

## Effects of Some of Nutritional Materials on Fruit Set and Its Characteristics in Apple

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### ABSTRACT

Balance of organic material, micro and macro elements are the most effect factors on yield and crop quality in apple trees. Therefore, for investigation the effect of different nutrient factors on fruit set and fruit quantity and quality, an experiment was conducted with 8 treatments including Thiofer, Ticaminmax, Ticaminmax + Oligogreen, Ticaminmax + B(Boran) + Zn(HAS Zn) 25% Fertilizer, B(Boran) + Zn(HAS Zn) 25% HAS green Italy, B(Boron) + Zn(HAS Zn) 25% + Thiofer, B(Boron) + Zn(HAS Zn) 25% Ticaminmax and control(water) in the buds swell stage using randomized complete bloke design (RCBD) in triplicate on the late winter 2011. Results showed that different treatment had various effects on fruit set and fruit quantity and quality in way that treatments contain Boron and Zinc compound had the most effect on fruit set than other treatments. Also treatments including organic material (amino acids) had the most effect on fruit weight. In generally, in this research, it was found that treatments with micronutrients and amino acids were affect on yield of apple.

**KEYWORDS:** Apple, antistress, fruit set, yield, Micro-nutrients

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### 1. INTRODUCTION

Due to the growing needs of society to agricultural production, all focuses and tries have been to increase productions efficiency of agricultural community and many studies have been done to achieve this important goal. The apple is one of the oldest fruit known to man, and to feed him has started to the breeding and domestication [2,15]. Fruit is one of the important products of the horticulture and the highest production rate belongs to China and the US. Apple producing, as a productive part of the horticulture economy is an important factor. In many developing countries, this part has a great grown, and has the export power, and it has a special place in agricultural programs. Apple production in Iran has a valuable role in the national economy and among the major apple producing countries, Iran has always been among the first ten countries in the world and has the second place in terms of the level of production after citrus. It was found Balance of organic material; micro and macro elements are the most effect factors on yield and crop quality in apple trees. Thus, the role of various elements in increasing yield and improving fruit quality has particular importance in enhancing the yield [2]. Hence, the need for research and planning, to increase the level, and more importantly increased yield is inevitable. The best way to achieve above objective is to increase production per unit area and enhance the quality of products. According to the documents, among agricultural inputs, adding a balanced fertilizer is the most efficient input than others, to increase agricultural productions. Obviously producers by adding balanced and proportionate nutrients, try to bring their production to the extent appropriate. In this regard, the best and most reasonable way to determine the amount of fertilizer is performed fertilizer recommendations based on soil test [3,6,15]. Lack of micro-nutrients in calcareous soils than in acid soils is greater. Unfortunately, these elements are missing, such as organic matter. In calcareous soils, the solubility of micronutrients far less compared to acidic soils, and therefore plants requires are more but in the past, it was not important, because were accepted the low production per unit area. Experience shows that, under these conditions, foliar application is an effective way to compensate for the lack of these elements in fruit trees [8,11]. The application of micro-nutrients in countries with advanced agriculture is, about 2 to 4 percent of the total fertilizer consumption, but in Iran this value is negligible in about .00002 percent [11]. In this method the elements necessary to quickly and efficiently extract the plant is relatively high. Reducing the use of chemical fertilizers and environmental consequences associated with it (such as contamination of groundwater and soil structure degradation) are characteristic of this method of fertilization. Foliar feeding of nutrients such as boron, manganese, zinc and iron in calcareous soils is more appropriate than soil fertilizing in calcareous soils. In this soil, foliar nutrition deficiency due to rapid removal and prevention of soil stabilizing elements in comparison with soil fertilizer has higher efficiency. One reason for the lack of micronutrients, especially iron and zinc in the fields and orchards is low availability of this element (due to high soil pH and high calcium carbonate), while the total number of elements in the soil may be high. In such circumstances, the foliar application can be found to increase the yield and improve the product quality [3,6,15]. Nowadays consistent with the management of foliar feeding respect to different methods to control and reduce injuries and damages caused by the stress has been studied and tested by researchers, but there are compounds that by spraying at the right times, can prevent of stress or improve the quantity and quality of fruit trees such as Thiofer, Crop Aid and

Ticaminmax. These compounds are due to having the different nutrients, including amino acids; in addition, retrofitting plants to various stresses is a very convenient nutritional supplement that is useful for plants. That effect of use during growing season is easily visible [9].

