J. Agric. Sci. Mansoura Univ., 34 (5): 5077 - 5087, 2009

RESPONSE OF MANGO (*Mangifera indica* L.) CV. HINDI BESINARA TO ZINC AND BORON AS SOIL AND SPRAYING APPLICATION TREATMENTS.

Kamal, A. B. ; H.A. AbdelKareem and A. S. AbdAllah

Tropical Fruit Research Division, Horticulture Research Institute, Agric. Research Center, Giza, Egypt.

ABSTRACT

This investigation was carried out during the two successive seasons of 2005/6 and 2006/7 to study the response of Hindi BeSinara cv. mango trees to zinc and boron as well as the combination (Zn+B) as soil and/or spraying application treatments. The chosen trees were 10-year-old grown in loamy soil of a private orchard at Beni-Mazar, Minia Governorate. The trees were supplied with N, P and K at rates of 1000, 400 and 1000 g/tree/year. Zn at 250 g and Boron at 500 g and its combination (Zn+B) were added as soil application. Spraying application with 150 g Zn and 300 g B and its combination (Zn+B) were occurred at monthly intervals (3 equal doses) from March to May. The obtained results revealed that all treatments of Zn and B and the combination of them did not affect growth of trees. Sex ratio, fruit length, fruit diameter and L/D ratio, total acidity and leaf contents of N, P, K, Ca, Mg, Fe, Mn and Cu showed insignificant differences as compared to control. However, fruit set, yield, fruit weight, pulp and peel weight, TSS, TSS/acid ratio, leaf Zn and B contents were significantly improved by Zn and B treatments.

In addition, B treatments were more effective than Zn treatments. The combination of Zn+B treatments was the best treatment and spraying application was superior in comparison to soil application.

INTRODUCTION

Fertilization practices varied widely among commodities and growers. In most cases, growers multiple criteria to determine their fertilizer program, the most common being time of year or crop growth stage and appearance. Few growers use soil or leaf analysis as a tool, to determine need of trees to fertilization. NPK application was most common in dry form, but the frequency and amount applied varied among crops and between growers of the same crop. Furthermore, foliar application is used for most micronutrients (Li *et al*., 2001). Major (N, P and K) and trace (Cu, Zn and B) elements were applied through the soil and/or as foliar spray to 28-year-old mango cv. Dashehari trees. With regard to major elements, the highest yield (number of fruits/tree and kg fruits/tree) were obtained with soil + foliar application. Individual fruit weight increased and fruit number decreased with increasing treatments application. Fruit quality was improved by higher trace element application. Moreover, highest mean values of available soil nutrients were obtained with combined soil and foliar application of NPK along with soil application of trace elements at the higher doses (Singh and Khan 1990, 1991, 1995 & 1996). Leaf mineral contents in mango clearly affected with NPK and treatments fertilizers. Potassium fertilization increased N, P, K, Zn and Mn contents but decreased level of Fe. Moreover, nitrogen and phosphor fertilization increased N, P and chlorophyll contents (Mondal and Chattopadhyay 1993

and Duta and Dhua 2002). Nitrogen application significantly influenced the tree growth and fruit yield of young Totapuri mango trees, while P and K application did not. Average fruit size and total soluble solids of pulp were significantly influenced by N nutrition during the tenth year, but other fruit quality attributes were unaffected (Reddy *et al*., 2002 and Smith, 2002). The response of mango to B application was found to be more in foliar than in soil application. The boron requirements of mango varieties used as crown is quite variable (Raja *et al.,* 2005).

Quietly foliar application of zinc sulphate was the most cost-effective way to maintain leaf zinc above the critical concentration. Yearly soil application of 50g slobber (soluble-boron) per tree maintained leaf boron above the adequate concentration of 50 mg/kg. Mango yield was not significantly affected by any of the treatments (Littlemore *et al*., 2005). Adequate NPK fertilization on station produced 8.2 t/ha, but with supplementation of S, Zn and B yield increased to 9.8 t/ha (Edward, 2007).

