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Determination of Some Physico-mechanicaland Nutritional Properties of Jujube (ZizyphusjujubaMill.) Fruitand Recomand ations forits Mechanization

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Abstract: *Inthisstudy, some of thephysico-mechanicalpropertiesandnutritionalvalues for development of sieving systems suitable forpostharvestclassificationprocedure of 3 cultivars of jujubefruit, namelyCoco, ShanxiLiandSugarCane, arediscussed.Forthispurpose, physicalpropertiessuch as length, width, thickness, geometricmeandiameter, sphericity, aspectratio, surfaceareaandmassandnutritionalvaluessuch as humidity, acidity, protein and total sugar of fruitsandstoneweredetermined.*

Keywords: *Jujube, physico-mechanical, nutritionalproperties*

I. Introduction

Jujube (*Zizyphusjujuba*Mill.)plantbelongstoRhamnaceaefamilywhichconsist of 45 species and 550 strains and is usually grown in tropical and sub-tropical regions in the world (Mukhtar *et al*., 2004). As jujube is grown in slopes with dry pebble or stones in its homeland China, it is grown in China, the Dominican Republic, Haiti, India, Iraq, Nigeria, Spain, the southern western part of the US, Afghanistan, Australia and Turkey today. It is raised as natural and closed gardens in Turkey, and grown in West and South Anatolia, in Alanya, Gazipaşa, Büyük Ada, Sinop, GanosMountain (Tekirdağ), Aydın andalso Gümüşsuyu county of Denizli (Ecevit *et al.*, 2002; Karıncalı, 2003; Akbolat*et al.*, 2008; Kavas and Dalkılıç, 2015).Since jujube fruit is quite delicious, it is consumed in food sector, and also because of antitoxin effect and different nutritional elements it contains, it is also used in alternative medicine. Various researchers suggest it forincreasing muscle strength, immunity against illnesses (Immune system resistance), treatment of cancer and gaining weight. It is also prescribed as a tonic to strengthen liverfunctions in China (Chevallier, 1996). When they are 3-4 years old, jujube trees start to yield fruit and it is possible to harvest them every year (Figure 1). Jujube tree has a cylindrical trunk, brown bark and thorny branches. Its leaves consist of 8-11 leaflets which are simple or combined, show opposing or spiral pattern formed by mother lode and with full or toothed edges. There are 2 hard thorns as little thorns with little leafstalks at thedepths of leaves (Anşin and Özkan, 1997; Karıncalı, 2003).

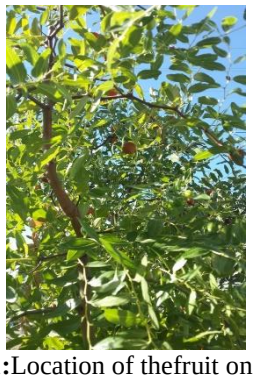

Figure 1: Location of thefruit on thetree

Itsfruitsaresimilartoeleagnus, sweetandjuicy, in shape of an egg, firstly in olive green, then dark red-blackcoloredandsinglestoned (Yaltırık, 1997; Genç, 2005; Yücel, 2005). Importance of jujube fruit, on which many studies and researches are conducted, is gaining momentum in some countries and it is expected to be grown widely as a new fruittype in nearfuture (Possingham 1990). In our country, pursuit of a alternative product is still on agenda. One of these products is jujube. However, in Turkey, there is still no professional orchardist potential in terms of growing jujube. One of the most important reasons of this is that in the regions where it is grown, harvest, sieving-classification and packaging systems do not have a developed mechanization level. With the increase of mechanization possibilities in jujube growing, overcoming laboring problems on

harvest and sieving-classification phases and less effort, jujube growing is believed to have potential of being spread to wide areas. In this study, bytakingsome of thephysico-mechanicalproperties of 3cultivarsof jujubefruitsharvestbyhandfrom Denizli-Gümüşsuyu countyintoaccount, alternatives in respect to improving harvest, sieving and classification mechanization are tried to be provided.

II. Materials And Methods

Main material of thestudyconsists of 3 cultivars of jujubefruits, namelyCoco, Shanxi Li and Sugar Cane, which were harvested by hand duringthe2015 harvestseasonfrom Denizli-Gümüşsuyu county. Following the harvest, jujube fruits were transported to laboratories in cardboard viols in such a way not to be damaged (Figure 2). Fruits were cleared from leaf parts and foreign substances, and the measurements carried out quickly without wasting any time.