In apple trees growing, factors such as fertilization, nutrition, irrigation, health and ratio of leaf to fruit or tree density in area units is affecting on quality of the crop that loss or impairment of any kind, makes the producer away from the goal [11]. So the goal of growing and maintain of fruit crops should be sufficient to deliver the annual fertility and crop production throughout the economic life of orchard. Therefore by applying logical methods and optimal use of fertilizer can increase yield and improve the quality characteristics of fruit, and can encourage farmers to develop more cultivation of apple [10,11,12]. In this regard, studies have been done on the effect of organic matter and micro-nutrients, has been emphasis on enhancing the crop. Pouzeshi *et al* (2011) [16] research on the effect of foliar zinc, acid hyomic acid and acetic acid on yield, yield components and element concentrations in Peykani grape cultivar, reported that spraying solution by the treatments could increase yield and concentration in leaves. The results reported by Hassan *et al* (2010) [6] regarding the effect foliar sprays on foliage with liquid organic fertilizers, some micronutrients and gibberellin acid on mineral content in leaves and the Hollywood plum, showed that fruit set, yield and fruit size in all treatments significantly has increased. Praabu and Singarm (2002) [17] reported that application of boron along with zinc in grapes at full bloom and growing twice caused the best yield. Asgharzade and Babaeian (2012) [2] in study of calcium borate and micronutrients effects on characteristics of Sheikh Amir apple cultivar showed that Micronutrients along with calcium borate had significant effect on fruit yield and the amount of calcium and boron in harvested fruit. Malakouti and Tehranian (2000) [11] in research during the effects of foliar sprays on yield and quality of cherry fruit, that can recommended enhancing the quality of the cherry fruit. The present study examined the effects of organic matter on the characteristics and content of elements and to introduce the most suitable material for foliar spraying on Fuji apple cultivar in Miyaneh area.

## 2. MATERIALS AND METHODS

### 2.1. Site and Treatments of the research

This experiment was carried out in private garden of Mr. Mohammadkhani in Balesin village of Miyaneh city, located in Kandevan area whit longitude 37°36, latitude 47°36 and the altitude of 1665 m above sea level. Soil test results of the research are presented in Table 1.

**Table 1.** Soil test of research locations

No.	Sample depth(cm)	salinity ds/m	pH	Lime T.N.V%	Clay %	Silt %	Sand %	Tissue
1	0-30	0.39	7.70	13.11	35	36	29	Sandy loam
2	30-60	0.29	8.11	24	41	34	25	Sandy loam
3	60-90	0.30	7.88	21.25	29	36	35	Sandy loam
4	90-120	0.28	7.80	28.79	23	36	41	Sandy loam

This study, was done in 2011 on ten year old trees on Fuji apple with MM106 rootstock and clay loam soils in Kandevan area and in situation that Possibility of plant growth, was available to demonstrate the characteristics of selected cultivar and the tests in terms of instruments measured and incremental growth conditions were the same for selected cultivar and trees were selected having a sufficient number of treatments and their products were satisfactory. Distance of research trees was 4×3 meter and irrigation system was drip. On March 18th, 2011, triplicate of under study cultivar were selected and marked with a specific color and three trees per replicate for each treatment were determined with a color. For investigation the effect of different nutrient factors on fruit set and fruit quantity and quality, an experiment was conducted with 8 treatments including Thiofer, Ticaminmax, Ticaminmax + Oligogreen , Ticaminmax + B(Boran) + Zn(Has zn) 25% Fertilizer, B(Boran) + Zn(Has Zn) 25% HAS green Italy, B(Boran) + Zn(Has Zn) 25% + Thiofer, B(Boran) + Zn(Has Zn) 25% Ticaminmax and control(water). In the buds swell stage Coincided with 12th April, 2011 foliar application of the determined compounds was done using randomized complete bloke design (RCBD) in triplicate. Combination treatments and foliar spraying concentrations of compounds are listed in Table 2. After foliar application, a branch of approximately 80cm to 100cm in length and each row on the right (east - west) were selected and 1cm to 1.5cm diameter branches were marked with specific colors for measurements. After opening of flowers, number of flowers per branch was marked, counted and recorded. After ripping stage, number of formed fruits was calculated, and noted.

