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 C (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.*

Introduction

Mango (*Mangifera indica* L.) is an important tropical fruit which is being grown in more than 100 countries of the world (Sauco, 1997). Delicious taste & unique flavor with high nutritive value has made it equally popular across the globe and its demand and trade is expanding rapidly in other parts of the world especially in Europe and America. It is believed to be originated in the Indo-Burma region and has evolved as a canopy layer species in the tropical rainforest of South and South East Asia (Kaur *et al*., 1980). It is estimated that mango cultivation appeared to have begun six thousand years ago. (Hill, 1952)

The rapid Growth of mango production in recent years has been due to its expansion in New World, China & parts of Africa and the adoption of modern field practices, which include irrigation management and control of flowering etc. (Mukherjee & Litz, 2009). Mango has become popular in the world and is praised due to its delicious taste, attractive flavor, diuretic and therapeutic values. It is a good source of vitamin A and ascorbic acid (Meadows, 1998). At present it is being cultivated in about 87 countries in the world but nowhere it achieve the same position as in the subcontinent of Indo-Pakistan that's why in Asian region it is considered as king of the fruits (Purseglove, 1972). Mango is the important fruit crop of Asia and currently ranked 5th in the world as regards of its total production among major fruit crops after bananas, citrus, grapes and apples. Pakistan is considered the world's 5th largest producer of mango after India, China, Thailand & Mexico with peak production occurring from June to August. (Anonymous, 2005). Langra is one of the commercial & principal cultivars of the Pakistan while others are Chaunsa, Dusehri, and Anwar Rataul etc. (Chadha & Pal, 1993). Nutritional status of the mango tree is considered as a key factor affecting vegetative growth, flowering, bearing of fruits & even malformation. As nutritional imbalance has also been recognized as a cause of malformation and irregular bearing (Jagirdar & Jafri, 1996; Sen, 1943). Deficiency of boron in mango results in poor flowering, pollination and reduced fruit set. Similarly leaves fail to reach full size in Zinc deficiency conditions (Bally, 2009). Zinc is essential for the synthesis of proteins, hormones, auxins and is required for the maintenance of bio membranes. (Salisbury & Ross, 1992; Marschner, 1995). Most of soils in the World where mango is being cultivated as commercial crop are in depreciation of these micronutrients and the question is that by which method these micronutrients should be applied and what should be the right time for this operation. Further, what are the effects of these micronutrients on the growth & physiology of mango tree?

The present research was hence aimed to determine the effect of foliar application of micronutrients i.e. Boric acid (B) & Zinc Sulphate (Zn) on vegetative, reproductive and malformation physiology of mango.

Materials and methods

The study was conducted at Post Graduate Research Station (PARS), 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 & Zinc Sulphate micronutrients alone and their combinations were applied. Each treatment was applied twice in a year (before fruit maturity and before the panicle emergence).

Experiment was laid out using RCBD with four replications. Data were 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 Torrie 1984). There were seven treatments making total number of experimental units twenty eight.

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

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T_2	1% Baric 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 was collected on following parameters:

1. Vegetative growth pattern

Total number of flushes/plant, Length of Flushes (cm) & Vegetative malformation percentage.

2. Reproductive growth pattern

Panicles/Plants, Flowers/Plant, Male Flower %, Hermaphrodite Flower %, Initial Fruit Set %, Initial Fruit Drop %, Final Fruit Drop %, Yield per Panicle (Kg) & Yield/Plant (Kg).

Results and discussion

The project was aimed to understand the pattern of vegetative & reproductive growth behavior of mango; cultivar, Langra and thus to proceed against the threatening drawbacks like poor fruit setting, fruit drop and low yield of mango by applying micronutrients (Zinc Sulphate and Boric acid) through foliar spray.

Samples of 4-6 months old healthy leaves of mango were collected and analyzed for their nutrients as shown in Table 1.

According to Chadha et al. (1984) optimum range of NPK in mango leaves was 0.95-1.45%, 0.040-0.117% and 0.45-0.77% respectively. The present analysis indicated that NPK before treatment application was within range and according to Singh et al. (1991) optimum range of Ca & Mg was 2.22-2.47%. 0.20-0.33% respectively in mango leaves. The present analysis indicated that Ca and Mg before treatment were within this range.

Analysis was again carried out after the application of treatment to determine the status of nutrients in the leaves s (Table 2 and Table 3).

