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USING SILICON, BORON AND FOLIC ACID TO PROMOTE YIELD QUANTITATIVELY AND QUALITATIVELY OF EARLY SUPERIOR GRAPEVINES

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ABSTRACT

This study was carried out during ٢٠١٠ and ٢٠١١ seasons to study the effect of singlr and combined applications of potassium silicate at ٠.٠٥ to ٠.٢ %, boric acid at ٠.٠١٢٥ to ٠.٠٢٥ % and folic acid at ٥٠ to ٢٠٠ ppm on reliefing yield decline and shot berries % problems in Early Superior grapevines grown under Minia region.

Growth characters, vine nutritional status, yield, cluster weight as well as physical and chemical characteristics of the berries were positively affected by using potassium silicate, boric acid and folic acid either singly or in various combinations in comparison to the check treatment. Both shot berries % and total acidity greatly reduced with application of such treatments. The promotion was in proportional to increasing concentrations of these materials. The best results were recorded with using folic acid, boric acid and potassium silicate, in ascending order. Increasing concentrations from medium to higher of each compound alone did not result in favorable effect. Combined applications showed positive effects on the investigated characters rather than single ones.

Three sprays of a mixture containing potassium silicate at ٠.١ %, boric acid at ٠.٠٢٥ % and folic acid at ١٠٠ ppm was responsible for obtaining higher yield, lower shot berries as well as promoting berries quality of Early Superior grapevines.

INTRODUCTION

The decline of yield as well as the problem of shot berries in Early Superior vineyards are the major problems that faces grape growers. Unbalanced or malnutrition as well as undesirable environmental conditions and the incidence of pests are considered to be the main causes for poor cropping (Levitt, ١٩٨٠). Recently more studies carried out confirmed the great benefits of using silicon, vitamins and boron on fruiting of different grapevine cvs.

Silicon (Si) deficiency in crops has been relatively unknown and the element has been regarded as non- essential for plant growth. However, recent research showed that Si is a functional plant nutrient and that Si application can considerably enhance insect pest resistance in plants with consequent yield increases. Most reports showed that responses to Si application in reducing pest populations and plant damage was more obvious in susceptible than in resistant varieties. Recent evidence suggests that Si deposition in the plant may reinforce plant insect resistance by providing a mechanical barrier against insect pests, and physiological resistance to diseases. Silicon is widely considered as an activator by stimulating the expression of natural defense reaction through the production of phenolic compounds. The application of Si in crops provides a viable component of integrated management of insect pests and diseases because it leaves no insecticide residues in foods or the environment and it can be easily integrated with other pest management practice, including biological control (Tzeng and Devay, ١٩٨٩ and Epstein, ١٩٩٩).

All silicon compounds had beneficial effects on growth and fruiting of fruit crops (Matichenkov *et al*., ٢٠٠٠; Neumann and Zur-Nieden, ٢٠٠١; Ma *et al*., ٢٠٠١; Ma and Takahashi, ٢٠٠٢; Kanto, ٢٠٠٢ and Qin and Tian, ٢٠٠٤).

Recently, it was suggested that vitamins B participate in plant growth and development indirectly by enhancing the endogenous levels of various growth factors such as cytokinins and gibberellins. They are synthesized in the leaves and translocated in the phloem. For more than two decades, study of the role of these antioxidants in plants attracted sporadic attention. These studies indicated that various physiological processes such as nutrient uptake, respiration, photosynthesis as well as chlorophyll and protein synthesis depend more or less on the availability of these antioxidants (Samiullah *et al*., ١٩٨٨).

Previous studies showed that exogenous application of vitamins was responsible for enhancing growth and fruiting of fruit crops (Oretli, ١٩٨٧; Ahmed and Seleem- Basma, ٢٠٠٨; Abada and Abd El- Hameed, ٢٠٠٩; Uwakiem, ٢٠١١; Madian and Refaai, ٢٠١١; Mohamed- Ebtesam, ٢٠١٢ as well as Ahmed *et al*., ٢٠١٢a and b).

Application of boron in any sources was essential for enhancing cell division, pollen germination, biosynthesis and transport of carbohydrates, disorders resistance as well as water uptake (Bose *et al*., ١٩٨٨ and Marschner, ١٩٨٨).

