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RESEARCH PAPER

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Study on pre-cooling treatments for extending ripening in mango (*Mangifera indica* L.) cv. KESAR

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● ABSTRACT ●

Pre-cooling is one of the important treatment in entire cold supply chain of fruits. It is not only removing the field heat but also enhance the shelf life by slowing down the metabolic activity of fruit during storage and ripening. The mango fruits cv. Kesar were harvested at its maturity stage (specific gravity 1.00-1.02) with 1 cm pedicel followed by desapping. The fruit were pre-cooled as per treatments at 6, 8, 10 and 12^{0}C for 2, 5 and 8 hour time combinations with subsequent storage at ambient condition (25-35^{0}C ± 2^{0}C and 60-80 ± 2% RH) along with control (without pre-cooling). 8^{0}C temperature pre-cooling of Kesar mango for 8 hours was found to be the most significant as compared to other treatments. The treatment tended to reduce the weight loss and total soluble solids which helped in increasing the shelf life of Kesar mango.

KEY WORDS : Kesar-mango, Pre-cooling, Shelf-life, Storage, Temperature

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● INTRODUCTION ●

Mango (*Mangifera indica* L.) is grown almost in 87 countries around the world but, this fruit occupies a unique place among the different fruit crops grown in India. Mango belongs to family Anacardiaceae genus *Mangifera* and is reported to contain 41 species in 793 countries (Kalra *et al*., 1995). Many efforts have been made to enhance fruit production and area under cultivation but, no systematic work has been made for post harvest handling of the produce of India, which is resulting in 20 to 30 per cent post harvest losses. The loss is due to the lack of proper infrastructure facilities like packing house for sorting, grading pre-cooling and packing of the harvest produce, non availability of commercial low temperature store houses, lack of cool chain during transport and storage (Krishnamurthy and Rao, 2001). Reduction of these losses both quantitatively and qualitatively could be achieved by proper post harvesting cold supply chain management. Shelf life of mango fruit is one of the most important aspects of marketing. It influenced considerably by fruit maturity and storage environment. Most of the work on storage of mango has been carried out at cold storage conditions. However, pre-cooling is the first most important treatment in entire cold supply chain management of fruits, because it not only remove the field heat but also increase the shelf-life of fruits. The individual effect of pre-cooling on increase in shelf life of fruits needs to be evaluated. Therefore, an experiment was planed at Centre of Excellence on Post Harvest Technology, NAU, Navsari to identify the best pre-cooling temperature-time combination for extending the shelf life of Kesar mango fruit at ambient storage.

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● MATERIALS AND METHODS ●

The experiment was laid out in Completely Randomized Design (CRD) with two repetitions and thirteen treatments. The fruits of mango cv. KESAR were harvested with the help of Dapoli improved mango harvester (*Vedi*) in the morning hours from farmer's field. Fully matured fruits (specific gravity 1.00-1.02) were uniform in size and shape, free from any bruising and mechanical injury were selected from harvested lots and carried in the carats to the Centre of Excellence on Post Harvest Technology, Navsari Agricultural University, Navsari and cleaned by washing under cold tap water

then wiped with muslin cloth. The without pre-cooled Kesar mango was considered as controlled treatment. Initial weight of fruits were recorded and placed in different carats, which were kept in pre-cooling room at 6, 8, 10 and 12^{0}C for 2, 5 and 8 hours combinations for pre- cooling. The temperature probe of sensor was inserted up to the core of fruit. Two fruits from each repetition were randomly selected at a time for physic-chemical analysis. Analysis was done at an interval of five days up to twenty days of ambient storage as described by Ranganna (1979). The recorded data were analyzed using statistical software and values compared with table value at 5% C.V. for significance of results.

● RESULTS AND DISCUSSION ●

The results are tabulated in Table 1 as average value of two repetitions and same is discussed here under. The results showed that the minimum physiological loss in weight (PLW) of Kesar mango was recorded (21.59%) when fruits are pre-cooled at 8^{0}C temperature for 8 hours (T_7). Moreover, other treatments comprising the pre-cooling treatments also showed lower physiological loss in weight as compared to control (T_1). Results after 20 days storage indicated that the treatment with 8 hrs. pre-cooling time has shown significantly low PLW compared to 2 and 6 hrs at same pre-cooling temperature. The fruits treated with pre-cooling showed lower weight loss due to reduction in rate of respiration and metabolic activity as well delaying in ripening due to restricted ethylene bio-synthesis process through methionine in the fruits. Similar observations were also recorded by Kapse (1993) and Puttaraju and Reddy (1997) in mango.