1. Vegetative parameters

Total flushes. Data regarding the total flushes indicated maximum number of flushes (686) per plant in the treatment T_1 (0.8% H_3 BO_3), which was significantly different from all other treatments, at 5% level of significance. It was followed by T_3 (622) that were statistically similar to T_1 (Table 4). Best treatments which helped to improve the total number of flushes per plant were T_1 and T_3 as already discussed above. Next best treatment was T_6 in which 598 flushes were counted. T_0 and T_4 showed intermediate results in which 572 and 546 flushes were counted (Table 4). Minimum flushes were observed in case of T_5 (503) indicating that increased level of $ZnSO_4$ decreased the total no. of flushes per plant. It was due to that the function of Zinc Sulphate that it was not related to vegetative growth. Tiwari and Rajput (1976) reported that foliar sprays of boric acid (0.6%) as aqueous solution improved the vegetative growth and fruit weight in mango.

Length of flushes (cm). The results regarding the length of flushes are non-significant among the treatments at 5% level of significance (Table 4). Maximum length of flushes was found in T_1 (14.60cm) followed by T_0 (14.53cm) and T_4 (14.37cm). Minimum length of flushes was observed in T_2 (13.06cm), trees sprayed with 1% boric acid. The results revealed that more length of flushes gained could be due to high photosynthetic reserves increasing the length of flushes potential in mango trees (Singh, 1978).

Number of leaves/flush. The results regarding number of leaves/flush are non-significant (Table 4). Maximum leaves per flush were found in T_4 (12.72) followed by T_2, T_3, T_5 and T_6 having 12.38, 12.35, 12.30 and 12.21 leaves respectively. Minimum leaves per flush were found in control (11.30). It was also supported by Banik et al., (1977).

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

Vegetative malformation. When all the panicles were emerged the counting for vegetative malformed panicles was conducted. Data pertaining to the number of vegetative malformed panicles showed non- significant results among the treatments at 5% level of significance (Table 4). Minimum vegetative malformed panicles were observed in T_3 (11.88%) followed by T_2 (12.50%).

It was observed that the treatment T_3 at 0.8% boric acid + 1% Zinc Sulphate was much effective for controlling the malformation. Maximum malformation was observed in T_0 (13.75). As we increased the concentration of Zinc Sulphate, the incidence of malformation was also decreased as it was in T_3. The results of this parameter were contrary to the findings of Khan and Khan (1958) who reported that the foliar spray of nitrogen significantly reduced malformation. Results also correlated with the earlier findings of Singh and Rajput (1977).

2. Reproductive parameters

Panicles/plant. Data regarding the total no. of panicles per plant revealed that maximum number of panicles recorded in T_4 (433.0) which was significantly higher than control (305.5) followed by T_5 (413.12) and T2 (372.2) (Table 5) T_6 and T_1 showed intermediate results in which (366.2) and (362.0) panicles were observed. Minimum number of panicles recorded in T_3 (301.5). Combined applications of Boric acid and Zinc Sulphate i.e. 1% + 1.2% significantly increased no. of panicles per plant. It is also supported by Qin. (1996).

Flowers/plant. Maximum number of flowers/plant were found in T_2 (1348.0) followed by control (1318.0) and T_1 (1302.0) (Table 5). There was no statistical difference between the treatments because treatment means showed non-significant results. Minimum number of flowers/plant was found in T_3 (1227.0). The results revealed that more number of flowers per plant was obtained with the application of Boric acid (1%). Regarding the number of flowers per panicles results confirmed the findings of Banik *et al.*, (1997) who concluded that application of B at higher rate (0.4% + 1% urea) promoted reproduction.

Male flowers. The minimum percentage of male flowers was observed in T_6 (81.03%) followed by control T_6 (80.79%) and T_2 (79.66%) (Table 5). Treatments which helped to reduce the male flower percentage were T_3 and T_1. The maximum percentage of male flowers was observed in T_3 (75.570) at 0.8% H_3BO_3 + 1% ZnSO4. It was concluded that with the application of boron and zinc male flower % was controlled but not much effectively.

Hermaphrodite flowers. The maximum percentage of hermaphrodite flowers was observed in T_3 (24.43%) followed by T_1 (24.21%) and T_5 (22.24%) (Table 5). T_1, T_5 and T_4 were statistically similar and showed that male flower % age was not effectively improved by these treatments. The minimum percentage of male flower was observed in T_6 (18.97) at 1.2% $ZnSO_4$) that was less than control (Table 5).

It was concluded that treatment of boric acid at 0.8% alone and in combination with zinc sulphate at 1% improved the percentage of hermaphrodite flowers. Results are also comparable with the earlier findings of Bahadur et al., (1998). Who showed that application of $ZnSO_4$ at 1% increased the number of flowers per panicle.

