Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 7, Issue, 02, pp.12425-12429, February, 2015

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

CHANGES IN THE MINERAL CONTENT DURING DEVLOPMENT AND MATURITY IN BER (*ZIZIPHUS MAURITIANA*, LAMK.) FRUITS CVS. MEHRUN KHEDI, MEHRUN, AND M.P.K.V.

[1]Abhang, A. R., *[,2]Rohokale, G. Y., [3]Pathare, S. A. and [4]Rohokale, P. G.

[1,2,3]Arts, Science and Commerce College, Rahuri-413705(M.S.) India
[3]Nanotech Laboratory, Department of Chemistry, Shri Shivaji Science College, Amaravati- 444 403 (M.S) India

ARTICLE INFO

Article History:
Received 28th December, 2014
Received in revised form
15th December, 2014
Accepted 27th January, 2015
Published online 26th February, 2015

Key words:

Ber, Cultivars, Fruit Pulp, Minerals.

ABSTRACT

The changes in mineral contents namely; Sodium, Potassium, Phosphorus, Magnesium and Iron were studied in ber cultivars Mehrun-Khedi, Mehrun and M.P.K.V. during development and maturity of fruit at 20 days, interval from 20 days after fruit-set upto 120 days. The sodium content of Mehrun-Khedi cultivar remained nearly constant upto 80 days after fruit-set. Afterwards, a marked decreasing trend was found in that cultivar, between 100 to 120 days. On the contrary M.P.K.V. variety showed a continuous decreasing trend. Increase in potassium content up to 80 days and thereafter it decreased gradually upto maturity in all the three cultivars. However phosphourus, magnesium and iron content of the fruit pulp gradually decreased from fruit-set to maturity in all the three cultivars.

INTRODUCTION

Ber (*Ziziphus mauritiana*, Lamk.) is one of the most ancient fruit indigenous to India. Its scattered cultivation all over India is ascribed to its hardy nature, ability to grow on poor soils and low cost of production. There are about 125 varieties of ber grown in different parts of India. Mehrun-Khedi and Mehrun are the famous varieties of Maharashtra, popularly grown in Jalgaon, Dhule and Nashik districts as these varities are resistant to rottening by nymphs, better in taste and suitable for processing in other products, while M.P.K.V. is a wild cultivar, locally cultivated in M.P.A.U. Rahuri. The minerals such as Na, P, K, Mg and Fe have a great importance in human health. Required amount of these elements must be in human diet to pursue good health life (**FNIC, 2008**). There is little information on jujube's chemical composition which plays an important role in human health. Few studies were performed on mineral composition of fruit of jujube (**S.M.Z *et al.*, 2001; Monitiel *et al.*, 2005; Li *et al.*, 2007a**). However more studies shouls be perform on mineral content of jujube that has an essential effect on human health in many ways. In this study, the main objective is to determine the mineral composition right from fruit set to ripening in fruits of the selected jujube. The studies on the changes in mineral content during development and maturity of fruits may undergo some characteristics physico-chemical changes. The studies on the changes in mineral content during development and maturity in ber fruits have been made by various workers. **Randhawa and Biswas (1966), Bal and Singh (1978 C), Bal (1981),Guta and Joshi (1985), Abbas *et al.* (1988), The wealth of India (1989), Ermosele *et al.* (1991), Li *et al.* (1994), Pareek *et al.* (2002), Li *et al.* (2007 a), Pareek (2013), Meena *et al.* (2014).** The harvesting of fruits at right stage is of paramount importance to receive the higher premium from the produce. From the available literature it has been observed that the work on changes in mineral content during development and maturity has not reported in ber Cvs. Mehrun-Khedi, Mehrun and M.P.K.V. Therefore, in the present investigation attempts have been made to study the changes in mineral content during development and maturity at different developmental stage right from fruit seting to maturity in ber cultivars, Mehrun-Khedi, Mehrun and M.P.K.V.

Corresponding author: Rohokale, G. Y.
[1,2,3]Arts, Science and Commerce College, Rahuri-413705(M.S.) India.

