

Morphological Studies on Physical Changes in Apple Fruit after Storage at Room Temperature

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ABSTRACT

The investigations were carried out on five apple varieties viz., Golden Delicious, Mashhadi, King Amri, Kalakulu and Amri to study the effect of ordinary storage at room temperature in the month of September at two weeks interval. The physical analysis consisted of colour, general appearance and weight loss. During first two weeks of storage, there was no change in colour and then it was changed gradually. During first two weeks the skin of fruits remained tight, firm, soft and attractive while during remaining four weeks of storage, it became loose and shriveled in all apple varieties. Storage showed significant effect on weight losses. The highest weight loss was (19.2%) in Amri and less weight loss was observed (16.3%) in Kalakulu during six week storage at room temperature.

Key Words: *Malus sylvestris*; Apple; Storage; Colour; Weight loss; General appearance

INTRODUCTION

The Apple (*Malus sylvestris*) is one of leading fruits which is being grown in temperate regions of the world. Its beautiful appearance, crispy flesh, pleasant flavour and sweet taste attracts the consumers and fetches high price. In Pakistan apples are only grown in temperate regions of the country such as Murree hills (Rawalpindi), part of Peshawar region, Northern areas, Kashmir and Quetta. Despite of multifarious problems, the apple growers obtain a phenomenal profit which leads to ultimate efforts for increasing the fruit production. There is a gradual weight loss in different varieties of apple during storage. Ferrao and Ferrao (1965) reported that fruit colour did not change appreciably except in Rome Beauty without refrigeration. Dzonova *et al.* (1970) attributed that when regular determination were made for the weight, dry matter, sugar, soluble acid and ascorbic acid contents, flavour and aroma of Jonathan apple, weight loss during storage condition were highest in Golden Delicious and lowest in Red Delicious. Sinn (1979) stated that firmness of apple fruit was reduced with fruit ripeness and length of storage and was related to cell size and breakdown of protopectins in older cell walls. Wills *et al.* (1980) reported that there was decrease in flesh firmness during storage of Delicious apples at 5-10°C or 20°C. Neves (1984) revealed that weight loss in different varieties of apple depends upon relative humidity, temperature and evaporation. Similarly various apple varieties contain different characteristic e.g. colour, size, general appearance etc. Scalzo *et al.* (2003) argued that the cultivar 'Gala' has a good aroma when ripe but loses flavour during storage.

Apple fruit is mainly harvested during the month of August and September and maximum fruit is supplied to the

market during these two months and growers do not get proper price during these days due to glut of fruit in the market. To get the fair price and to keep it in the edible condition without hampering its availability throughout the year, this fruit has to be stored in ordinary and cold storage conditions. The apple fruit has a good potential for storage under favourable conditions, especially in Kashmir and Murree hills where the natural cold storage facilities are present due to low temperature. The purpose of present studies was to investigate the physical changes that occur during storage at room temperature.

MATERIALS AND METHODS

The fruit of five apple varieties viz., Golden Delicious, Mashhadi, King Amri, Kalakulu and Amri were randomly harvested at full maturity from Rawalakot, Dirkot and Azad Kashmir. The fruit was then brought to the Post Graduate Research Laboratory, Institute of Horticultural Sciences, University of Agriculture Faisalabad. The fruit of each variety was divided in four samples and kept in storage periods i.e. fresh, two weeks, four weeks and six weeks intervals. Each sample comprised of five fruits which was used for Physical analysis to find out the storage effect on keeping quality of fruit at room temperature. Data was collected on three physical parameter i.e. colour, general appearance and weight loss.

RESULTS

Effect on general appearance. The general appearance of fruit was observed visually. At the initial stage of storage the fruit had tight, firm and soft skin in all apple varieties. According to the observation it is clear that changes in

general appearance of fruit occur with the increase in storage period. During first two weeks of storage, the fruits of all varieties maintained their general appearance while during remaining four weeks the appearance of fruit changed. In king Amri, the skin of fruit became loose and shriveled at the end of fourth week and remained as such during six week storage period. In Mashhadi, the skin of fruit became loose and shriveled at the end of fourth week of storage period. However, no change in general appearance was observed during six week storage period. The skin of fruit became loose and shriveled at the end of fourth week in Kalakulu variety during storage. In Amri, the skin of fruit become loose at the end of fourth week and later on there was no effect of storage. Same way after fourth week, skin of Golden Delicious became loose, shriveled and remained as such upto six weeks. Similar behavior was showed by Amri (Table I).

Effect on colour. Visual observations were made for determination of colour after different periods and compared with standard colour charts. The apple fruit of different varieties have different colours. In Kalakulu as the storage period increased, the colour of fruit changed from pale yellow to deep yellow in first two week storage and remained as such throughout six weeks storage life. In king Amri variety, colour of fruit changed from dark reddish to carnet brown reddish. In Mashhadi, colour of the fruit changed from red strips on greenish surface to light reddish. In Amri variety of apple colour of the fruit changed from deep red to carnet brown red. In golden delicious fruit colour changed from yellow to yellowish during first two weeks of storage and remain unchanged throughout six weeks storage at room temperature in all varieties (Table II). These results were confirmed by the findings of Golding *et al.* (2003).

