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Wrapping Materials and Cold Storage Durations Effect on Dry Matter Content of Plum

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Abstract: Three wrapping materials (kraft paper + straw, kraft paper and news paper) and five cold storage durations (0, 8, 16, 24 and 32-day) were investigated for dry matter content of plum (cv. Shablon) during cold storage at -1°C temperature and 98% relative humidity. The experiment was laid out in Factorial Completely Randomized Design (FCRD) with four replications for each one of factors. The data collected were subjected to Analysis of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT) at 1% probability was performed to compare the means of different treatments. The statistical results of the study indicated that wrapping material and cold storage duration significantly (P = 0.01) affected dry matter content. Results of the study also indicated that dry matter content increased by increasing cold storage duration. In addition, news paper was the best wrapping materials for conserving dry matter content.

Key words: Plum · Wrapping Material · Cold Storage Duration · Dry Matter Content

INTRODUCTION

A plum (*Prunus domestica*) is a drupe fruit of the genus *Prunus*. Fruits are usually of medium size, between 1 to 3 inches in diameter, globose to oval. The flesh is firm, juicy and mealy. The fruit's peel is smooth, with a natural waxy surface that adheres to the flesh. The fruit has a single large seed. Plum fruit tastes sweet and/or tart; the skin may be particularly tart. It is juicy and can be eaten fresh or used in jam-making or other recipes. Plums come in a wide variety of colors and sizes. Some are much firmer-fleshed than others and some have yellow, white, green or red flesh, with equally varying skin color [1]. Plums are produced around the world and China is the world's largest producer. The ten largest producers of plums are China, Romania, USA, Serbia, Chile, France, Iran, Turkey, Italy and India. Iran products nearly about 269,139 tons of plum and is ranked 7th in the world [2, 3].

Methods that are being used to preserve whole fruits and vegetables during storage and marketing are generally based on refrigeration with or without control of composition of the atmosphere [4, 5]. However, temperature, atmosphere, relative humidity and sanitation must be regulated to maintain quality of them [6, 7]. In this direction, several methods that have been used are refrigeration, controlled atmosphere packaging, modified atmosphere packaging and chemical preservatives [8-10]. The most prevalent method is rapid cooling at a low temperature with high relative humidity [11]. However, low temperature storage is not economically feasible in most developing countries [5, 12].

Moreover, coatings, films and wrapping materials are effective in reducing desiccation (moisture loss), but are subject to microbial growth and disposal problems [10, 13]. Many years of research are conducted to develop a material that would cover fruit so that an internal modified atmosphere would develop [14, 15].

In this paper, the effect of wrapping material and cold storage duration on dry matter content of plum (cv. Shablon) during cold storage at -1°C temperature and 98% relative humidity is reported.

MATERIALS AND METHODS

Plant Materials: Plums (cv. Shablon) were purchased from a local market in Karaj, Iran. They were visually inspected for freedom of defects and blemishes. Plums were then wrapped in different wrapping materials (kraft paper + straw, kraft paper and news paper),

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placed in plastic boxes and stored in cold storage at -1°C temperature and 98% relative humidity for 0, 8, 16, 24 and 32 days.

Dry Matter Content: The dry matter content of plums was determined using the equation (1):

$$\text{Dry matter content (\%)} = 100 \times M_2/M_1 \quad (1)$$

where,
M_1 = Mass of sample before drying, g
M_2 = Mass of sample after drying, g

Statistical Analysis: The experiment was laid out in Factorial Completely Randomized Design (FCRD) with three wrapping materials (kraft paper + straw, kraft paper and news paper) and five cold storage durations (0, 8, 16, 24 and 32-day) at -1°C temperature and 98% relative humidity with four replications for each one of factors. The effect of the factors on dry matter content was determined by analysis of variance (ANOVA) using SPSS 12.0 (Version, 2003). Also, Duncan's Multiple Range Test (DMRT) at 1% probability was performed to compare the means of different treatments.

RESULTS AND DISCUSSION

Wrapping material and cold storage duration significantly (P = 0.01) affected dry matter content of plum (Table 1). The highest dry matter content of 14.95% was observed in news paper and lowest (14.14%) in kraft paper and wrapping material affected dry matter content in the order of news paper > kraft paper + straw > kraft paper. Also, the highest dry matter content of 16.17% was observed in 32-day and lowest (12.80%) in 0-day and dry matter content increased with increased cold storage duration (Table 2). Moreover, interaction of wrapping material × cold storage duration had no significant effect (P = 0.01) on dry matter content (Table 1). The study of wrapping material and cold storage duration combinations on dry matter content indicated that in each wrapping material, dry matter content had the highest value in 32-day and the lowest value in 0-day. In addition, the maximum mean value for dry matter content (16.70%) was observed in 32-day of news paper and the minimum mean value for dry matter content (12.80%) was observed in 0-day of three wrapping materials. Furthermore, dry matter content in each wrapping material increased with increased cold storage duration (Table 3). These results are in agreement with those of Mahmoud and Savello [16], Avena-Bustillos *et a*l. [17], Rashidi *et al*. [18] and Rashidi *et al*. [19] who concluded that coatings, films and wrapping materials significantly affected dry matter content. These results are also in line with the results reported by Smith and Stow [4], Baldwin *et al*. [9],

Table 1: Analysis of variance for dry matter content of plum (cv. Shablon)

Source of variation	Degree of freedom	Mean square
Wrapping material	2	3.31 **
Cold storage duration	4	23.2 **
Wrapping material × Cold storage duration	8	0.25 ns
Error	45	0.24
C.V. (%)	---	3.36

** = Significant at 0.01 probability level
ns = Non-significant

Table 2: Means comparison for dry matter content of plum (cv. Shablon) for different studied treatments using DMRT at 1% probability

	Treatment	Dry matter content (%)
Wrapping material	Kraft paper + straw	14.61 b
	Kraft paper	14.14 c
	News paper	14.95 a
Cold storage duration	0-day	12.80 e
	8-day	13.53 d
	16-day	14.80 c
	24-day	15.53 b
	32-day	16.17 a

Means in the same column with different letters differ significantly at 0.01 probability level according to DMRT

Table 3: Means comparison for dry matter content of plum (cv. Shablon) for combinations of wrapping material and cold storage duration using DMRT at 1% probability

Wrapping material × Cold storage duration		Dry matter content (%)
Kraft paper + straw	0-day	12.80 h
	8-day	13.53 gh
	16-day	14.85 de
	24-day	15.58 bcd
	32-day	16.30 ab
Kraft paper	0-day	12.80 h
	8-day	12.98 h
	16-day	14.28 ef
	24-day	15.15 cd
	32-day	15.50 cd
News paper	0-day	12.80 h
	8-day	14.10 fg
	16-day	15.28 cd
	24-day	15.88 bc
	32-day	16.70 a

Means in the same column with different letters differ significantly at 0.01 probability level according to DMRT

Rashidi *et al.* [18], Rashidi *et al.* [19], El Ghaouth *et al.* [20], Bahri *et al.* [21] and Niari *et al.* [22] that dry matter content significantly increased with increased cold storage duration.

CONCLUSION

Wrapping material and cold storage duration significantly (P = 0.01) affected dry matter content of plum. Also, dry matter content increased by increasing cold storage duration. In addition, news paper was the best wrapping materials for conserving dry matter content.

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