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Международной конференции, посвящ. 70 ‑ летию Центрального сибирского ботанического сада (Новосибирск, 1–8 августа 2016 г.). – Новосибирск: ЦСБС СО РАН, 2016. – С. 150 – 152.

7. Каталог Национального генетического фонда хозяйственно полезных растений. Кн. 2 / НПЦ НАН Беларуси по земледелию; редкол.: Ф.И. Привалов (гл. ред.) [и др.]. – Минск: Беларус. навука, 2012. – 439 с.

8. *Урбанович О.Ю., Якимович О.А., Кузмицкая П.В., Козловская З.А., Картель Н.А.* Молекулярные методы в систематизации коллекционного материала груши // Интродукция, сохранение и использование биологического разнообразия мировой флоры: материалы Международной конференции, посвященной 80-летию Центрального ботанического сада Национальной академии наук Беларуси (19-22 июня 2012 г., Минск, Беларусь): в 2 ч. / Национальная академия наук Беларуси, Центральный ботанический сад. – Минск, 2012. – Ч. 2. – С. 345-347.

Yakimovich V.A. Collection of pears of institute for fruit growing - national determination of the Republic of Belarus // Woks of the State Nikit. Botan. Gard. – 2017. – Vol.144. – Part I. – P. 83-87.

The genetic collection of the pear in the Institute for Fruit Growing is described in this article. Together with other cultures (fruit, berry and walnut), it is recognized as a national treasure of the Republic of Belarus. As of 01.06.2017, the basic collection of pears consists of 717 samples of different genetic and geographical origin. Samples of the pear are stored in the field genebank. They are used to implement the institute's breeding program.

Key words: *pear; collection; variety; hybrid; view; Belarus.*

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EFFECT OF FOLIAR APPLICATION OF MICRONUTRIENTS (Zn & B) ON FRUIT QUALITY CHARACTERS OF MANGO (*MANGIFERA INDICA*) VAR. LANGRA

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This experiment was conducted to investigate the effect of foliar application of micro-nutrients i.e. Boric acid (H3BO3) and Zinc Sulphate (ZnSO4) on the fruit quality characters of Mango (*Mangifera indica* L.) var. Langra. Maximum value for (TSS) Total Soluble Solids (18.50%) was observed in treatment (T4)1% H3BO3 + 1.2% ZnSO4 followed by (18.25%) in treatment (T1) 0.8% H3BO3 and in treatment (T6) 1.2% ZnSO4 it was (17.57%) respectively. The maximum amount of Vitamin-C (54.3 mg/100g) was measured in the treatment (T4) as compared to control (94.7 mg/100g). Maximum Total Sugars (51.08%) were found in (T5) 1% ZnSO4 as compared to control (45.0%).Whereas, Reducing Sugars were in non-significant range but found highest (19.30%) in (T1).

Key words: *mango; Mangifera indica L.; Langra; fruit quality; physic-chemical analysis; micronutrients B, Zn.*

Introduction

Mango is one of the most important among fruit crops of Asia and currently ranked 5th in the world as regards total production among major fruit crops, after bananas, citrus, grapes and apples (Anonymous, 2005). Although, mango is grown between 30^{o} North and South latitude in almost all tropical and sub-tropical regions of the world except Spain, France and Portugal (Millington, 1984), but its commercial production is limited only in few countries. In Asia; India, China, Thailand, Pakistan, Philippine and Indonesia are producing

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71.67% of the total world being 41.08%, 13.35%, 4.05%, 3.48%and 2.86% respectively. Mexico and Brazil are the largest producers (5.88% and 3.31% respectively) in America while Nigeria 2.86% in Africa, the largest mango producer (Anonymous, 2004).

Like most of the fruits, mango is seasonal and perishable in nature. Mangoes are judged as luxury item on the market of most industrialized countries, although reduction in price, together with improved and consistent quality, likely could result in increased consumption. The advancement in the mango research has occurred during the last 35 years since the Singh's comprehensive study of mango (Singh, 1960).

Mango has become popular in the world and is praised due to its delicious taste, attractive flavor, diuretic and therapeutic values. Eating mango in the season may provide store of vitamin-A in liver, sufficient to last for the rest of the year and highly beneficial for the prevention of vitamin-A deficient disorders like night blindness. High vitamin-A (4016 lU/ 100g) and a good source of ascorbic acid (28.5mg/100g) (Meadows, 1998).In mango, both are antioxidants and help to prevent free radical energy and thus reduce the risk of certain cancers but those on potassium restricted diet, like renal failure diet, should avoid mangoes (Sify, 2004). Mango pulp contains as much Vitamin-A as butter (Perry and Zilva, 1932).