Fertilization must be designed to enhance the productivity, while maintaining the quality of the cultivated plants at as low a cost as possible. However, fertilization treatments at suitable level and source showed promotive effect on the plant growth, root system characters as well as active ingredients. The application of N, P, K, Zn, Fe and B fertilization has been reported to stimulators growth and to affect the chemical constituents of plants (Salem, 1994 and Manchonda *et al*., 1972).

MATERIALS AND METHODS

This experiment was carried out through the two seasons of 2005/6 and 2006/7 on Hindi- Be Sinara mango cv. trees grown in a private orchard at Beni-Mazar District, Minia Governorate. The trees were 10-year-old grown in loamy soil (Table, 1) irrigated with flooding system and planted in square shape 5 m apart. Twenty one trees nearly similar in vigor, which received the normal farm practices, were subjected to different seven treatments, each treatment was replicated three times (one tree/one replicate), then, the following treatments were conducted:

1- 1000 g ammonium sulphate (26.0% N) + 400 g calcium super phosphate (10.5% P2O) + 1000 g potassium sulphate (20.5% K_2O) as control.
2- 1000 g N + 400 g P + 1000 g K + 250 g Zn sulphate as soil application.
3- 1000 g N + 400 g P + 1000 g K + 500 g Borax as soil application.
4- 1000 g N + 400 g P + 1000 g K + 250 g Zn sulphate + 500 g Borax as soil application.
5- 1000 g N + 400 g P + 1000 g K + 150 g Zn sulphate as foliar spraying.
6- 1000 g N + 400 g P + 1000 g K + 300 g Zn sulphate (Borax) as foliar spraying.
7- 1000 g N + 400 g P + 1000 g K + 150 g Zn sulphate + 300 g Borax as foliar spraying.

In this concern, ammonium sulphate, potassium sulphate and calcium super phosphate were used as a sources of N, P and K. Control trees were received N, P and K only during the two studied seasons. Calcium super phosphate was added during winter (January) with organic manure around

the root zone of trees. Rates of N, P, K, Zn and B were divided in two equal doses and added at 1st February and 1st April during the both studied seasons as soil application. Foliar spraying of Zn and B and the combination of Zn + B were sprayed at monthly intervals from March to May (3 equal doses) in both seasons. The following measurements were estimated:

1- Number of flushes per season and number of panicles per tree.
2- Sex ratio (Number of perfect flowers/total number of flowers per panicle).
3- Fruit set percentage was calculated at pea stage which was quantified on 10 panicles per tree as shown by (El-Masry and Galila, 1991).
4- Physical properties of fruit, i.e. Fruit length (cm), fruit diameter (cm), L/D ratio.
5- Fruit chemical properties, i.e. Total soluble solids (TSS) as brix, Total acidity percentage (expressed as grams of citric acid per 100 ml juice) as pointed in A.O.A.C. (1980) and total sugars.
6- Leaf mineral content: Samples of the third and fourth leaf from the shoot base (10 leaves/tree) were collected after harvesting (September). The leaf samples were oven dry at 70°c, and then grinded and N, P, K, Ca, Mg, Fe, Zn, Mn, Cu and B contents were determined. Total nitrogen was determined using micro Kieldahl method as described by Pregl (1945). Phosphorous was determined colorimetrically by staunus chloride method (Toth *et al.,* 1948). Potassium level was estimated according to Brown and Lilleland, (1946). Calcium and magnesium were determined by titration against Na EDTA (Verssenete) solution (Johenson and Ulrich, 1959). The results obtained for the above mentioned determinations were expressed as percentage on dry weight basis. Copper, zinc, iron and magnesium were determined after dry aching of leaf samples according to method determined by Chapman and Pratl (1961), directly in the original solution without adding any reagents by using the Atomic Absorption Spectrophotometer apparatus boron was determined colorimeterically using curcumin oxalic acid method (Chapman and Pratl, 1961). The concentrations of zinc, iron, manganese, copper and boron were exposed as parts per million on dry weight basis.

Table (1): Mechanical and chemical analysis of the tested soil (30 cm depth).