Figure 2: Jujube fruits

Thephysico-mechanicalproperties of jujubefruitsandstones were determined by the following methods: Moisture content (%) of the samples was determinedaccordingtothemethods of AOAC (1984). Linear dimensions of fruits as length (*L*), width (*W*) andthicknes (*T*) weremeasuredbyusing a digitalcallipergaugewith a sensitivity of 0.01 mm. The linear dimensions were measured on 100 samples for fruits and 20 samples for stones. The fruit mass was determined with an electronic balance of 0.01 g accuracy.
The aspect ratio (*R*a) of fruits and stones were calculated byusingthefollowingequation (Omobuwajo*et al*., 1999)

$$Ra = \frac{W}{L}100$$

Geometric mean diameter (*D*g) and sphericity (*Q*) were calculated byusingthefollowingequations (Mohsenin, 1986; Jainand Bal, 1997;):

$$D_g = (L \cdot W \cdot T)^{1/3}$$

$$Q = \frac{D_g}{L}$$

Thesurfacearea (*S*) of the fruits and stones were calculatedfromtherelationshipgivenbyBaryeh (2001):

$$S = \pi D g^2$$

Acidity (%), protein (%) and total sugar (%) were determined accordingtothemethods of TS 1125-ISO 750, TS 1620-ISO 1871 and TS 1466-TS 7780, respectively.

III. Results And Discussion

Tables 1 and 2 showsomephysico-mechanicalandnutritionalproperties of the Coco, Shanxi Li and Sugar Cane jujube cultivars. The average length (19.43, 38.63 and 18.18 mm), width (19.41, 35.24 and 17.81 mm), thickness (17.62, 33.17 and 16.47 mm), and geometric mean diameter (18.79, 35.58 and 17.45 mm) of the Coco, Shanxi Li and Sugar Cane fruit varieties, respectively, were recorded in this experiment. The greatest values of dimension of jujube fruits were obtained for Shanxi Li variety. The mean values of sphericity were 0.96 for Coco, 0.91 for Shanxi Li and 0.96 for Sugar Cane fruit varieties. The mean values of fruit aspect ratio for Coco, Shanxi Li and Sugar Cane varieties were 0.99, 0.90 and 0.97 respectively. The mean values of fruit surface area for Coco, Shanxi Li and Sugar Cane varieties were 964.05, 3875.51 and 961.79 mm^2respectively. The mean values of fruit mass were 3.07 for Coco, 21.02 for Shanxi Li and 3.00 for Sugar Cane varieties. The average

length, width, thickness and geometric mean diameter of the Coco, Shanxi Li and Sugar Cane stone varieties were found (13.78, 24.19 and 12.26 mm), (7.01, 10.81 and 7.62 mm), (7.25, 10.58 and 7.57 mm) and (8.86, 14.02 and 8.90 mm) respectively. Mean values of stone sphericity were 0.65 for Coco, 0.58 for Shanxi Li and 0.73 for Sugar Cane varieties. The greatest value of stone surface area was obtained for Shanxi Li variety.

Table 1: Some of thephysico-mechanicalproperties of jujubefruitsandstones

Parameters	Coco			Shanxi Li			Sugar Cane		
	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean
Fruit length (mm)	21.14	16.47	19.43	46.19	33.70	38.63	21.31	15.31	18.18
Fruit width (mm)	21.36	17.38	19.41	45.73	27.41	35.24	20.17	15.26	17.81
Fruit thickness (mm)	21.14	15.03	17.62	43.36	25.77	33.17	17.36	15.12	16.47
Geometric mean diameter (mm)	21.21	16.26	18.79	44.46	28.77	35.58	19.32	15.72	17.45
Fruit sphericity (%)	98.75	93.53	95.70	99.02	85.36	91.35	99.40	90.64	95.56
Fruit aspect ratio	1.00	0.97	0.99	0.97	0.81	0.90	1.00	0.89	0,97
Fruit surface area (mm^2)	1413.70	831.03	964.05	5531.37	2599.67	3875.51	1172.16	776.64	961.79
Mass of fruits (g)	3,85	2,51	3.07	39.96	11.04	21,02	4.39	1.96	3,00
Stone length (mm)	16.15	11.14	13.78	27.02	20.87	24.19	13.83	11.02	12.26
Stone width (mm)	7.62	6.56	7.01	12.39	9.09	10.81	8.04	6.60	7.62
Stone thickness (mm)	8.32	6.41	7.25	12.47	9.33	10.58	8.11	6.85	7.57
Stone geometric mean diameter (mm)	9.49	8.25	8.86	15.27	12.55	14.02	9.40	7.98	8.90
Stone sphericity (%)	76.95	57.98	64.88	66.29	53.11	58.15	79.65	67.96	72.77
Stone aspect ratio	0.68	0.43	0.52	0.54	0.38	0.45	0.72	0.55	0.62
Stone surface area (mm^2)	282.95	213.95	247.08	694.29	494.76	619.47	277.56	199.82	249.50

When nutritionvaluesareexamined, Sugar Canevariety has the highestacidityratio, whileShanxiLivarietyhas thehighesthumidityand protein values. When it comestototal sugarpercentage, Cocovariety has thehighestratio (Table 2).