Because of its excellent flavor, delicious taste and nutritive values, mangoes of Pakistan have attained a good reputation and appreciation in many countries i.e., Afghanistan, Bahrain, Dubai, Kuwait, Saudi Arabia, United Kingdom and Canada thus opening tremendous opportunities for its export as fresh fruit as well as its products. It is a fact now that mangoes of Pakistan are considered for superior in the quality throughout the world.Pakistan's soil and climatic conditions are much suitable for mango cultivation and are helpful to produce good yield of high quality.

The present study of two years (2006-2008) was hence aimed to determine the effect of micronutrientsi.e. Boric acid (B) & Zinc Sulphate (Zn) were applied in this experiment.

Materials and methods

The field research reported in this write up was conducted at the Post-graduate Agricultural Research Station (PARS), University of Agriculture, Faisalabad, Pakistan and laboratory work was conducted in the Post-graduate Pomology Laboratory of the Institute of Horticultural Sciences, University of Agriculture Faisalabad, during 2006-2008. Fifteen to twenty year's old mango plants (*Mangifera indica* L.) cv. Langra, were selected as experimental material. Foliar spray of Boric acid and Zinc Sulphate micronutrients singly and their combinations were applied. Each treatment with its replication was applied twice in a year (before the panicle emergence& before fruit maturity).The five fruits were collected at random from all the sides from each treatment and physicochemical analysis was carried out.

Experiment was laid out according to Randomized Complete Block Design. (RCBD). Data was analyzed statistically by using the Fishers analysis of variance and treatments were compared by using the Least Significant Difference (LSD) test at 5% probability level (Steel and Torrei, 1980). There were seven treatments, which were repeated four times making total number of experimental units twenty eight. The layout of the experiment was as follows.

Layout design	= RCBD
Number of treatments	= 7
Number of plant(s)/treatment	= 1
Number of replications	= 4
Total number of treatments	= 28

Treatments	**Micro-nutrients &their doses**
T_0	Control
T_1	0.8% Boric acid (H_3BO_3)

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T_2	1% Boric acid (H_3BO_3)
T_3	0.8 % Boric acid (H_3BO_3) + 1% $ZnSO_4$
T_4	1% Boric acid (H_3BO_3) + 1.2% $ZnSO_4$
T_5	1% $ZnSO_4$
T_6	1.2% $ZnSO_4$

Data collection. Following parameters were studied and data was collected:
Total Soluble Solids (TSS), Acidity, Vitamin-C, Total Sugars, ReducingSugars.

Results and discussion

The project was aimed to understand the fruit quality characters of mango cv. Langra by applying micronutrients (Zinc Sulphate & Boric acid) through foliar spray.

Total soluble solids (TSS). Maximum TSS was observed in T_4 (18.50%) followed by T_1 (18.25%) and T_6 (17.57%) while minimum total soluble solids (17.18) was found in T_2, trees sprayed with boric acid @ 1%. It was confirmed from above data that either increasing level of $ZnSO_4$ increased the TSS of the mango fruit. T_2,T_3 and T_5 showed the TSS of 17.18%, 17.38% and 17.35% respectively. These studies confirmed by the findings of Singh and Rajput (1977) and also by Singh (1976). Bihera*et al*. (19940) reported that foliar spray application of 0.8% Zinc Sulphate had significantly increased fruit size, total soluble solids and ascorbic acid contents in the fruit.

Acidity. Maximum acidity percentage was observed in T_6 (0.427) trees sprayed with Zinc Sulphate @ 1.2% followed by T_4 (0.420) and T_2 (0.398) while the minimum acidity percentage was found 0.295% in untreated plants (control). The results are non-significant so no need of further discussions. But these results were inconsistent with the earlier findings of Kumar and Kumar (1989) that a single application of $ZnSO_4$ (at 1%) reduced spoilage, higher sugar contents and lower acidity. Keeping in view the effect of all the treatments as both nutrients increased the acidity (%) significantly thatis non-significant for good quality of the fruit. In case of boric acid it is clear that with increasing concentrations of this nutrient, acidity percentage was also increased and is not good for quality parameters. Results showed that combination of Boric acid and Zinc Sulphate wasnon-significant for the increase in the levels acidity (%). These studies confirmed the findings of Singh and Rajput (1977) and also by Singh (1976).