Growth, yield as well as physical and chemical characteristics in various grapevine cvs were remarkably enhanced in response to foliar application of boron compounds (Ali, ٢٠٠٠; Ahmed and Abd El- Hameed, ٢٠٠٣; Farahat, ٢٠٠٨; El- Sawy, ٢٠٠٩; Abd El- Gaber- Nermean, ٢٠٠٩; Abd El- Wahab, ٢٠١٠; El- Kady- Hanaa, ٢٠١١; Mohamed- Ebtesam, ٢٠١٢ and Abdelaal, ٢٠١٢).

The goal of this study was testing the effect of silicon, vitamins B and boron on fruiting of Early superior grapevines.

MATERIALS AND METHODS

This investigation was carried out during ٢٠١٠ and ٢٠١١ seasons on ١٢٦ six- years old Early Superior grapevines. The experimental vines were grown in a private vineyard located at Bany Ebeid Village, Abo Korkas district, Minia Governorate where the soil is silty clay. Characteristics of the soil are presented in Table (١). Vines are spaced at ٢ meters (between vines) × ٣ meters (between rows) (٦٧٠ vines in one feddan). The vines were pruned during the first week of Jan. in both seasons. Cane pruning system using Gable supporting system was followed. Vine load for all the selected vines was ٨٤ eyes (in the basis of six fruiting canes × twelve eyes plus six renewal spurs × two eyes). Surface irrigation system was followed.

Table ١: Analysis of the tested soil:

Constituents	Values
Sand %	١٠.٩
Silt %	٥٨.٨
Clay %	٣٠.٣
Texture	Silty clay
pH (١:٢.٥ extract)	٧.٥
E.C (١: ٢.٥ extract, mmhos/ ١ cm ٢٥° C)	٠.٩٥
O.M. %	١.٩٩
CaCO٣ %	١.٩٥
Total N %	٠.١٠
Available P (Olsen method, ppm)	٤.٩
Available K (ammonium acetate, ppm)	٥٦٠

Horticultural practices were carried out as usual expect those dealing with application of K, silicon, boron and antioxidants compounds.

This study involved the following fourteen treatments from single and combined applications of potassium silicate, boric acid and folic acid beside the control treatment:-

١. Control (water sprayed vines).
٢. Spraying potassium silicate at ٠.٠٥ %.
٣. Spraying potassium silicate at ٠.١ %.
٤. Spraying potassium silicate at ٠.٢ %.
٥. Spraying boric acid at ٠.٠١٢٥ %.
٦. Spraying boric acid at ٠.٠٢٥ %.
٧. Spraying boric acid at ٠.٠٥ %.
٨. Spraying folic acid at ٥٠ ppm.
٩. Spraying folic acid at ١٠٠ ppm.
١٠. Spraying folic acid at ٢٠٠ ppm.
١١. Spraying potassium silicate at ٠.١ % + boric acid at ٠.٠٢٥ %.
١٢. Spraying potassium silicate at ٠.١ % + folic acid at ١٠٠ ppm.
١٣. Spraying boric acid at ٠.٠٢٥ % + folic acid at ١٠٠ ppm.
١٤. Spraying potassium silicate at ٠.١ % + boric acid at ٠.٠٢٥ % + folic acid at ١٠٠ ppm.

Each treatment was replicated three times, three vines per each. The three compounds namely potassium silicate (٢٥ % Si and ١٠ % $K_{٢}O$), boric acid (١٧ % B) and folic acid were sprayed three times. The first spray was carried out before bloom (١st week of Mar.) and the other two sprays were conducted just after berry setting (last week of April) and at three weeks later (the third week of May). Triton B as a wetting agent was applied at ٠.٠٥ % to all solutions. Control vines were sprayed with water containing Triton B. The selected vines were sprayed with these nutrients till runoff (٢ L/ vine).

The present experiment was set up in a randomized complete block design with three replicates, each consisted of three Early Superior grapevines.

At the last week of June during both seasons vegetative growth characters of the vines were evaluated in terms of leaf area ($cm^{٢}$) according to Ahmed and Morsy (١٩٩٩), main shoot length (cm), cane thickness (cm) by vernier caliper and weight of pruning (kg) by weighing the one year old wood that removed from each vine during pruning season.