### 2.2. Measuring the yield of trees under treatment

Total yield was determined by weighting all fruits of each tree. Total soluble solids were determined with hand refractometer. Titrable acidity was determined using ten milliliters of fruit juice with titrating 0.1 N NaOH to a malic acid endpoint of pH 8.2 for measurements. The lengths of five shoots of each replication were measured and mean shoot length was calculated as arithmetical. In 22th October, recording operation of all treatments was performed and yield per treatment was measured.

### 2.3. Analysis of data

Data from an experiment as randomized complete block design(RCBD) in triplicate and using SAS software for statistical analysis and means comparison by Duncan Multiple Range Test, and drawing diagrams using Mini-Tab software version 16 and Excel 2010 version was done.

### 3. RESULTS AND DISCUSSION

The results of the mean comparison of different treatments on leaf nutrients content and yield are presented in Figures 1 to 7.

#### 3.1. Yield

As shown in Figure 1 among the various nutrition treatments in terms of effects on the yield, there was a significant difference so that mean comparison the yield of various treatments in different and trees that treated foliar application with Thiofer + Br + Zn, the greatest effect in yield and production are tree. However, the control treatments have the least effects on yield. Similar results regarding the effect of Zn in increased fruit set of almonds [11] 20% increase in fruit set in grapes sprayed with zinc sulphate [12], positive results in increasing fruit set and seed formation and yields Such as wheat, potatoes, apricots, apples, peaches, tomatoes, cucumbers and grapes in pilot projects in the country with sprayed zinc sulphate [10] have been reported.

#### 3.2. Shoot growth

The results of Fig. 2 also reveal that treated trees foliar application with Br + Zn had the greatest effect in growth of a tree branch. However, the Ticaminmax treatment had the least effect on the growth of the tree shoot. This surveillance indicates that Ticaminmax treatment may be suitable for supplying the required material for Shoot growth early in the growing season [14].

#### 3.3. Fruit weight

The results indicated that different treatments effects in this study on weight of fruit, were different significantly, So that treatment Ticamin max + Zn + boron at the highest effect and the lowest was in control. And was observed Significant difference between the different treatments Ticaminmax + B +Zn, compared to control (Fig. 3) treatment had higher fruit weight, cause of increase fruit weight in this treated that contain Ticaminmax + B + Zn, Because there has been combinations of amino acids and other effective materials. Results of this experiment, is according to reports by Hassan et al (2010) [6] that the use of liquid organic and other effective materials, increased Fruit weight and yield compared to control.

#### 3.4. Fruit set

According to the Fig.4 results determined that the treatments in this study, termed of fruit set had a significant difference. Most of the fruit set on the trees sprayed with Ticaminmax + Zn + boron treatment, was 43.18% and the lowest level related to control was 19.10 %. The highest percentage of fruit set in which related to treatments containing compounds have been used Boron and Zinc and had significant Differences with each other. Among the nutrient elements, three elements N, B and Zn have the greatest effect in fruit set. Nitrogen supply of pollen required proteins for movement during pollen tube and reaching the egg and increase the lifespan of the egg, Increases the effective time of pollination and embryo sac formed been strong and increase the percentage of fruit set and stimulate the growth of pollen tubes and in enzyme activity, protein synthesis and breakdown and tryptophan biosynthesis have contributed and thereby increases the percentage of fruit set. Boron, causing pollen germination and pollen tube growth and have many roles in metabolic activities Zinc is a micronutrient element that is needed for the formation of the desired size for fruit production. This element is part of the carbonic anhydrase enzyme is present in all photosynthetic tissues that is required for chlorophyll biosynthesis. Zn is also role in in the synthesis of tryptophan that is a precursor for the synthesis of auxin [5,7,13]. And hence, this research is consistent with tens of researches, related to the use of nitrogen, Boron and Zinc to fruit set. For example William (1991) [20] reported that in peach trees, zinc deficiency causes the production of small fruits, deformation and make the quality is too low. Bybordi and Malakouti [4] also reported effect of Zinc boric acid and zinc sulfate on the fruit set significantly.