Mechanical		Chemical	
Analysis	**conditions**	**Analysis**	**conditions**
Fine sand	1.16 %	$CaCO_3$	1.84 %
Silt	44.23 %	Total N	0.35 %
Clay		Available K	1.54 ppm
	54.61 %	Available P	118.6 ppm
		Available Fe	0.24 ppm
		Available Cu	0.29 ppm
		Available Zn	0.16 ppm
		Available Mn	0.23 ppm
		Organic matter	1.04 %

A complete randomized block design was used for statistical analysis and New L.S.D. test was used for comparison between means (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

1-Growth and flowering:

The obtained results in Table 2 showed the effect of soil application and spraying of Zn, B and the combination (Zn +B) beside N, P and K fertilization treatments on number of flushes, number of panicles per tree, total number of flowers per panicle, number of perfect flowers and the sex ratio. Concerning number of flushes produced in each studied season, the obtained results showed that, all tested trees did not differ significantly and gave similar number of flushes (3) during the both experimental seasons. Meanwhile, number of panicles per tree showed significant variations between all tested treatments and control which ranged between 27 and 31 panicles per tree in both studied seasons. In addition, total number of flowers and number of perfect flowers per panicles also showed true variations between all tested treatments and control trees. However, the sex ratio did not affect by N, P and K treatment (control) or by Zn, B and the combination (Zn+B) treatments either as soil application or as spraying application and ranged between 21 and 32% in the first season, and between 20 and 22% in the second one, respectively.

Analogical results were reported by Singh and Khan 1990 ; Roja, 2005 and Littlemore *et al.* (2005).

2-Fruit set and yield:

The obtained results in Table 3 showed that, Zn and B treatments increased percentage of fruit set as well as yield per tree in comparison to N, P, K only (control). Meanwhile, B treatments were more effective than Zn treatments. The highest values concerning fruit set percentage were obtained from the combination of Zn+B. Fruit set percentage increased gradually with Zn, B and Zn+B treatments as soil application (0.27, 0.30 and 0.31%) and (0.26, 0.29 and 0.31%), respectively. However, foliar spraying of Zn, B and Zn+B was superior, gave 0.28, 0.34 and 0.41% in the first season and (0.29, 0.36 and 0.43%) in the second season, respectively. On the other hand, the least values of fruit set percentage (0.25 and 0.24%) were produced from trees fertilized with N, P and K only (control).

Regarding the effect of trace elements Zn, B and the combination (Zn+B) treatments on yield, the obtained data also showed that, Zn treatment increased yield per tree (number of fruits or kg/tree) when supplied to soil and gave 21 and 20 fruits weighted 5.538 and 5.300 kg. While when sprayed on the tree gave 22 and 22 fruits weighted 5.922 and 5.949 kg. Moreover, B treatment was more effective which produced 25 fruits weighted 6.670 kg and 24 fruits weighted 6.458 kg as soil application while spraying B trees produced (27 fruits weighted 7.228 kg and 27 fruits weighted 7.306 kg) in the first and second seasons, respectively.

2-3

In addition, combination between Zn and B were superior in this respect and spraying application was more effective which gave the highest yield per tree (35 fruits weighted 9.597 kg) and (36 fruits weighted 9.907 kg) against (26 fruits weighted 7.056 kg) and (25 fruits weighted 6.833 kg) for soil application. However, trees supplied with NPK only (control) gave the lowest yield per tree (19 and 18 fruits) weighted (4.965 and 4.736 kg) in the first and second seasons, respectively.

These results were in agreement with the finding of Singh and Khan (1990 and 1991), Roja, 2005; Littlemore *et al.* 2005 and Edward (2007) on mango.

3-Fruit physical properties:

The obtained results in Table 4 revealed that, fruit weight significantly affected by Zn and B treatments. Moreover, B treatments increased fruit weight to 266.8 and 269.1 g against Zn treatment (263.7 and 265.0 g) as soil application trails, additionally spraying B treatments were superior (269.7 and 270.0 g) then spraying Zn treatments (267.2 and 269.4 g). Overall, combination between Zn and B treatments produced the highest values concerning fruit weight, which soil application treatments gave 271.4 and 273.3 g, while spraying application treatments were the effective and gave 274.2 and 275.2 g. However, fruit of trees received NPK only (control) weighted 261.3 and 263.1 g in the first and second seasons, respectively.