METHODS AND MATERIALS

The present investigation on Ber (*Ziziphus Mauritiana* Lamk) Var. Mehrun-Khedi, Mehrun and M.P.K.V. was carried out during 2010-2011. Material used and method followed during the investigation are described in the succeeding paragraph.

A) Materials

1) Five year old plants of Ber cultivars Mehrun-khedi, Mehrun and M.P.K.V. growing in orchards of Mahatma Phule Agricultural University, Rahuri(MS) were selected for the present investigation.

2) The fruit of these cultivars were collected at an interval of 20 days after fruit set and continued till the complete ripening stage was reached.

B) Methods

For the estimation of minerals 1 gm. oven dried fruit sample is acid digested according to the method of **Toth *et al.* (1948).** This acid digested extract was used further for the estimation of Na, K, P, Mg and Fe. The estimation of Na and K, the acid digested extract of fruit sample is analyzed by flame photometric method. The element Na is estimated at wavelength 588 nm, while K at 768 nm. The mineral P, Mg and Fe is estimated using different reagents as per **Sekine (1965)**, **Richards (1954) and Elevehjem (1930)** method respectively.

RESULTS AND DISCUSSION

The mineral content namely Na, K, P, Mg and Fe are most important elements which required for different metabolic functions. The quality of fruit is also governed by these elements. However, the information of minerals content of the fruits of ber Cvs. Mehrun-Khedi, Mehrun and M.P.K.V. at different developmental stages during the growth period, which are vital to metabolic process in fruit tissue is lacking. The result obtained with the changes in mineral contents of ber fruits of all three cultivars studied during the growth period are presented in Fig. 1,2,3,4 and 5.

Sodium (Na)

Sodium content of fruit pulp exhibited almost decreasing trend throughout the growth and development of fruits in all the three cultivars studied (Fig. 1).