Initial fruit set. Data regarding the initial fruit set percentage showed that maximum initial fruit was set in T_6 (16.00%) sprayed with 1.2% Zinc Sulphate followed by T_2 (14.80%) sprayed with 1% H3BO3 (Table. 5) Treatments T_5, T_4, T_1 and T_3 having 13.45, 13.31, 13.16 and 12.87% initial fruit set respectively were statistically similar. The minimum initial fruit set percentage was recorded in control (12.38%). The best treatment was T6 which significantly improved initial fruit set percentage. The results are according to the findings of Rajput and Tiwari (1975) and Singh and Rajput (1977).

Initial fruit drop. A healthy mango tree produces more than one thousand panicles and each panicle has 1000-3000 flowers, which comprise 21.1 to 90.6% hermaphrodite flowers. (Anjum et al., 1999). Maximum fruit drop percentage was found in T0 (99.89%) followed

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

by T1 (86.81%). Minimum fruit drop percentage was recorded in T3 (82.23%) followed by T6 (84.00%). The best treatment was T3 that significantly reduced the initial fruit drop.

It was observed that the fruit drop pattern in this experiment was not in accordance to the treatments. Results were supported by Abd El-Migeed et al., (2002) who reported that Boron as a micro nutrient played an important role in growth behavior and productivity of trees. It increases pollen grains germination and pollen tube elongation, consequently fruit set percentage and finally the yield (reference).

Final fruit drop. Data observed on final fruit drop showed highly significant results for final fruit drop minimum (table 5) final fruit drop percentage was found in T_3 & T_6 (99.82%) and these treatments are statistically best to reduce fruit drop percentage. Next best treatment T2 in which 99.85% fruit drop was observed T_3 and T_5 showed intermediate results in which 99.2% and 99.83% fruit drop was observed. Maximum fruit drop (99.95%) was recorded in T_4 that was even higher than control having 99.89% fruit drop. It indicated that increased levels of boric acid and Zinc Sulphate caused the more fruit drop when applied in combination. But boric acid and Zinc Sulphate at increased levels of concentrations significantly decreased final fruit drop percentage that was the next best treatments. And also in T6 (99.82%) it was observed that the fruit drop pattern in this experiment was within the accordance to the treatment.

Yield per panicle (kg). Maximum fruit yield per panicle was recorded in T_4 (2.80 kg) at 1% H_3BO_3 + 1.2% $ZnSO_4$ followed by T_2 (2.60kg) (Table 5). There was no statistically significant difference between the treatments that showed that an increase in the concentration and their combination are not very effective because all have increased in yield per panicle, statistically as it is very clear from the Table No. 5. Minimum fruit yield per panicle was recorded in T_6 (0.536) which was also less than to. Result are in accordance to the earlier work of Bahadur et al., (1998) that with the increasing foliar spray of $ZnSO_4$ will increase the yield of mango fruit.

Yield / plant (kg). Maximum fruit yield per plant was found in T_4 (52.60kg) followed by T_3 (47.52kg). Minimum yield per plant was found in control (40.57%). There was no statistically significant difference between the treatments T_1 and T_2 indicating that an increase of boric acid was not effective for enhancing per plant mango yield. On the other hand treatment combinations of Boric acid and Zinc Sulphate showed the best results for improvement of the yield. Results are in accordance with the earlier work of Bahadur *et al*., (1998) that with increasing foliar spray of $ZnSO_4$ increased the yield of mango fruit.

Table 1

Leaf analysis for macro and micronutrients before treatment

Nutrients	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	Zn (mg/kg)	Cu (mg/kg)	Mn (mg/kg)	Fe (mg/kg)
Concentrations	1.37	0.04	0.52	2.41	0.27	22.02	34.77	67.24	186.80

Table 2

Macronutrients, status of healthy leaves after treatment

Treatments	Nitrogen %	Phosphorus %	Potassium %	Calcium %	Magnesium %
T_0	1.28c	0.069dc	0.59b	2.20c	0.35bed
T_1	2.36b	0.075d	0.77b	2.38bc	0.38bc
T_2	1.92bc	0.056e	0.69b	2.54b	0.53a
T_3	2.60ab	0.070de	0.81a	2.21c	0.39bc
T_4	3.18a	0.074c	0.82a	3.29a	0.30cd
T_5	2.55ab	0.081b	0.69b	2.32a	0.42b
T_6	2.25b	0.083a	0.61b	3.15a	0.27d

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Table 3

Micronutrient concentrations (mg kg^{-1}) in healthy leaves (after treatment)