Concerning pulp and peel weight, a significant differences were noticed between treatments and control. Thus, combination treatments (Zn+B) as soil application increased pulp weight (162.8 and 164.9 g) against (106.6 and 108.4g) for peel weight while spraying applications of Zn+B increased pulp weight to 165.5 and 166.4g against (108.7 and 108.8 g) for peel weight. However, the lowest values for pulp weight 156.8 and 157.9 g and peel weight (104.5 and 105.2 g) were obtained from trees received NPK only (control) in both seasons, respectively.

Fruit length (L), diameter (D) and L/D ratio showed insignificant differenced between all experimental treatments and control trees.

These results coinciding the findings of Sing and Khan(1990), Roja, 2005 and Edward, 2007.

4-Fruit chemical properties:

The effect of Zn and B and the combination of them (Zn+B) treatments on fruit chemical constituents are illustrated in Table 5 obtained data showed significant increments in TSS only with combination treatment (Zn+B) as spraying application (18.26 and 18.32 %). and, TSS/acid ratio significantly increased with the same treatment 17.73 and 17.79%) in comparison to control trees. Moreover, values of total acidity show insignificant differences between all studied treatments and control trees in the first and second seasons, respectively.

These results are in agreed with that obtained by Salem, (1994).

5-Leaf mineral contents:

The obtained data in Table 6 show the effect of Zn and B and the combination of them on leaf macro and micro-nutrient contents.

4-5

The obtained results showed that, N, P and K did not differ significantly between all tested treatments and control trees. Also, Ca, Mg, Fe, Mn and Cu values showed insignificant variations between all tested treatments in both studied seasons. On the other hand, Zn and B leaf contents significantly increased by using Zn, B and (Zn+B) treatments in comparison to control trees, which spraying treatments of Zn and/or B were more effective than soil application treatments. The higher values of leaf zinc contents (68 and 71 ppm) and leaf boron contents (181 and 184 ppm) were obtained from spraying Zn and B treatments in both studied seasons, respectively. In addition, the leaf contents of Zn and B reached the highest values (69 and 76 ppm for Zn) and (187 and 189 ppm for B) with Zn+B spraying treatment in the first and second seasons, respectively.

These results were in accordance with those finding by Salem (1994), Manchonda *et al*. (1972); Singh, (1995); Mondal, (1993), Littlemore *et al*. (2005) and Edward, (2007).

It can be concluded that, treatments of Zn and B and their combination (Zn+B) did not significantly affect growth of Hindi Be-Sinnara mango cv. Sex ratio, fruit length, fruit diameter, L/D ratio, total acidity and leaf contents of N, P, K, Ca, Mg, Fe, Mn and Cu. Moreover, fruit set percentage, yield, fruit weight, pulp and peel weight, TSS, TSS/acid ratio, leaf Zn and B contents significantly improved by that tested treatments. In addition, B treatments were more effective than Zn treatments in this respect. The combination of Zn + B as spraying application was superior in comparison to soil application.

REFERENCES

A.O.A.C. (1980): Official Methods of Analysis of the Association of Official Agric. Chem., 8th Ed 100pp.

Brown, J. D. and O. Lilleland (1946): Rapid determination of potassium in plant materials and soil extracts by flame-photometry. Proc. Amer. Soc. Hort. Sci., 46:341-346.

Chapman, H. D. and P. F. Pratl (1961): Methods of Analysis for Soil, Plants and Waters. Univ. of Calif. Division of Agric. Sci.

Dutta, P. and R. S. Dhua (2002): Effect of potassium nutrition on mineral composition of mango leaf and ripe fruit. Indian Hort., 56(3):238-241.

Edward, R. M. (2007): Balanced fertilization for quality fruit mango production in Ultar Pradesh. Indian Inst. Hort. Res. Bangalore, India.

El-Masry, H. M. and S. A. Galila (1991): Effect of different rates of nitrogen fertilization on flowering, fruit set, yield and fruit quality of Annona trees. Anal Agric. Sci. Moshtohor, Egypt.pp 451.

Johanson, C. H. and A. Ultrich (1959): Analytical Methods for Use in Plant Analysis. U.S. Dept. Agric. Calif. Univ. Bull. Pp 231.

Li, Y. C., J. Crane, B. Boman and C. Balerdi (2001): Fertilizer management survey for tropical fruit crops in south Florida. Proc. Florida State Hort. Soc., 112:127-176.