On the middle of September, twenty shoots of the current season growth were tagged for each replicate (three vines) to follow up the coefficient of wood ripening. Total length of the shoot was measured and the part of the shoot that ripened i.e. changing its color from greenish to brownish was also measured. Coefficient of wood ripening was calculated by dividing the length of the ripened part by the total length of the shoot according to Bouard (١٩٦٦).

Vine nutritional status was evaluated by determining N, P, K and Mg (as percentages) as well as Zn, Fe, Mn and Cu (as ppm) in the petiole of the leaves opposite to the basal clusters (١st week of June) (according to Balo *et al.*, ١٩٨٨) according to the procedure of Wilde *et al.*, (١٩٨٥).

Harvesting was done when T.S.S/ acid parameter in the untreated berries reached ٢٥/ ١ (the first week of June during both seasons). Yield per vine expressed in number of clusters/ vine and weight (kg) was recorded. Ten clusters from each vine were harvested for determining the following physical and chemical characteristics:-

١- Average cluster weight (g.).
٢- Berry weight (g.)
٣- Shot berries % by dividing number of small berries by total number of berries per cluster and multiplying the product by ١٠٠.
٤- Percentage of total soluble solids in the juice using handy refractometer.
٥- Percentage of total sugars in the juice (according to Lane and Eynon volumetric method (١٩٦٥) (A.O.A.C., ١٩٩٥).
٦- Percentage of total acidity in the juice by titration against ٠.١ N sodium hydroxide using phenolphthalein as indicator (as g tartaric acid/ ١٠٠ ml juice) (according to A.O.A.C., ١٩٩٥).

Data were statistically analyzed with standard methods according to Mead *et al*., (١٩٩٣) and the new L.S.D test was used for comparison between treatment means.

RESULTS AND DISCUSSION

١- Growth characters and wood ripening coefficient:

Data in Table (٢) clearly showed that single and combined applications of potassium silicate at ٠.٠٥ to ٠.٢ %, boric acid at ٠.٠٢٥ to ٠.٠٥ % and folic acid at ٥٠ to ٢٠٠ ppm significantly stimulated the leaf area, shoot length, pruning weight, cane thickness and wood ripening coefficient rather than unapplication. The promotion on these growth characters was significantly associated with increasing concentrations of each material. The beneficial effects on these parameters was attributed to using folic acid, boric acid and potassium silicate, in ascending order. Increasing concentrations of each compound alone from medium to high concentrations failed to enhance such traits. Significant differences on these characters were observed among most treatments. Combined application of these nutrients was superior than using each material alone on enhancing growth traits and wood ripening coefficient. The maximum values were recorded on the vines that treated thrice with all materials at the medium concentrations. Untreated vines recorded the lowest values. These results were similar during both seasons.

Table ٢: Effect of spraying silicon, boron and folic acid on some growth characters and leaf content of N and P of Early Superior grapevines during ٢٠١٠ and ٢٠١١ seasons.