Treatments	Zinc	Copper	Iron	Manganese	Boron
T_0	26.02d	38.27c	191.75b	68.00a	40.20dc
T_1	22.28b	39.80de	197.00a	70.9a	46.98d
T_2	34.98bc	38.00e	180.00e	68.2b	56.43c
T_3	35.58b	40.95cd	183.25d	84.8b	65.20ab
T_4	38.60a	43.73b	191.0b	80.1b	58.87ab
T_5	32.19c	42.23bc	186.50c	68.5b	69.98a
T_6	33.48bc	47.92a	192.00b	62.4b	65.43ab

Table 4

Vegetative growth parameters of the mango variety, Langra

Treatments	Total Flushes	Length of Flushes (cm)	Leaves/Flush	Vegetative Malformation %
T_0	572 bcd	14.53 a	11.32 a	13.57 a
T_1	686 a	14.60 a	11.33 a	13.12 a
T_2	533 cd	13.06 a	12.38 a	12.50 a
T_3	622 ab	13.85 a	12.35 a	11.88 a
T_4	546 bcd	14.37 a	12.72 a	13.12 a
T_5	503 d	13.21 a	12.30 a	13.75 a
T_6	598 bc	14.14 a	12.21 a	13.12 a

Table 5

Reproductive Parameters of the mango variety, Langra

Treat-ments	Panicles/ Plant	Flowers/ Plant	Male Flowers%	Herma-phrodite Flowers %	Initial Fruit Set %	Initial Fruit Drop &	Final Fruit Drop %	Yield per Panicle (kg)	Yield/ Plant (kg)
T_0	305.5 c	1318.0 a	80.79 a	19.214 d	19.21d	12.38 c	99.89 b	0.56 a	40.57 b
T_1	362.0 bc	1302.0 a	75.79 c	24.21 ab	24.21ab	13.16 bc	99.88 b	1.79 a	43.94 b
T_2	372.2 ab	1348.0 a	79.66 ab	20.33cd	20.33cd	14.80 ab	99.85 c	2.23 a	43.20 b
T_3	301.5 c	1227.0 a	75.57 c	24.43a	24.43a	12.87 bc	99.82d	2.33 a	17.52 ab
T_4	433.0 a	1268.0 a	78.44 b	21.56c	21.56c	13.31 bc	99.95 a	2.80 a	52.60 a
T_5	413.0 ab	1258.0 a	77.79 b	22.24b	22.24bc	13.45 bc	99.83 cd	2. 59a	46.01 ab
T_6	366.2 bc	1279.0 a	81.03 a	77.79b	18.79d	16.00 a	99.82d	2.53 a	45.23b

Literature cited

1. *Abd EL-Migeed M.M.M., Saleh M.M.S., Mostafa E A. M. and Abou Raya M.S.* Influence of soil and foliar applications of boron on growth fruit set, mineral status, yield and fruit quality of Picual olive trees // Egypt. J. Appl. Sci. – 2002. – 17: 216-272.
2. *Anjum M.A., Ghattha G.A., Sultan M. and Abbas S.* Flowering behavior, fruit setting and extent of mango malformation // International Journal of Agriculture & Biology. – 1999. – 1 (3): 88-90.
3. Anonymous, 2005. Agricultural statistics of Pakistan. Government of Pakistan, Ministry of Food, Agriculture & Livestock, Islamabad, Pakistan.
4. *Bahadur I., Malhi C.S. and Singh Z.* Effect of foliar and soil application of Zinc sulphate on Zinc uptake, tree size yield and fruit quality of mango // Journal of Plant Nutrition. – 1998. –21 (3): 589-600.

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

5. *Bally I.S.E.* Crop Production: Mineral Nutrition in: R.E. Litz. (ed.). The Mango, 2nd edition: Botany, Production and Uses CAB International, UK. – 2009. – Pp. 404-431.

6. *Banik B. C., Sen S. K. and Bose T. K.* Effect of Zinc, Iron and Boron in combination with urea on growth. Flowering and fruit quality of mango cv. Fazli // Environment and Ecology. – 1997. – 15(1): 122-125.

7. *Chadha K.L., Pal R.N.* The current Status of the mango industry in Asia // Acta Horticulture. – 1993. – 341: 42-54.

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

9. FAO, 2004. Food and Agriculture Organization (FAO), Rome. www.fao.

10. *Hill A.F.* In: Economic of Botany. Chapter-Introduction. 2nd Ed. McGraw Hill, New York, 1952. – P. 156.

11. *Jagirdar S.A.P. and Jafri N.R.* Malformation of inflorescence // Agri Pak. – 1996. – 17: 357.

12. *Kaur A., Ha C.O, Jong K., Sands V.E., Chan H.T., Soepadmo E. and Ashton P.S.* Apomixis may be widespread among trees of climax rain forest // Nature. 1980. – 271: 440-442.