Littlemore, J.; E. C. Winston, C. J. Howitt; P.O. Forrell and D. C. Wilfen (2005): Improved methods for zinc and boron application to mango (*Mangifera indica* L.) cv. Kengiston Pride in the Mareebo Dimbulah district of North Queensland. Australian J. Agric. Sci., (6):327-332.

Manchonda, H. R.; V. C. Shukla and N. S. Pandhow (1972: Effect of soil and foliar application of zinc and Cu, M, F alone and in combination on the incident of chlorosis in sweet orange. Indian J. Hort., 29(1):19-29.

Mondal, A. and P. K. Chattopadhyay (1993): Soil and leaf nitrogen, phosphorus and potassium and leaf chlorophyll of custard apple in relation to variation in soil nutrition. Crop Res. (Hisra), 6(2):300-305. (C.F.,Hort. Abst., 63:8419).

Pregl, F. (1945): Quantitative Organic Micro-Analysis, 4th Edit, J. A. Charchill, LTD. London.

Raja, M. E.; S. Kumar; C. Anil and S. Y. Raju (2005): Boron deficiency in mango (*Mangifera indica* L.) A case delineation study in actic soils. Indian Instit. Hort. Res. South Indian Hort., 34(1):7-13.

Reddy, Y. T.; R. M. Kurian ; R. R. Kohli and G. Singh (2002): Effect of nitrogen, phosphorous and potassium on growth, yield and fruit quality of "Tota puri" mango (*Mangifera indica* L.) Ind. J. Agric. Sci., 70(7):475-478. (C.F. Hort. Abst.72:3214)

Salem, M. S. (1994): Response of Annona trees to nitrogen, zinc, manganese and iron as foliar treatments. Egypt J. Appl. Sci. Zagazig Univ., 9(7):1-18.

Roy, S. and M. N. Hoda (1994): Effect of period of defoliation and storage of bud-wood on veneer grafting in mango. India J. Appl. Biology 4(1-2):30-32.

Singh, K. and A. Khan (1990): Effect of fertilization on yield and quality of mango fruit cv. Dashehari. Progressive Hort. 22(1-4):44-50.

Singh, K. and A. Khan (1991): Effect of fertilization on the availability of nutrients in soil of mango orchard cv. Dashehari. Progressive Hort. 23(1-4):93-96.

Singh, K. and A. Khan (1995): Effect of fertilization on the uptake of minor elements in root, leaf and fruit of mango fruit cv. Dashehari. Recent Hort. 2(2):24-28.

Singh, K. and A. Khan (1996): Effect of fertilization on the uptake of major elements in mango leaf cv. Dashehari. Recent Hort. 3(1):14-17.

Smith, B. L. (2002): The effect of different level and timing of nitrogen fertilization on the yield and internal quality of mangoes cv. Tommy Atkins. Hort. Abst., 72:2220.

Snedecor, G.W. and W.G.Cochran (1967). Statistical Methods . 6th ed. Iowa State Univ. Press, Amer , Iowa, U.S.A. pp . 395.

إستجابة أشجار المانجو صنف هندى بسنارة للمعاملات بالزنك والبورون كإضافة أرضية أو بالرش

أحمد بهى الدين كامل ، حسن على عبد الكريم و عباس سعد عبد الله
قسم بحوث الفاكهة الاستوائية، معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر.