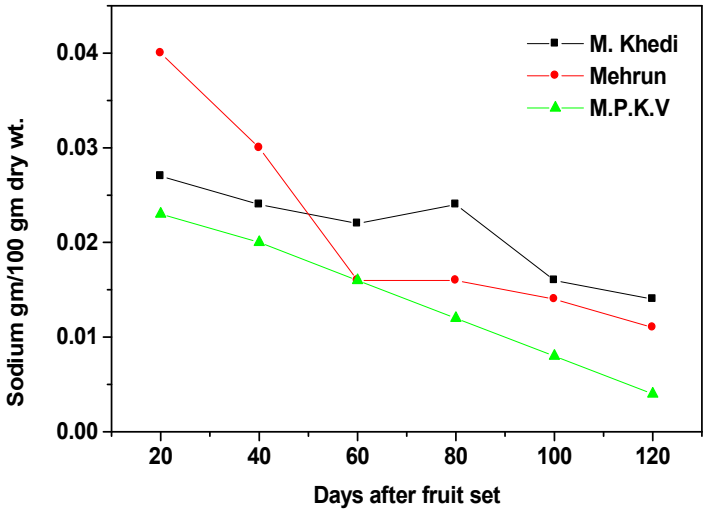

Fig.1. Changes in sodium during development and maturity of ber fruits

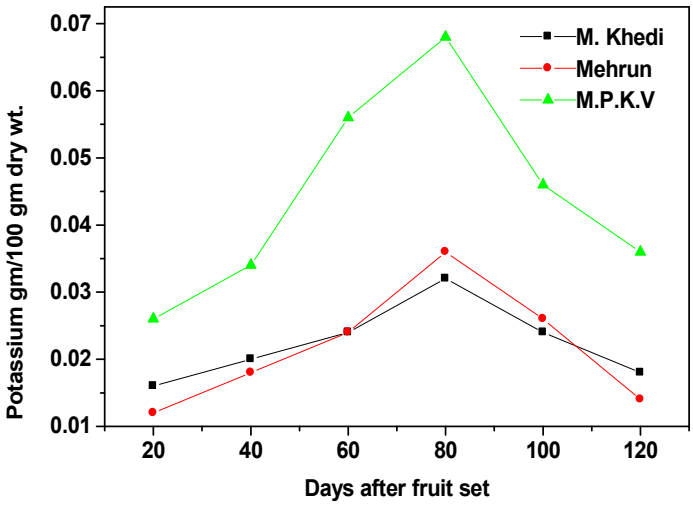

Fig.2. Changes in potassium during development and maturity of ber fruits

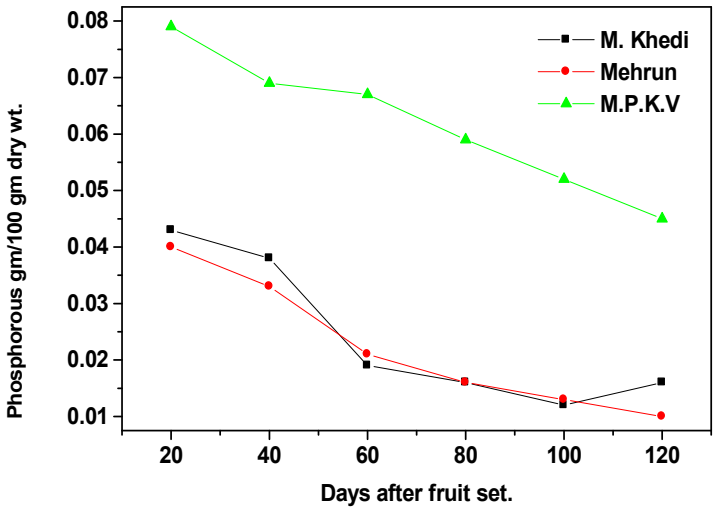

Fig.3. Changes in phosphorous during development and maturity of ber fruits

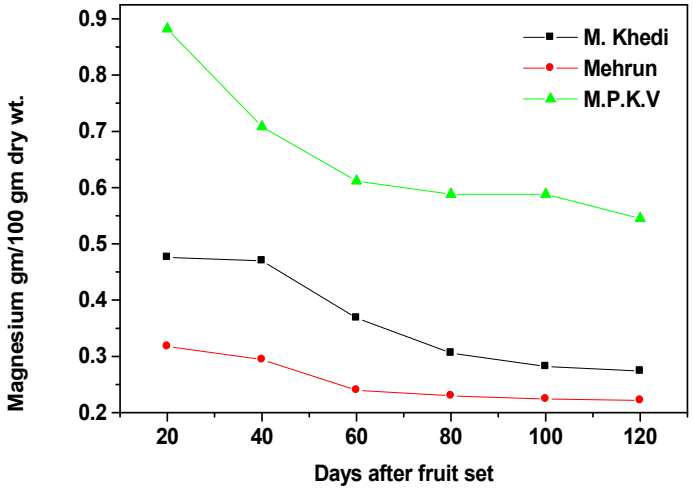

Fig.4. Changes in magnesium during development and maturity of ber fruits

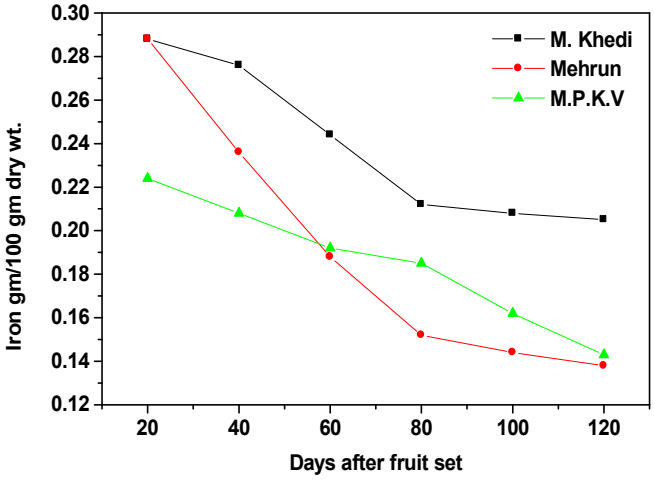

Fig.5. Changes in iron content during development and maturity of ber fruits

The rate of decline in sodium content was more in M.P.K.V. than Mehrun-Khedi and Mehrun. At maturity, sodium content is more in Mehrun-Khedi followed by Mehrun and M.P.K.V. Gupta and Joshi (1985) studied the mineral content of ber cultivars Umaran, Gola, Kaithli and Jogia and reported gradual decrease in sodium content during the growth of fruit in all the varieties estimated. Our results are also in a similar line with those of Gupta and Joshi (1985), **Tiwari and Bhanafar (1995)**, **Li *et al.* (2007a), Gupta *et al.* (2011), Krishnamurty and Sarala (2012), Mahapatra *et al.* (2012), Meena *et al.* (2014)**.

Potassium (K)

An increasing trend in potassium content of fruit pulp was observed up to 80 days in all the three cultivars. However the rate of increase was rapid during 40 to 80 days and thereafter, it decreased gradually up to maturity. Although a decreasing trend of potassium content was observed at maturity, the amount of potassium was more than at the initial stage. At maturity potassium content was more in M.P.K.V. followed by Mehrun-Khedi and Mehrun. **Gupta and Joshi (1985) and Niamat *et al.* (2012)** reported slow increase in potassium content in the initial stage followed by rapid increase in potassium content in the middle stage and thereafter slow decline in it. However, they noted more amount of potassium at maturity than the initial stage in all the cultivars studied. Our results (Fig. 2) of the potassium content of fruit pulp in all the three cultivars during the development and maturity of the fruits are also in agreement with those of **Gupta and Joshi (1985), Tiwari and Bhanafar (1995), Li *et al.