Vitamin C (mg/100 g). Maximum vitamin C was observed in T_4 (154.3mg/100g) followed by T_2 (138.0 mg/100g) while the minimum vitamin C was found in control (94.7 mg/100g). The results are highly significant regarding the Vitamin C percentage in mango pulp but T_6, T_5, T_1 and T_3 showed similar results. These studies confirmed the findings of Singh and Rajput (1977) and also by Simao and Gomes (1996).

Total sugars (%). Maximum total sugars were observed in T_5 (51.08%) followed by T_6 (50.82%) and T_1 (55%) while the minimum total sugars were observed in unsprayed trees T_0 (45.00%) followed by T_3 (49.40%). The results showed that Zinc Sulphate at increased rate of concentrations showed high levels of total sugars and in case of boric acid there were non-significant results showing that with the increase of concentration decreased the total sugars. The combination of these two micronutrients showed somewhat significant results, indicating a very slight increase in the total sugars of mango pulp. These studies confirmed the findings of Singh and Rajput (1977) and also by Simao and Gomes (1996) stated that application of $ZnSO_4$ with increasing rate increased the total sugar contents.

Reducing sugars (%). Maximum reducing sugars were observed in T_1 (19.30%) followed by T_3 (18.92%) and T_6 (18.80%) while the minimum reducing sugars were observed in unsprayed control trees T_0 (15.77%). In these results we have come to know that zinc Sul-

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phate at increasing rates of concentrations i.e. 1% and 1.2% is much effective for controlling reducing sugars while with combination of boric acid is not much effective as it is clear from the table of means 4.21. These studies confirmed by the findings of Singh and Rajput (1977) and also by Simao and Gomes (1996).

Table 1

Physico-chemical analysis of the mango; variety Langra

Treatments	Total soluble solids (Brix)	Acidity (%)	Vitamin C (mg/100g)	Total sugars (%)	Reducing sugars (%)
T_0	16.48b	0.295a	94.7c	45.00b	15.77b
T_1	18.25a	0.368a	124.1b	50.05a	19.30a
T_2	17.18ab	0.398a	138.0b	49.80a	17.40ab
T_3	17.38ab	0.383a	122.8b	49.40a	18.92a
T_4	18.50a	0.420a	154.3a	49.85a	18.16ab
T_5	17.35ab	0.382a	126.4b	51.08a	17.97ab
T_6	17.57ab	0.427a	133.0b	50.82a	18.80a

Literature cited

1. Anonymous, 2004. Food and Agriculture Organization (FAO), Rome. www.fao.org.

2. Anonymous, 2005. Agricultural statistics of Pakistan. Government of Pakistan, Ministry of Food, Agriculture & Livestock, Islamabad, Pakistan.

3. *Bahadur L., Malhi C.S. and Singh Z.* Effect of foliar and soil applications of Zinc Sulphate on Zinc uptake, tree size, yield and fruit quality of mango // Journal of Plant Nutrition. – 1998. – 21(3): 589-600.

4. *Bihera T.K., Rath S. and Dora D.K.* Sex distribution, fruit set and fruit retention in two varieties of mango-A note // Haryana Journal of Horticulture Science. – 1994. – 23(2): 134-136.

5. *Chadha K.L., Thakur R.S., Rajput M.S. and Samra J.S.* Leaf nutrient status of three mango cultivars at flowering and post-harvest stages // Indian Journal of Horticulture. – 1984. – 42: 83-84.

6. *Kumar O.V. and Kumar G.* Effect of preharvest foliar sprays of zinc on post nitrogen, magnesium, zinc and boron to apple trees. Effects on fruit set and cropping // J. Hortic. Sci. – 1989a. – 57: 151-158.

7. *Meadows J.* Florida food fair. Cooperative Extension Service for Sarsota Country. University of Florida: Extension Institute of Food and Agriculture Sciences. –1998.

8. *Perry E.O.V. and Zilva S.S.* Preliminary Report on vitamin content of the mango. Empire Marketing Board, London // Phytopathol. – 1932. – 17: 97-122.

9. *Qin X.* Foliar spray of B, Zn and Mg and their effects on fruit production and quality of Jincheng orange (*Citrus sinensis*) // Journal of Southwest Agricultural Univ. – 1996. – 18: 40- 45.