The mango fruit cv. KESAR, pre-cooled at 8^{0}C temperature for 8 hours (T_7) registered minimum total soluble solids (19.35%) after 5th days onwards up to 20th days of ambient storage during experiment period. The slower increment in TSS was also showed under treatment T_7 (Pre-cooling at 8^{o}C for 8 hours) for entire storage periods as compared to other treatments. Slower increment in TSS is might be due to pre-cooling immediately after the harvest reduced field heat from the fruit which restricted respiratory activities. Similar trend was also observed by Puttaraju and Reddy (1997), and Kapse (1993) in mango and Deshmukh *et al.* (2010) in sapota.

The initiation of ripening process was found to be slower in mango fruits cv. KESAR (after 11.50 days) when

Table 1: Effect of pre-cooling on changes in physiological loss in weight (%), total soluble solids (%), days for ripening and shelf-life (days) of mango fruits cv. Kesar during storage at ambient temperature

Treatments	Physiological loss in weight (%) (Days)				Total Soluble Solids (%) (Days)				Days for ripening	Shelf-life (days)
	5	10	15	20	5	10	15	20		
T_1	4.98	9.29	21.31	0.00	11.65	15.80	18.25	21.45	9.71	12.19
T_2	4.26	8.21	20.70	0.00	11.08	14.34	17.00	19.48	10.33	13.70
T_3	5.07	7.75	17.57	22.75	11.15	14.60	17.35	19.90	10.96	14.80
T_4	5.15	6.97	17.27	21.80	11.45	15.60	17.72	21.25	11.32	15.07
T_5	4.36	8.16	20.11	0.00	11.10	14.35	17.21	20.05	10.46	15.20
T_6	5.13	7.30	17.48	22.55	11.23	14.80	17.45	20.25	11.18	15.62
T_7	5.23	6.79	16.71	21.59	11.07	14.30	16.90	19.35	11.50	16.49
T_8	4.53	8.16	18.07	23.45	11.12	14.45	17.27	19.49	10.65	15.22
T_9	4.23	7.65	17.50	22.59	11.21	14.74	17.34	20.13	11.07	15.49
T_{10}	4.51	6.81	17.17	21.72	11.53	15.71	18.24	21.25	11.42	15.87
T_{11}	4.25	7.89	17.58	22.80	11.13	14.50	17.33	20.15	10.81	15.27
T_{12}	4.70	7.69	17.55	22.70	11.20	14.65	17.38	20.17	11.00	15.37
T_{13}	4.62	7.25	17.28	22.37	11.42	15.50	17.53	21.17	11.25	15.56
C. D. (P=0.05)	NS	0.97	0.85	0.87	NS	0.52	0.76	0.52	0.87	1.84
C. V. %	6.91	5.83	2.16	2.34	1.39	1.62	2.00	1.19	3.68	5.67

Treatment details-

T_1 Without pre-cooling
T_2 Pre-cooling of mango at 6^{0}C for 2 hours
T_3 Pre-cooling of mango at 6^{0}C for 5 hours
T_4 Pre-cooling of mango at 6^{0}C for 8 hours
T_5 Pre-cooling of mango at 8^{0}C for 2 hours
T_6 Pre-cooling of mango at 8^{0}C for 5 hours
T_7 Pre-cooling of mango at 8^{0}C for 8 hours
T_8 Pre-cooling of mango at 10^{0}C for 2 hours
T_9 Pre-cooling of mango at 10^{0}C for 5 hours
T_{10} Pre-cooling of mango at 10^{0}C for 8 hours
T_{11} Pre-cooling of mango at 12^{0}C for 2 hours
T_{12} Pre-cooling of mango at 12^{0}C for 5 hours
T_{13} Pre-cooling of mango at 12^{0}C for 8 hours

pre-cooled at 8^0C for 8 hours (T_7). The slower rate of ripening might be due to rapid removal of field heat from mango fruits resulted in reduction in the respiration activity of fruit, as well as restricted rate of ethylene bio-synthesis process. Similar observations were also recorded by Shah (1995), Puttaraju and Reddy (1997) and Padhye (1997) in mango and Deshmukh *et al.* (2010) in sapota.

In case of shelf life, the data revealed that the mango fruits were pre-cooled at 8^0C temperature for 8 hours (T_7) recorded maximum (16.49 days) shelf-life. Other treatments persisting different pre-cooling temperatures and duration had also been delayed ripening of mango fruits as compared to control (T_1). The extension of shelf-life of mango fruits through pre-cooling treatments might be due to the reduction in field heat, restricted metabolic and respiratory activities and inhibition in water loss and reduction in ethylene bio-synthesis process in fruits. These results are in agreement with the results of Joshi *et al.,* (1993) and Kapse (1993) in mango.

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