أجريت هذه الدراسة خلال موسمى ٢٠٠٥/٦ ، ٢٠٠٦/٧ لمعرفة استجابة أشجار المانجو صنف هندى بسنارة لمعاملات الزنك والبورون كإضافة أرضية أو رشاً على الأشجار. وكانت الأشجار المعاملة نامية فى أرض طميية بمزرعة خاصة بمركز بنى مزار محافظة المنيا. وتم التسميد بالعناصر الكبرى بإضافة ١٠٠٠جم سلفات امونيوم ، ٤٠٠ جم سوبر فوسفات ، ١٠٠٠ جم سلفات بوتاسيوم وكانت المعاملات كالتالي: أشجار كنترول تم تسميدها بالعناصر الكبرى فقط NPK وباقى المعاملات هى الزنك بمعدل ٢٥٠جم والبورون بمعدل ٥٠٠ جم وخليط من المعاملتين (زنك + بورون) كإضافة أرضية. أما معاملات الرش فكانت بمعدل ١٥٠جم زنك ، ٣٠٠ جم بورون وخليط منهما . وقد أوضحت النتائج المتحصل عليها أن جميع معاملات الزنك والبورون والخليط منهما لم تؤثر معنويا على النمو. كما لم تتأثر النسبة الجنسية وطول وقطر الثمرة وكذلك معدل الطول إلى القطر وأيضا لم تتأثر نسبة الحموضة الكلية للثمار. محتوى الأوراق من النتروجين والفوسفور والبوتاسيوم والكالسيوم والمغنسيوم والحديد والمنجنيز والنحاس لم يظهر فروقا معنوية بين أشجار الكنترول وأشجار المعاملات المختلفة.

من ناحية أخرى أدت المعاملات بالزنك والبورون الى تحسن معنوى فى نسبة العقد والمحصول ووزن الثمرة واللب والقشرة كما تحسنت بصورة معنوية محتوى الثمار من المواد الصلبة الذائبة الكلية ومعدا المواد الصلبة الذائبة الى الحموضة وارتفع محتوى الأوراق معنويا من الزنك والبورون. بالإضافة الى ذلك كانت معاملات البورون أفضل من حيث تأثيرها مقارنة بمعاملة الزنك. وأفضل المعاملات هى الخليط من الزنك والبورون عند استخدامها رشا على الأشجار.

Table (2): Effect of different treatments on number of flushes, number of panicles per tree and the sex ratio of Hindi BeSinara mango cv during 2005/6 and 2006/7 seasons.

Treatments	First season					Second season				
	No. of Flushes	No. of Panicle per tree	Total No of flowers per panicle	No of perfect flowers	Sex %	No. of Flushes	No. of Panicle per tree	Total No of flowers per panicle	No of perfect flowers	Sex %
NPK	3	27	341	75	21.99	3	29	346	73	21.1
NPK + Zn (soil App)	3	29	343	75	21.87	3	31	345	76	22.03
NPK+ B (soil App.)	3	31	347	76	21.9	3	28	348	78	22.41
NPK+Zn+ B (soil App.)	3	27	344	74	21.15	3	31	346	76	21.97
NPK+Zn (spray App.)	3	28	349	78	22.34	3	27	341	75	21.99
NPK+B (Spray App)	3	30	344	77	22.38	3	30	349	77	22.06
NPK+Zn+ B (Spray App.)	3	29	347	78	28.47	3	29	345	76	22.02
New L.S.D at 0.05	NS	1.4	2.7	2.1	N.S	N.S	1.1	1.6	2.2	N.S

Table (3): Effect of different treatments on some fruit set and yield of Hindi BeSinara mango cv. during (2005/6 and 2006/7 seasons.

Treatments	First season			Second season		
	Fruit set %	Yield		Fruit set %	yield	
		Fruit/ tree	Fruit weight (kg)		Fruit/tree	Fruit weight (kg)
NPK	0.25	19	4.965	0.24	18	4.736
NPK + Zn (soil App)	0.27	21	5.538	0.26	20	5.300
NPK+ B (soil App.)	0.30	25	6.670	0.29	24	6.458
NPK+Zn+ B (soil App.)	0.31	26	7.056	0.31	25	6.833
NPK+Zn (spray App.)	0.28	22	5.922	0.29	22	5.949
NPK+B (Spray App)	0.34	27	7.228	0.36	27	7.306
NPK+Zn+ B (Spray App.)	0.41	35	9.597	0.43	36	9.907
New L.S.D at 0.05	0.04	3.2	3.4	0.06	3.7	2.1

Table (4): Effect of different treatments on some physical characteristics of Hindi BeSinara mango cv. during (2005/6 and 2006/7 seasons.