#### 3.5. Acidity of the juice

According to the Figure 5 was determined that the treatments in this study were significant difference in terms of fruit pH. So that Thiofer treatment and Oligogreen have highest acidity that containing zinc, manganese, molybdenum, copper, iron, and magnesium, were recorded. These results are consistent with Asgharzade and Babaeian (2012) [2] reported that treated Sheikh Amir Apple fruit with application of calcium borate decrease the fruit acidity.

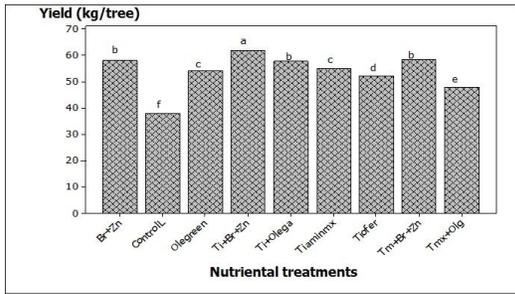
#### 3.6. Titrable acid of juice

According to Fig. 6 and with reviews the mean comparison, is determined that B + Zn + Ticaminmax treatment is the highest level in terms of titrable acid. Similar reports can be found in Asadi kangarshahi *et al* (2007) [1] and Bybordi and Malakouti (2005) [4].

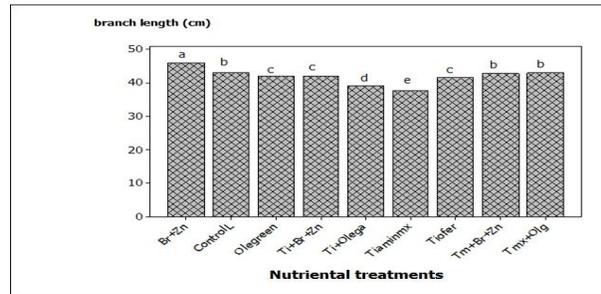
#### 3.7. Total Soluble Solids (TSS)

Obtained results in this research showed that Ticaminmax treatment, with 19.76 percent of TSS average, at the highest level and Thiofer treated with 16.33 percent is in lowest (Fig.7) and treatments containing amino acid compounds, especially Tiaminmax, in higher levels than other treatments were placed that increase in total soluble solids is due to the presence of amino acids and other compounds in dietary supplements in this compounds. These results are consistent

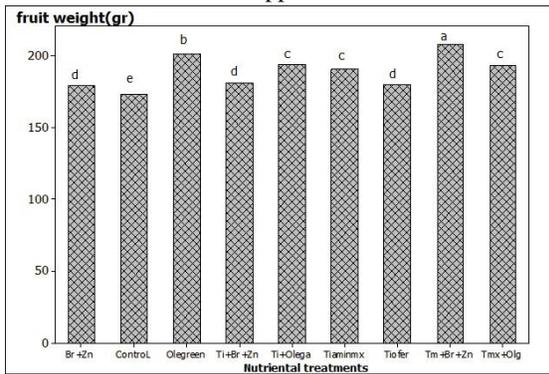
with the results of Smith (1997) [18] reported That, with increasing used boron concentration, citric acid and vitamin C in fruit juice reduced and apparently, total solution solids of fruit juice, are not affected by boron concentration. Also, with results of Hassan *et al* (2010) [6] that effects of amino acids in elevated levels of total soluble solids comparison to control in plums were reported significant is consistent.