* (2007a), Gupta *et al.* (2011), Krishnamurty and Sarala (2012), Mahapatra *et al.* (2012), Meena *et al.* (2014)**.

Phosphorous (P)

The phosphorous content of the fruit pulp gradually decreased from fruit set to maturity in all the three cultivars. The sharp decline in phosphorous content was observed between 40 to 60 days in Mehrun – Khedi, and Mehrun. However, slow decline in phosphorous content was observed in M.P.K.V. in the same period. A gradual downward trend in phosphorous content was found after 60 days (Fig.3) till maturity in all the three cultivars. At maturity, the phosphorous content was more in M.P.K.V. followed by Mehrun-Khedi and Mehrun. Our results of phosphorous content of fruit pulp in Mehrun-Khedi, Mehrun and M.P.K.V. during the development and maturity are inconsonance with results obtained by **Bal and Singh (1978c) and Bal (1981), Mortan (1987), Wealth of India (1989), Li *et al.* (2007a), Pareek and Dhaka (2008), Pareek *et al.* (2009), Bekir San (2009), Gupta *et al.* (2011) Krishnamurty and Sarala (2012), Meena *et al.* (2014)**.

Magnesium (Mg)

The magnesium content in the fruit pulp showed (Fig.4) a decreasing trend right from fruit set to maturity in all three cultivars. The sharp decline in magnesium content was observed up to 60 days in Mehrun and M.P.K.V. and up to 80 days in Mehrun – Khedi. Thereafter, the downward trend was slow and more or less similar up to maturity in all three cultivars. At maturity, the more amount of magnesium was recorded in M.P.K.V. followed by Mehrun-Khedi and Mehrun. Our results of magnesium content of fruit pulp in all these three cultivars are also on the similar line to those reported by **Gupta and Joshi (1985), Li *et al.* (2007a), Bekir San (2009), Gupta *et al.* (2011), Krishnamurty and Sarala (2012), Niamat *et al.* (2012), Meena *et al.* (2014)**.