Treatment	Leaf Area (cm^{٢})		Shoot lengt (cm.)		Pruning weight (kg.)		Cane thickness (cm)		Wood ripening coefficie nt		Leaf N %		Leaf P %	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Control (untreated vines)	١١٦.٠	١١٧.٤	١١١.٠	١١٣.٧	١.١٩	١.١٨	٠.٨٣	٠.٨٧	٠.٦٠	٠.٦٢	١.٥١	١.٤٤	٠.١٤	٠.١٥
Potassium silicate at ٠.٠٥ %	١٢٧.٠	١٢٨.٥	١٢٢.٠	١٢٤.٦	١.٦٨	١.٧٢	١.١٨	١.١٦	٠.٨٤	٠.٨٣	١.٨٨	١.٨٥	٠.٢٩	٠.٣٠
Potassium silicate at ٠.١ %	١٢٩.٥	١٣٠.٩	١٢٤.٥	١٢٦.٦	١.٨٠	١.٨٢	١.٢٥	١.٢٣	٠.٨٥	٠.٨٤	١.٩٥	١.٩٢	٠.٣٢	٠.٣٢
Potassium silicate at ٠.٢ %	١٢٩.٩	١٣١.٥	١٤٢.٨	١٢٦.٩	١.٨١	١.٨٣	١.٢٦	١.٢٤	٠.٨٥	٠.٨٤	١.٩٥	١.٩٢	٠.٣٢	٠.٣٢
Boric acid at ٠.٠١٢٥ %	١٢٣.٠	١٢٤.٥	١١٨.٧	١٢٠.٨	١.٥٠	١.٥٠	١.٠٣	١.٠٥	٠.٧٦	٠.٧٦	١.٧٣	١.٧٠	٠.٢٣	٠.٢٣
Boric acid at ٠.٠٢٥ %	١٢٤.٥	١٢٦.٠	١٢٠.٠	١٢٢.٢	١.٦٢	١.٦٠	١.١١	١.١١	٠.٨٠	٠.٧٩	١.٨٠	١.٧٧	٠.٢٥	٠.٢٦
Boric acid at ٠.٠٥ %	١٢٥.٠	١٢٦.٤	١١٩.٨	١٢٢.٠	١.٦٣	١.٦٢	١.١٢	١.١١	٠.٨١	٠.٨٠	١.٨١	١.٧٧	٠.٢٦	٠.٢٦
Folic acid at ٥٠ ppm	١١٨.٠	١٢٠.١	١١٢.٩	١١٥.٠	١.٣٠	١.٢٨	٠.٩٠	٠.٩٢	٠.٦٥	٠.٦٥	١.٥٨	١.٥٥	٠.١٦	٠.١٦
Folic acid at ١٠٠ ppm	١٢٠.٢	١٢١.٩	١١٥.١	١١٧.٢	١.٤٠	١.٣٩	٠.٩٧	٠.٩٩	٠.٧٠	٠.٦٩	١.٦٥	١.٦٢	٠.١٩	٠.١٨
Folic acid at ٢٠٠ ppm	١٢٠.٥	١٢٢.٠	١١٥.٢	١١٧.٣	١.٤١	١.٤٠	٠.٩٨	٠.٩٩	٠.٧١	٠.٧٠	١.٦٦	١.٦٣	٠.٢٠	٠.٢٠
Silicon + boron at mid. conc.	١٣٩.٣	١٤٢.٠	١٣٤.١	١٣٦.٢	١.٩٥	١.٩٥	١.٤٤	١.٤٥	٠.٨٨	٠.٨٨	٢.١٨	٢.١٥	٠.٣٦	٠.٣٥
Silicon + Folic at mid. conc.	١٣٥.٠	١٣٧.٧	١٣٠.٠	١٣٣.٣	١.٩٢	١.٩١	١.٣٧	١.٤٠	٠.٨٧	٠.٨٦	٢.١١	٢.١١	٠.٣٥	٠.٣٣
Boron + Folic at mid. conc.	١٣٣.٠	١٣٤.٠	١٢٧.٠	١٢٩.٨	١.٨٣	١.٨٥	١.٣٠	١.٣٢	٠.٨٦	٠.٨٥	٢.٠٥	٢.٠١	٠.٣٣	٠.٣١
All at mid. conc.	١٤٢.٩	١٤٩.٠	١٣٧.٣	١٤٠.٠	١.٩٩	١.٩٩	١.٥٠	١.٥٢	٠.٨٩	٠.٨٨	٢.٢٧	٢.٣٠	٠.٣٩	٠.٤٣
New L.S.D at ٥ %	١.١	١.٢	١.٠	١.١	٠.٠٩	٠.١٠	٠.٠٥	٠.٠٥	٠.٠٤	٠.٠٥	٠.٠٦	٠.٠٥	٠.٠٢	٠.٠٢

The beneficial effects of silicon, boron and folic acid on enhancing cell division, the biosynthesis of organic foods and the resistance of the vines to different disorders results (Samiullah *et al*., ١٩٨٨ and Epstein and Bloom, ٢٠٠٣) may explain the present .

The obtained results arein agreement with those of Epstein (١٩٩٩) and Ma and Takhashi (٢٠٠٢) who worked on silicon, Mohamed- Ebtesam (٢٠١٢) and Abdelaal (٢٠١٢) who worked on boron and Ahmed *et al*., (٢٠١٢a) and (٢٠١٢b) who worked on folic acid.