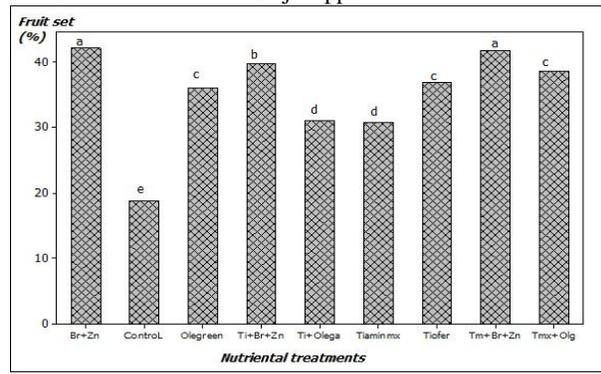
**Fig. 1.** Effect of nutritional treatments on yield of "Fuji" apple



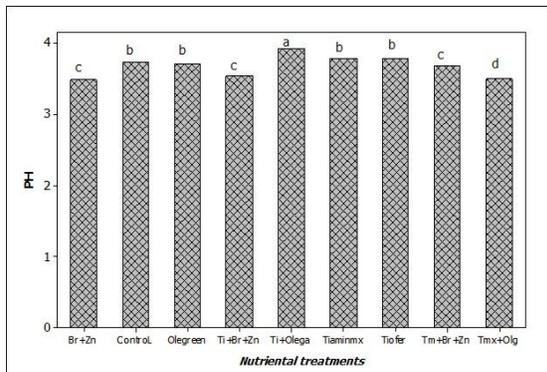
**Fig. 2.** Effect of nutritional treatments on shoot growth of "Fuji" apple.



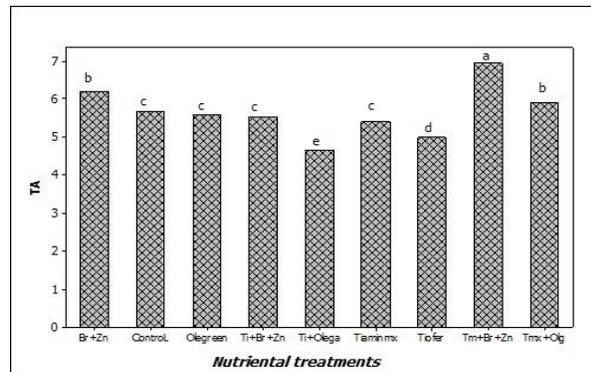
**Fig. 3.** Effect different nutritional treatments on fruit weight



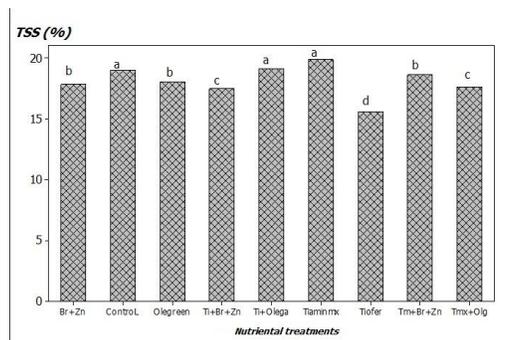
**Fig. 4.** Effect of different nutritional treatments on the percentage of fruit set



**Fig. 5.** Effect of different nutritional treatments on the acidity of the juice



**Fig. 6.** Effect of different nutritional treatments on amount of titrable acid



**Fig. 7.** Effect of different nutritional treatments on fruit soluble solids

#### 4. Conclusion

Results showed that different treatment had various effects on fruit set and fruit quantity and quality in way that treatments contain Boron and Zinc compound had the most effect on fruit set than other treatments. Also treatments including organic material (amino acids) had the most effect on fruit weight. In generally, in this research, it was found that treatments with micronutrients and amino acids were affect on yield of apple. From the data, it can be concluded that Some organic material and micro-nutrients application to apple trees is very useful in different characters of apple fruit and tree and it could be recommended to improve fruit set, yield, and fruit quality of "Fuji" apple trees grown under Miyaneh area condition.

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