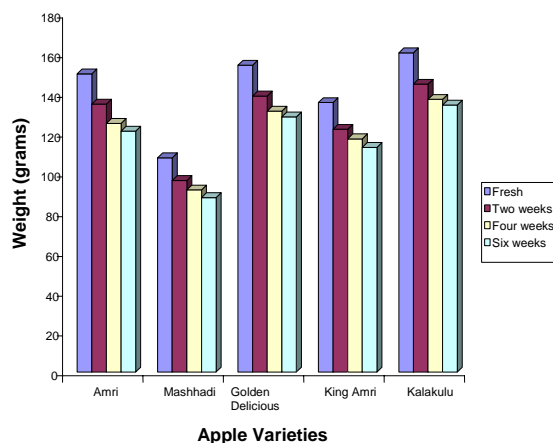
Effect on the weight loss percentage. Storage periods showed a significant effect on the weight loss in apple fruit. The highest weight loss (19.2%) was observed in Amri, followed by 18.6% in Mashhadi and 16.8% in Golden Delicious and less weight loss 16.6% in King Amri and 16.3% in Kalakuku during six weeks storage. The reduction in weight of fruits was due to transpiration and chemical changes resulting from respiration in the fruit at room temperature.

In six weeks as a whole Amri variety differs from all other varieties because its weight loss was significantly higher as compared to other four varieties. Mashhadi and Golden delicious showed similar behaviour but their weight loss was significantly higher as compared to King Amri and Kalakulu (Fig. 1).

DISCUSSION

Storage period affected the fruit colour significantly. During first two weeks of storage, there was no change in colour but after two weeks colour of fruits was changed gradually upto six weeks. These results collaborated the

Fig. 1. Weight loss in different apple cultivars at room temperature



finding of Ferrao and Ferrao (1965) who argued that the reduction in firmness of texture was slight but definite in all cases during storage. Wills *et al.* (1980) reported that there was a decrease in flesh firmness during storage of Delicious apple at 5-10°C or 20°C. Period of storage showed a significant change on the general appearance of fruit. During first two weeks storage of fruit at room temperature, the skin of fruits remained tight, firm, soft and attractive while during remaining four weeks of storage skin of fruit became loose and shriveled in all apple varieties. These findings confirmed the results of Landfold (1965) who found that in apple fruit, the development of yellow skin was most rapid during storage. Bedabe *et al.*, (1970) investigated the effect of storage on the colour and stated that the skin colour of apple fruit changer during storage. Storage periods exhibited significant effect on weight losses during storage. Highest weight loss was 19.2% in Amri and less weight loss was 16.3% in Kalakulu during six weeks storage at room temperature. These results are in accordance with the studies carried out by Mukerjee and Srivestava (1980), Blanpid (1981) and Langston and Pfunter (1986). Their results revealed that weight loss in different varieties of apple depends upon storage period, temperature, humidity and evaporation.

CONCLUSION

During two weeks storage, the skin of different apple varieties became tight, firm and soft but after four and six weeks storage, skin of the fruit became loose and shriveled. In first two weeks of storage, colour of all varieties remained attractive and then started declining. These result revealed weight loss percentage of fruit directly proportional to the storage interval. It is evident from above results that loss of weight occurred during storage with the passage of time. It could be attributed to loss of moisture from fruit due to respiration and transpiration.

Table I. Effect of different storage periods on general appearance of different apple cultivars at room temperature

Varieties	Fresh	Two weeks	Four weeks	Six weeks
Amri	Skin tight Firm& soft	Skin tight Firm& soft	Skin become Loose&shrivelled	Skin remained Loose&shrivelled
Mashhadi	Skin tight Firm& soft	Skin tight Firm& soft	Skin become Loose&shrivelled	Skin remained Loose&shrivelled
Golden Delicious	Skin tight Firm& soft	Skin tight Firm& soft	Skin become Loose&shrivelled	Skin remained Loose&shrivelled
King Amri	Skin tight Firm& soft	Skin tight Firm& soft	Skin become Loose&shrivelled	Skin remained Loose&shrivelled
Kalakulu	Skin tight Firm& soft	Skin tight Firm& soft	Skin become Loose&shrivelled	Skin remained Loose&shrivelled

Table II. Effect of different storage periods on colour of different cultivars at room temperature

Varieties	Fresh	Two weeks	Four weeks	Six weeks
Amri	Deep red	Carnet brown Reddish	Carnet brown Reddish	Carnet brown Reddish
Mashhadi	Red stripes on Greenish surface	Light Reddish	Light Reddish	Light Reddish
Golden Delicious	Yellow	Yellowish	Yellowish	Yellowish
King Amri	Dark reddish	Carnet brown Reddish	Carnet brown Reddish	Carnet brown Reddish
Kalakulu	Pale yellow	Deep yellow	Deep yellow	Deep yellow

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