٢- Leaf mineral content:

It is clear from the data in Tables (٢ & ٣) that treating Early Superior grapevines three times with single and combined applications of potassium silicate, boric acid and folic acid was significantly enhanced nutrients namely N, P, K, Mg, Fe, Zn and Mn in the leaf petioles in relative to the check treatment. The promotion was associated significantly with using folic acid, boric acid and potassium silicate, in ascending order. Increasing concentrations of each material was followed by a gradual promotion on these nutrients. Negligible promotion on these nutrients was observed among the higher two concentrations of each compound. Using these materials together showed a positive effect than using each material alone in improving vine nutritional status. Using all materials together at the medium concentrations gave the maximum values. Vines of control set recorded produced the minimum leaf content of these nutrients. The present treatments had no significant effect on the leaf content of Cu. Similar trend was noticed during both seasons.

The positive action of silicon, boron and folic acid on enhancing the resistance of the vines to different unfavourable conditions as well their essential role on enhancing water uptake may explain the present results (Samiullah *et al*., ١٩٨٨ and Epstein, ١٩٩٩).

The present results may in harmony with those results of Epstein (١٩٩٩) and Ma and Takhashi (٢٠٠٢) who worked on silicon, Mohamed- Ebtesam (٢٠١٢) and Abdelaal (٢٠١٢) who worked on boron and Ahmed *et al*., (٢٠١٢a) and (٢٠١٢b) who worked on folic acid.

٣- Yield and cluster weight:

Data in Tables (٣ & ٤) revealed that supplying Early Superior grapevines three times with potassium silicate, boric acid and folic acid either alone or in combinations was significantly improved the yield expressed in weight (kg.) per vine and number of clusters/ vine as well as cluster weight comparing with the control treatment. Applications of folic acid, boric acid and potassium silicate, in ascending order was necessary from statistical analysis point of view in promoting the yield and cluster weight. There was a gradual promotion on yield and cluster weight with increasing concentrations of potassium silicate from ٠.٠٥ to ٠.٢ %, boric acid from ٠.٠١٢٥ to ٠.٠٥ % and folic acid from ٥٠ to ٢٠٠ ppm. Significant differences were observed between most treatments on yield and cluster weight with few exceptions among the higher two concentrations of each compound. The best material in this respect was potassium silicate, followed by boric acid and folic acid. The best results were obtained with using the three materials together at the medium concentrations. Under such promised treatment, yield per vine reached ١١.٢ and ١٣.٧ kg during both seasons, respectively. The untreated vines produced ٧.٥ and ٧.١ kg during ٢٠١٠ and ٢٠١١ seasons, respectively. The percentage of increase on the yield due to application of the previous promised treatment reached ٤٣.٦ and ٩٣ % during both seasons, respectively comparing to control. The present treatments had no significant effect on the number of clusters per vine in the first season of study.

The previous beneficial effects of silicon, boric acid and folic acid on growth, wood ripening and vine nutritional status possitively reflected on promoting the yield.

The results of Epstein (١٩٩٩) and Ma and Takhashi (٢٠٠٢) who worked on silicon, Mohamed- Ebtesam (٢٠١٢) and Abdelaal (٢٠١٢) who worked on boron and Ahmed *et al.*, (٢٠١٢a) and (٢٠١٢b) who worked on folic acid may emphasized the present results.

Table ٣: Effect of spraying silicon, boron and folic acid on leaf content of K, Mg, Zn, Fe, Mn and Cu as well as number of clusters per vine of Early Superior grapevines during ٢٠١٠ and ٢٠١١ seasons.