Table 2: Some nutritional properties of Jujube

Assay	**Coco**	**Shanxi Li**	**Sugar Cane**
Humidity Rate (%)	22.08	26.90	23.72
Acidity (%)	8.9	7.1	9.0
Protein (%)	3.05	3.46	2.35
Total Sugar (%)	48.03	40.5	46.5

IV. Conclusion And Recommandat □ons

In recent years, in Turkey, there have been problems with harvesting and sieving, cleaning, classification and storing in postharvest phase of jujube, which has the potential of becoming an alternative product.Due to existence of thorny leaves near the fruits and elastic structure of branches, justliketheones of eleagnustypetrees, theharvesting person is not able to move freely on the tree during harvest by hand. To overcome this problem, development of harvesters with suitable harvesting criteria can be suggested.In jujube fruits, which are harvested by using stripping by hand or dropping with pole, leaves are found as partial foreign substance. While clearing from these leaves, picking out by hand or tossing in wind methods are used. Jujube growers usually sieve the fruits they harvested and sale them by classifying according to their sizes (Figure 3). All these cleaning, sieving and classification processes are troublesome and time-consuming. Also, since there are differences in the prices of jujube fruits, which have many different sizes and various types, due to size differences, sieving-classification mechanization should be developed and mechanized. Thus, more jujube fruits can be processed fast and easily, and sold from a high price.

Figure 3: Classification of harvestedjujubefruitsbysieves

It is possiblefor foreign substances such as leaves and branches to mix among the harvested fruits. And this decreases market quality of the product. Utilizing from pneumatic type sieving-picking out systems to separate foreign substances in question from the fruit is believed to increase the market quality of the product.
To preserve and store jujube fruits for a long time after these procedures, humidity of the fruit should be decreased under a certain level and the fruit should be dried. For this procedure, the fruits are laid in open air to dry under direct sunlight (Figure 4).

Figure 4: Drying procedure of jujube fruit

Basic parameterstodevelopsuitablesievingsystemsfortheclassification of jujube fruit are discussed in this study. By determining harvest, sieving and drying parameters for the development of jujube cultivation, additional studies in which basic data are obtained are suggested to be conducted.

References

[1]. Mukhtar, H. M., S. H. Ansari, M. Ali and T. Naved. 2004. New compoundsfrom*Zizyphusvulgaris*. *Pharmaceutical Biology*, 42(7): 508-511.
[2]. Ecevit, M.F., Hallaç, F., DilmaçÜnal, T. 2002. DenizliiliÇivrilİlçesiGümüşsuYöresindeYetişmekte Olan Hünnap (ZiziphusjujubaMill.)' ın SeleksiyonYoluylaIslahıÜzerindeAraştırmalar. *TÜBİTAK TOGTAGTARP-1988*, Ankara, 42 S.
[3]. Karıncalı, M. 2003. *ZiziphusjujubaMill*. (Hünnap) BitkisininMorfolojik, Anatomik,EkolojikvePolenÖzelliklerininAraştırılması, *PamukkaleÜniversitesi Fen BilimleriEnstitüsüBiyolojiAnabilim Dalı, YüksekLisansTezi,* Denizli,45 S.
[4]. Akbolat, D., Ertekin, C., Mengeş, H.O., Ekinci, K., Erdal, İ., 2008., Physical and NutritionalProperties of Jujube (*Zizyphusjujuba*Mill.) Growing in Turkey,*AsianJournal ofChemistry*Vol. 20, No. 1 (2008), 757-766.
[5]. Kavas, İ., Dalkılıç, Z., 2015. BazıHünnap Genotiplerinin Morfolojik,Fenolojikve Pomolojik Özelliklerinin Belirlenmesive Melezleme OlanaklarınınAraştırılması, *Adnan Menderes ÜniversitesiZiraatFakültesiDergisi* 2015; 12(1) : 57 - 72
[6]. Chevallier, A., 1996. *The Encyclopedia of Medicinal Plants*, London.
[7]. Anşin, R., Özkan, Z.C. 1997. TohumluBitkiler: (Spermatophyta) OdunsuTaksonlar. S:465-466. *KaradenizTeknik Üniversitesi Basımevi*, Trabzon. 512 S.
[8]. Yaltırık, F., 1997. Ormanve Park Ağaçlarımız, *GenişYapraklılar, Atlas Dergisi*.
[9]. Genç, M., 2005. SüsBitkisiYetiştiriciliği. 1. Cilt, TemelÜretmeTeknikleri. *SüleymanDemirelÜniversitesiYayını*, No. 55, Isparta, S.369.
[10]. Yücel, E., 2005. AğaçlarveÇalılar. S.301, Eskişehir.
[11]. Possingham, J.V., "Under-exploitedwild species that have potential for horticulture", *Advances in Horticultural Science*, 4 (1), 49-55, (1990).
[12]. Omobuwajo TO, Akande AE, Sanni LA (1999). Selected physical, mechanical andaerodynamicpropertiesAfricanBreadfruit (*Treculiaafricana*) seeds. *J. Food Eng*. 40: 241-244.
[13]. Mohsenin N. N., 1986. Physical properties of plant and animal materials. *New York: Gordon and Breach Science Publisher*.
[14]. Jain, R. K., & Bal, S. 1997. Physical properties of pearl millet. *Journal of Agricultural Engineering Research*, 66, 85–91.
[15]. BaryehE.A., 2001. Physicalproperties of bambaragroundnuts. *J. Food Eng*. 47: 321-326.