Treatments	First season						Second season					
	L (cm)	D (cm)	L/D	Fruit weight (gm)	Pulp weight (gm)	Peel weight (gm)	L (cm)	D (cm)	L/D	Fruit weight (gm)	Pulp weight (gm)	Peel weight (gm)
NPK	11.0	6	1.8	261.3	156.8	104.5	11.0	5	2.2	263.1	157.9	105.2
NPK + Zn (soil App)	12.0	6	2.0	263.7	158.2	105.5	12.0	6	2.0	265.0	159.0	106.0
NPK+ B (soil App.)	12.0	7	1.7	266.8	160.1	106.7	12.0	6	2.0	269.1	161.5	107.6
NPK+Zn+ B (soil App.)	12.0	7	1.7	271.4	162.8	106.6	12.0	7	1.7	273.3	164.9	108.4
NPK+Zn (spray App.)	12.0	6	2.0	267.2	161.5	106.7	12.0	6	2.0	269.4	162.2	107.2
NPK+B (Spray App)	12.0	6	2.0	269.7	160.6	109.1	12.0	6	2.0	270.6	162.4	108.2
NPK+Zn+ B (Spray App.)	12.5	8	2.0	274.2	165.5	108.7	12.5	8	1.7	275.2	165.4	108.8
New L.S.D at 0.05	NS	N.S	N.S	2.4	2.1	1.6	N.S	N.S	N.S.	2.1	1.4	1.7

Table (5): Effect of different treatments on some chemical characteristics of Hindi BeSinara mango cv. during (2005/6 and 2006/7 seasons.

Treatments	First season			Second season		
	TSS (%)	Acidity (%)	TSS/ acid ratio	TSS (%)	Acidity (%)	TSS/acid ratio
NPK	17.04	1.12	15.21	17.14	1.11	15.44
NPK + Zn (soil App)	17.62	1.08	16.32	17.53	1.07	16.38
NPK+ B (soil App.)	17.65	1.07	16.50	17.68	1.05	16.84
NPK+Zn+ B (soil App.)	17.71	1.03	17.19	17.81	1.04	17.13
NPK+Zn (spray App.)	17.68	1.05	16.84	17.66	1.08	16.35
NPK+B (Spray App)	17.72	1.04	17.04	17.69	1.05	16.85
NPK+Zn+ B (Spray App.)	18.26	1.03	17.73	18.32	1.03	17.79
New L.S.D at 0.05	1.01	N.S	1.12	1.04	N.S	1.14

Table (6): Effect of different treatments on some leaf micro and macro-nutrient contents of Hindi BeSinara mango cv. during (2005/6 and 2006/7 seasons.

Treatments	First season										Second season									
	N	P	K	Zn	B	Ca	Mg	Fe	Mn	Cu	N	P	K	Zn	B	Ca	Mg	Fe	Mn	Cu
	%	%	%	ppm	ppm	%	%	ppm	ppm	ppm	%	%	%	ppm	ppm	%	%	ppm	ppm	ppm
NPK	1.17	0.085	0.94	34	153	1.7	0.16	252	33	19	1.19	0.0884	0.93	35	154	1.71	0.16	251	33	19
NPK + Zn (soil App)	1.20	0.089	0.95	49	154	1.71	0.15	253	36	19	1.19	0.087	0.95	51	154	1.72	0.16	250	34	19
NPK+ B (soil App.)	1.19	0.086	0.94	39	173	1.7	0.15	251	34	19	1.21	0.085	0.95	36	171	1.7	0.15	253	36	20
NPK+Zn+ B (soil App.)	1.20	0.091	0.94	52	178	1.7	0.16	251	35	20	1.2	0.09	0.94	54	177	1.73	0.17	250	35	19
NPK+Zn (spray App.)	1.18	0.089	0.95	68	156	1.71	0.17	251	36	20	1.19	0.089	0.96	71	158	1.72	0.16	251	37	20
NPK+B (Spray App)	1.20	0.087	0.95	39	181	1.73	0.16	253	34	19	1.2	0.087	0.95	37	184	1.71	0.15	253	35	19
NPK+Zn+ B (Spray App.)	1.20	0.089	0.95	69	187	1.72	0.15	254	36	19	1.19	0.086	0.94	76	189	1.72	0.16	252	36	20
New L.S.D at 0.05	N.S	N.S	N.S	2.04	2.16	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	2.15	2.21	N.S	N.S	N.S	N.S	N.S