Iron (Fe)

A decreasing trend in Iron content of fruit pulp was observed right from fruit set to maturity in all the three cultivars. (Fig.5). The decrease in iron content was slow and gradual in Mehrun –Khedi, while it was sharp up to 60 days in Mehrun and M.P.K.V. At maturity, the iron content was maximum in Mehrun-Khedi followed by M.P.K.V. and Mehrun. Our results of Iron content of fruit pulp in Mehrun-Khedi, Mehrun and M.P.K.V. during development and maturity of fruits almost showed a gradual decrease in iron content at the initial, middle and final stage of fruit development. The trend of iron content at maturity was almost similar to those of **Bal and Singh (1978 C), Bal (1981), Gupta and Joshi (1985), Mortan (1987), Li and Hu (1994), Li *et al.* (2007a), Pareek and Dhaka (2008), Bekir San (2009), Pareek *et al.* (2009), Krishnamurty and Sarala (2012), Niamat (2012), Meena *et al.* (2014)**. The iron content of fruit pulp in all the three cultivars in general, comparatively more than sodium, potassium, phosphorous and magnesium. **Bal and Singh (1978 C)** in **Umran, Bal (1981) in Sanaur-2, Joshi and Gupta (1985)** in Umran and Gola have also reported more amount of iron content in fruit pulp than other major elements.

The changes in mineral content of fruit pulp during development and maturity in all three cultivars may be attributed to their involvement in cellular metabolism, synthesis of enzymes and chlorophyll biosynthesis. The decrease in chlorophyll content of fruit peel with the advancement of fruit growth may be attributed to the decreased level of magnesium (Fig.4.), as magnesium is a structural unit of chlorophyll (**Lodh and Selvaraj 1974**). As mentioned earlier, the role of K, Fe and Mg in the activation of different enzymes. It may also be possible that the K, Fe and Mg content in fruit pulp may be responsible for the changes in the respiratory metabolism as well as carbohydrate metabolism during development and maturity of fruits.

Conclusion

In general, the changes in the amount of Na, K, P, Mg, and Fe of fruit pulp during development and maturity of fruits in all the three cultivars studied may be due to their rapid mobilization, translocation and distribution within the fruit pulp and may also be due to their involvement in cellular metabolism, Chlorophyll biosynthesis and enzyme biosynthesis (**Selvaraj *et al.*, 1982**).

Acknowledgement

The authors are thankful to the Head, Department of Horticulture, M.P.A.U., Rahuri, for providing fruit samples and

the Principal, A.S.C College, Rahuri for providing laboratory facilities during the investigation.

REFERENCES

Abbas, M. F., J. H. Al Niami, M. F. and B. S. Fandi, 1988. Some physiological characteristics of jujube fruits at different stages of maturity. *J.Hort. Sci.,* 63:337-339.

Bal, J. S. 1981. Some aspects of developmental physiology of ber (Ziziphus mauritiuna Lamk.) Prog. Hort. 12:5-12.

Bal, J.S. and P. Singh, 1978c. Developmental physicology of ber var. Umran. I. Physical Chenges Ind. *Food Packer*, 32:59-61.

Bekir San, A. N. Yildirim, M. Polat and F. Yildirim, 2009. Mineral composition of leaves and fruits of some promising jujube (Zizyphus jujube Miller) Genotypes. *Asian J. Chem.,* 21(40:2998-2902.

Elvehjem, C. A. 1930. Cited by P. B. Hawke, B. L.Oser and W. H. Summerson (1948). Practical Physiological Chemistry; Blackiston co. *Toranto. J. Biol. Chem.,* 463.

Ermosele I. C., C. O. Ermosele and D. M. Kuzhkuzha 1991 Evaluation of mineral elements and ascorbic acid contents in fruits of some wild plants. *Plant Foods Hum. Nutr.*, 41:151-154.

FNIC, (Food and nutrition information center) (internet addresses). http://warp.nal.usda.gov./fnic/etext/000105. html (2008)

Gupta D., S. Mann, I. Jain and R. K. Gupta 2011. Phytochemiscal, Nutritional and Antioxidant Activity Evaluation of Fruits of Ziziphus nummularia Burm. F. *Int. J. of Pharma and Bio Sci.,* 2(4): 629-633.