13. *Khan M.D. and Khan A.M.* Some studies on malformation of mango inflorescence // Ind. Jour. Hort. – 1958. – 22: 254-265.

14. *Koo R C. J. and Young T.W.* Effect of age and position on mineral composition of mango leaves // J. of Ameer. Soc. of Horti. Sci. – 1972. – 97: 729-794.

15. *Marschner H.* Mineral Nutrition of Higher Plants, 2nd edition. Academic Press, London, 1995.

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

17. *Mukherjee S.K. and Litz R.E.* Introduction: Botany and Importance, in: R.E. Litz. (ed.). The Mango, 2nd edition: Botany, Production and Uses CAB International, UK, 2009. – Pp. 1-18.

18. *Purseglove J.W.* Mangoes of West India // Acta Horticulture. – 1972. – 24: 107-174.

19. *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.

20. *Salisbury F.B. and Ross C.W.* Plant Physiology. Wadsworth, Belmont, California, 1992.

21. *Sauco V.* Mango World Production // Acta Horticulture. – 1997. – 455: 15-20.

22. *Sen. PK., Sen S K. and Guha D.* Carbohydrates and nitrogen contents of mango shoot in relation to their fruit bud differentiation // Indian Agriculture. – 1943. – 7: 133-138.

23. *Singh R.N.* 1978. Mango. Indian Council of Agricultural Research, New Dehli. Pp. 39-55.

24. *Singh R.R. and Rajput C.B.S.* 1977. Effect of various concentrations of zinc on vegetative growth characters, flowering, fruiting and physio-chemical composition of fruits in mango (Mangifera Indica L.) ev. Chaunsa. Haryana Journal of Horticultural Science 10-14.

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

26. *Steel R.G.D. and Torrie J.H.* Multiple comparison, Principles and Procedures of Statistics. McGraw Hill Book Co. Inc. New York, 1980. – Pp. 336-354.

27. *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. 91-98.

Эксперимент был проведен на постдипломной исследовательской станции (PARS) в Университете сельского хозяйства Фейсалабад (Пакистан) для изучения влияния микронутриентов, а именно B & Zn на вегетативно-репродуктивный рост разновидности манго (*Mangifera indica* L.) Langra. Максимальные flushes (686) возникали у растений, обработанных вариантом (T1) 0,8% H3BO3 по сравнению с контролем (572). В то время как максимальные метелки (433) возникали на растениях, обработанных (T4) 1% H3BO3 и 1,2% ZnSO4 по сравнению с контролем (305) и T1 (362), соответственно. Анализ показал, что максимальный выход / растение (52,60 кг) регистрировалось в варианте T1 по сравнению с контролем (40-57 кг).

Ключевые слова: манго; *Mangifera indica* L.; Langra; вегетативный и репродуктивный рост; микроэлементы; B; Zn.

СОВРЕМЕННЫЕ НАПРАВЛЕНИЯ, МЕТОДЫ И РЕЗУЛЬТАТЫ СЕЛЕКЦИИ ПЛОДОВЫХ, ЯГОДНЫХ, СУБТРОПИЧЕСКИХ ПЛОДОВЫХ И ОРЕХОПЛОДНЫХ КУЛЬТУР

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СОЗДАНИЕ СОРТОВ АЙВЫ ДЛЯ ПРОМЫШЛЕННОГО САДОВОДСТВА

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Приведены результаты многолетнего изучения новых сортов айвы селекции Никитского ботанического сада. Выделены сорта, перспективные для использования в промышленном садоводстве Крыма и юга России: Дачная, Знахидка, Мрия, Новоричная, Октябрина, Осенний Сувенир, Сладкая, Сказочная. Дана их характеристика. Они соответствуют современным требованиям, предъявляемым к сортам интенсивного типа

Ключевые слова: *айва; селекция; гибрид; новые сорта; устойчивость; урожайность; интенсивное садоводство.*

Введение

Айва – ценная плодовая культура, которая, благодаря достаточно высокой устойчивости к абиотическим стрессорам, может успешно возделываться в Крыму. С развитием консервной промышленности в пятидесятые годы прошлого столетия в Степном отделении Никитского ботанического сада была начата работа по интродукции, сортоизучению и селекции айвы. Полученные результаты показали широкие возможности и целесообразность возделывания этой культуры в степной зоне Крыма, располагающей достаточными земельными ресурсами [2].

В настоящее время айве, к сожалению, не уделяется должного внимания и промышленных насаждений практически не существует. В производстве соков, нектаров,