26	1.33	4.14	1.91	-	5.13	4.76	4.26	4.71
Mean	1.18	2.70	5.20		-	4.84	4.40	3.86	
CD (P=0.05)	Treatment (T): 0.81 Storage Interval (SI): 0.70 T x SI: NS				Treatment (T): NS Storage Interval (SI): 0.6 T x SI: NS				

RBD factorial design. Two kg of fruits for each replication were packed in Corrugated Fibre Board (CFB) cartons and these cartons were placed in cool chamber at 1-3°C and 90-95 per cent RH. After 45, 60 and 75 days of storage interval fruits were taken out for physical and biochemical observations. Physiological loss in weight (PLW), and spoilage and core browning were calculated on per cent basis. The fruit firmness was recorded with the help of 'Penetrometer' after removing about one square inch of skin from shoulder of the fruit and pressure reading was taken in Kg per square inch. TSS was determined with the hand refractometer and acidity by titrating the juice against 0.1 per cent NaOH by using phenolphthalein indicator and expressed as per cent maleic acid. The reducing sugar contents were determined by method of Lane and Eynon (AOAC, 1).

RESULTS AND DISCUSSION

Physiological Loss in Weight

The application of diphenylamine significantly influenced the physiological loss in weight (PLW) of Punjab Beauty pear fruits (Table 1). PLW was significantly low after 45 days of cold storage whereas highest PLW was recorded after 75 days of storage. PLW was recorded with 1500 ppm DPA after 45 days of storage, which was significantly lower than control and found at par with DPA 1000 ppm and DPA 500 ppm. Similar findings have also been advocated by Farooqi and Hall (4) and Asrey *et al.* (2) who noticed the reduction of weight loss with coatings containing DPA and 1-MCP, respectively.

treatments, DPA 1500 ppm was found better in maintaining fruit firmness throughout the storage period and it was found at par with DPA 1000 ppm, whereas sharp decline in fruit firmness was recorded in control. Results are in confirmation with the findings of Mahajan and Chopra (7) in apple fruits. Higher fruit firmness in Kinnow mandarin due to 1-MCP treatment (Asrey *et al.*, 2) is in conformity with present study.

Fruit spoilage

The spoilage of fruits progressed gradually during storage as a results of different treatments and storage intervals (Table 2). Spoilage was lowest after 45 days while highest after 75 days of storage. Diphenylamine (1500 ppm) proved effective lowering the spoilage of fruits as compare to control. Drake *et al.* (3) also reported that in D'Anjou pears packed in boxes with ETH and Cu paper wraps developed less decay and scald than pears in polyethylene bags. Jawandha *et al.* (5) had also concluded that storage rot in Kinnow fruits can be reduced with boric acid (3%) + LDPE packaging treatment.

Core browning

Different treatments effected significantly with regard to core browning (Table 2). No core browning was observed in DPA (1500 ppm and 1000 ppm) treated fruits during cold storage. However core browning was occurred in fruits treated with DPA 500 ppm and control fruits. While considering days of storage intervals, no browning was recorded after 45 days in all the treatments. Fruits under control showed

Table 2 : Effect of diphenylamine on spoilage (%) and organoleptic rating of Punjab Beauty pear fruits.

Treatments	Spoilage (%)				Core browning (%)			
	45 days	60 days	75 days	Mean	45 days	60 days	75 days	Mean
Control	2.62	4.45	6.30	4.46	0	2.11	3.44	1.85
DPA 500 ppm	1.20	2.45	5.33	3.00	0	0	1.4	0.47
DPA 1000 ppm	0.00	2.23	4.25	2.16	0	0	0	0
DPA 1500 ppm	0.00	1.69	2.94	1.54	0	0	0	0
Mean	0.96	2.71	4.71		0	0.53	1.21	
CD (P=0.05)	Treatment (T): 0.37 Storage Interval (SI): 0.32 T x SI: 0.65				Treatment (T): 0.89 Storage Interval (SI): 0.77 T x SI: 0.35			

more browning percentage after 90 days of storage. The results are in accordance with findings of Kupferman and Gtuzwiler (6) where reported that shield DPA 2000 ppm and ethoxyquin 2700 ppm is effective to control the internal browning (IB) in Anjou Pear.

Total Soluble Solids

An examination of the data (Table 3) clearly shows the effect of storage time and treatments on TSS contents of Punjab Beauty pear fruits. TSS level of cold

Acidity was recorded at lower level after 75 days of storage and at higher after 45 days of cold storage. Effect of different treatments on acidity level was recorded maximum in the fruits dipped in DPA 1500 ppm followed by fruits treated with DPA 1000 ppm (0.301), however acidity was lowest (0.287%) in fruits under control after 75 days of storage. Apple fruits given dip treatment with DPA 1500 ppm + Frutox wax (6%) showed higher titratable acidity as compared to the untreated fruits (Mahajan and Chopra, 7).

Table 3 : Effect of diphenylamine on TSS (%) and acidity (%) of Punjab Beauty pear fruits.

Treatments	TSS (%)					Acidity (%)				
	0 days	45 days	60 days	75 days	Mean	0 days	45 days	60 days	75 days	Mean
Control	12.8	12.5	13.1	13.6	13.0	0.324	0.317	0.283	0.234	0.215
DPA 500ppm	-	12.7	12.5	13.5	13.5	-	0.338	0.312	0.268	0.232
DPA 1000ppm	-	12.3	12.7	13.3	13.0	-	0.344	0.320	0.296	0.244
DPA 1500ppm	-	12.1	12.4	13.1	13.1	-	0.347	0.331	0.308	0.268
Mean	-	12.4	12.7	13.4	13.1	-	0.336	0.311	0.276	0.240
CD (P=0.05)	Treatment (T): NS Storage Interval (SI): 0.31 T x SI: 0.54					Treatment (T): NS Storage Interval (SI): 0.21 T x SI: 0.37				

stored fruits varied significantly when analyzed after different storage intervals (after 45, 60 and 75 days.) Different treatments showed their non-significant effect with regard to TSS. The level of TSS was lowest in fruits dipped in DPA 1500 ppm, DPA 1000 ppm and DPA 500 ppm while highest in control fruits. Singh (9) also observed that DPA 1500 ppm treated pear fruits showed higher TSS content as compared to the control.

Titration acidity

The titration acidity (Table 3), measured in terms of total maleic acid content in the juice, showed a descending trend as the storage period advanced.

Reducing sugars

The data with respect to reducing sugars content recorded under various treatments and days of storage in pear fruits stored at cool temperature shows a steep increase up to 60 days and started decrease (Table 4). The high range of reducing sugar contents were recorded in fruits dipped in DPA 1500 and 1000 ppm. The lowest reducing sugars were recorded in fruits under control after 75 days of cold storage. The higher level of sugars in these treatments might be due to retained respiratory breakdown of polysaccharides. Singh (9) had advocated the similar findings in Patharnakh pear fruits.

Table 4: Effect of diphenylamine on reducing sugar content of Punjab Beauty pear fruits.

Treatments	Days of storage				
	0 days	45 days	60 days	75 days	Mean
Control	7.54	5.68	6.40	5.95	5.28
DPA 500 ppm	-	5.51	6.05	6.46	5.37
DPA 1000 ppm	-	5.44	5.86	6.55	5.65
DPA 1500 ppm	-	5.38	5.86	6.59	5.74
Mean	-	5.50	6.04	6.39	5.51
CD (P=0.05)	Treatment (T) : NS Storage Interval (SI) : 0.36 T x SI: 0.65				

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