10. *Rajput M.S., Chadha K.L. and Thakur R.S.* Standardization of leaf sample size for nutrient analysis in mango // Indian Journal of Horticulture. –1985. – 42: 210-212.

11. *Simao S. and Gomes F.P.* Sugars and acids: their distribution in mango (Mangifera indica L.) fruit // Revista de Agricultura. – 1996. – 71(1): 3-12.

12. *Singh L.B.* The Mango Botany, cultivation. Leonard Hill Books Ltd. London, 1960. – P.38.

13. *Singh A.R.* Effect of foliar sprays of nitrogen and growth regulators on the physico-chemical composition of mango (*Mangifera indica* L.) // Plant Science. – 1976. – 8: 75-81.

ISSN 0201–7997. Сборник научных трудов ГНБС. 2017. Том 144. Часть I

14. *Singh B.P., Singh S.B., Singh D.C. and Singh T.B.* Effect of soil and foliar application of urea on the physico-chemical composition of fruit of mango (*Mangifera indica* L.) cv. Langra // Bangladesh Horticulture. – 1977. – 5: 29-33.

15. *Singh R.R. and Rajput C.B.S.* Effect of various concentrations of zinc on vegetative growth characters, flowering, fruiting and physico-chemical composition of fruits in mango (*Mangifera indica* L.) cv. Chaunsa // Haryana Journal of Horticultural Sciences. – 1977. – 6: 10-14.

16. *Singh U.R., Gupta J.H. and Dhar L.* Performance of mango cultivars against malformation in Uttar Pradesh // Prog. Hort. – 1991. – 8: 65-8.

17. *Steel R.G.D. and Torrie J.H.* Multiple comparisons, Principles and Procedures of Statistics. McGraw Hill Book Co. Inc., New York, 1984. – P. 336-354.

18. *Tiwari J.P. and Rajput C.B.S.* Effect of urea spray on the vegetative growth and fruit weight of different cultivars // Bangladesh Horticulture. – 1976. – 3 (1): 31-36.

Ferdosi M.F.H., Farooq A. Влияние некорневой подкормки микроэлементами Zn и B на качественные характеристики плодов манго (*Mangifera indica*) var. Langra // Woks of the State Nikit. Botan. Gard. – 2017. – Vol.144. – Part I. – P. 87-91.

Этот эксперимент был проведен для изучения влияния некорневой подкормки микронутриентами (борной кислотой (H3BO3) и сульфатом цинка (ZnSO4)) на качество плодов манго (*Mangifera indica* var. Langra). Максимальное значение общего содержания растворимых твердых веществ (18.50%) наблюдалось в варианте (T4) 1% H3BO3 + 1.2% ZnSO4, 18.25% – в варианте (T1) 0.8% H3BO3 и варианте (T6) 1.2% ZnSO4 (17.57%). Максимальное количество витамина С (54.3 мг/100г) было отмечено в варианте (T4) по сравнению с контролем (94.7 мг/100г). Максимальное количество общих сахаров (51.08%) было обнаружено в (T5) 1% ZnSO4 по сравнению с контролем (45.0%). Принимая во внимание, что количество редуцирующих сахаров было незначительное, самое высокое из них было в варианте (T1) – 19.30%.

Ключевые слова: манго; мангифера индийская; Langra; качество плодов; физико-химический анализ; микро-нутриенты.

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EFFECT OF FOLIAR APPLICATION OF MICRONUTRIENTS (Zn & B) ON VEGETATIVE AND REPRODUCTIVE GROWTH OF MANGO (*Mangifera indica* L.) VARIETY LANGRA

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An experiment was conducted at Post Graduate Research Station (PARS), University of Agriculture Faisalabad, Pakistan to investigate the effect of micronutrients i.e. (B & Zn.) on vegetative and reproductive growth of mango (*Mangifera indica* L.) variety Langra. The maximum flushes (686) were emerged in the plants treated with treatment (T_1) 0.8% H_3BO_3 as compared to control (572). Whereas the maximum panicles (433) were emerged in the plants treated with (T4) 1% H_3BO_3 & 1.2% ZnSO4 as compared to control (305) and T_1 (362) respectively. The analysis showed that maximum yield/plant (52.60 kg) was recorded in the treatment T_1 as compared to control (40-57 kg).

Key words: *mango; Mangifera indica L.; Langra; vegetative and reproductive growth; micronutrients; B; Zn.*