Gupta, A. K. and D. C. Joshi, 1985. Mineral content of ber (*Zizuphus mauritiana* lamk.) at different developmenta stages. *Indian J. Hort.,* 12(1/2):37-40.

Krishnamurthy, S. R. and P. Sarala, 2012. Determination of nutritive value of Zizuphus rugosa Lamk.: A famine edible fruit and medicinal plant of Western Ghats. *Indian J. of Nat. Product and Resources,* 3(1): 20-27.

Li, J. and X. Hu, 1994. Rejuvenation and utiliza tion of world Zizyphus mauritiana in chinse, *J. Forest Research*, 7(2), 224-226.

Li, J. W. Fan, L. P., Ding, S. D. and Ding, X. L. 2007a. Nutritional composition if five cultivars of Chinese jujube. *Food Chemistry*, 103:454-460.

Lodh, S. B. and Y. Selvaraj 1974. Bichemical Changes associated with growth and development of grape var. *Banglore Blue. Indian J. Hort.,* 31:232-237.

Mahapatra A. K., S. Mishra, U. C. Basak and P. C. Panda, 2012. Nutrient analysis of some selected wild edible fruits of deciduous forest of India: an explorative study towards non-conventional bio-nutrition. *Adv. J. Food and Sci. and Techno.,* 4(1) : 15-21.

Meena, S. H. P. Meena and R. S. Meena 2014. Diversified uses of Ber (Ziziphus spp). Popular Kheti 2(1): 154-159.

Morton J. 1987. Indian Jujube. http:www.hort.purdue.edu./ newcrop/morton/Indian_jujube.html(assessedon 20.12.11)

Niamat R., M. A Khan, K. Y. Khan, M. Ahmad, B. Ali, P. Mazari, M. Mustafa and H. Ahmad. 2012., Element content of some ethnomedical ziziphus linn. Species Using AAS Technique. *J. App. Pharmaceutical Sci.*, 2(3) : 96-100.

Pareek O. P. 2002. Ber Ziziphus Mauritania. Available by International Centre for Underutilized Crops (On line).

Pareek S. and Dhaka R. S. 2008. Association analysis for quality attributes in ber. *Ind. J. Arid Hort.,* 3:77-80.

Pareek S. Kitinoja L., Kaushik, R. A. and Paliwal, R. 2009. Postharvest physiology and storage of ber. *Stew. Posthar. Rev.,* 5(5):1-10.

Pareek, S. 2013. Nutritional composition of jujub fruit, J. *Food Agric*, 2013.25(6):463-470 .

Randhawa, G. S. and G. S. Biswas 1966. Studies on Morphology and Chemical Composition of some jujube varieties. *Indian J. Horti.,* 23: 101-107.

Richards, L. A. 1954. Diagnosis and Improvement of saline and alkaline soil. (U.S.D.A.) 60:56.

S.M.Z. Al-Kindy, A. O. Abdulnour and M. M. Al-Rasbi, 2001. Mineral composition of fruit and leaves of jujube. *Sci. Technol.,* 6, 39

Sekine, T. 1965. Photometric colourimetry in Biochemistry. Part II. Pb. Nanko-d-pub.co.Tokyo.pp.242.

Selvaraj, Y., D.K. Pal, M.d. Subramanyan and C.P.A. Iyer 1982. Changes in the chemical composition of four cultivars of papaya (*Carica papaya*) during growth and development. *J. Hort. Sci.,* 57:135-143.

The Wealth of India Raw material Vol XI X-Z, Council of Industrial and Scientific Research, New Delhi, 1989.p.111-24.

Tiwari, R.J. and R.N.S. Banafar, 1995. Studies on nutritive constituents, yield and yield attributing characters in some ber (*Zizyphus jujuba*) genotype, *Ind. J. Plant Physiol.,* 38: 88-89.

Toth, S.J., A.L. Prince: A. Wallace and D.S. Mikkelson, 1948. Rapid qualitative determination of eight mineral elements in plant tissues by systematic procedure involving use of flame photometer. *Sail and Sci.,* 66:459-466.

****