Treatment	Leaf K %		Leaf Mg %		Leaf Zn (ppm)		Leaf Fe (ppm)		Leaf Mn (ppm)		Leaf Cu (ppm)		No. of clusters/ vine	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Control (untreated vines)	١.٤١	١.٤٥	٠.٤١	٠.٤٦	٥٩.٠	٥٦.١	٤٦.٣	٤٤.٨	٤١.٩	٤٣.٧	٤.١	٤.٠	٢٦.٠	٢٤.٠
Potassium silicate at ٠.٠٥ %	١.٦٩	١.٧٣	٠.٦٥	٠.٧٢	٦٩.٠	٦٩.٨	٥٧.٥	٥٨.٢	٥٢.٥	٥٣.٠	٤.٢	٤.٢	٢٧.٠	٣٠.٠
Potassium silicate at ٠.١ %	١.٧٥	١.٧٩	٠.٧٠	٠.٧٦	٧١.٢	٧٢.٠	٥٩.٦	٦٠.٣	٥٥.٠	٥٥.٤	٤.٢	٤.٢	٢٧.٠	٣٠.٠
Potassium silicate at ٠.٢ %	١.٧٥	١.٨٠	٠.٧١	٠.٧٦	٧١.٣	٧٢.٠	٦٠.٠	٦٠.٦	٥٥.٤	٥٦.٠	٤.٣	٤.٣	٢٧.٠	٣٠.٠
Boric acid at ٠.٠١٢٥ %	١.٥٨	١.٦٢	٠.٥٥	٠.٦٠	٦٤.٣	٦٥.١	٥٣.٠	٥٣.٨	٤٧.٠	٤٧.٥	٤.٢	٤.٢	٢٦.٠	٢٨.٠
Boric acid at ٠.٠٢٥ %	١.٦٣	١.٦٧	٠.٦٠	٠.٦٦	٦٦.٠	٦٦.٨	٥٥.١	٥٥.٩	٤٩.٠	٤٩.٤	٤.٢	٤.٢	٢٦.٠	٢٩.٠
Boric acid at ٠.٠٥ %	١.٦٤	١.٦٨	٠.٦١	٠.٦٧	٦٧.٠	٦٨.٠	٥٥.٢	٥٦.٠	٤٩.٦	٥٠.٠	٤.٢	٤.٢	٢٦.٠	٢٩.٠
Folic acid at ٥٠ ppm	١.٤٦	١.٥٠	٠.٤٥	٠.٥٠	٦١.٠	٦٢.٠	٤٨.٩	٤٩.٦	٤٣.٥	٤٤.٠	٤.٢	٤.٢	٢٦.٠	٢٦.٠
Folic acid at ١٠٠ ppm	١.٥١	١.٥٥	٠.٤٩	٠.٥٥	٦٢.٦	٦٣.٦	٥٠.٩	٥١.٥	٤٥.٠	٤٥.٥	٤.٢	٤.٢	٢٦.٠	٢٧.٠
Folic acid at ٢٠٠ ppm	١.٥٢	١.٥٦	٠.٥٠	٠.٥٦	٦٣.٠	٦٤.٤	٥١.٠	٥١.٧	٤٥.٣	٤٥.٨	٤.٢	٤.٢	٢٦.٠	٢٧.٠
Silicon + boron at mid. conc.	١.٩٤	١.٩٨	٠.٨٤	٠.٨٩	٧٩.٠	٨٠.٠	٦٧.٠	٦٧.٦	٦١.٣	٦١.٧	٤.٤	٤.٤	٢٧.٠	٣٣.٠
Silicon + Folic at mid. conc.	١.٨٧	١.٩٢	٠.٨٠	٠.٨٣	٧٦.٠	٧٦.٩	٦٥.٠	٦٥.٨	٥٩.٠	٥٩.٥	٤.٤	٤.٤	٢٧.٠	٣٢.٠
Boron + Folic at mid. conc.	١.٨١	١.٨٦	٠.٧٥	٠.٧٨	٧٤.٣	٧٥.٠	٦٢.٣	٦٣.٠	٥٧.٦	٥٧.٦	٤.٤	٤.٤	٢٧.٠	٣٢.٠
All at mid. conc.	١.٩٩	٢.٠١	٠.٨٧	٠.٩٢	٨١.٠	٨١.٨	٦٩.٠	٧١.٠	٦٧.٣	٦٨.٠	٤.٤	٤.٤	٢٧.٠	٣٣.٠
New L.S.D at ٥ %	٠.٠٥	٠.٠٤	٠.٠٣	٠.٠٣	١.٣	١.٤	١.٧	١.٥	١.٤	١.٥	NS	NS	NS	٢.٠

٤- Shot berries %:

It is clear from the data in Table (٤) that shot berries % in Early Superior grapevines significantly reduced with single and combined applications of potassium silicate, boric acid and folic acid in relative to the check treatment. The reduction on shot berries % was associated with increasing concentrations of each material. The best control of shot berries in the clusters was recorded with using potassium silicate, followed by boric acid, meanwhile folic acid occupied the last position in this concern. Meaningless reduction on shot berries % was recorded among the higher two concentrations of each material. Using two or three of the tested materials was significantly favourable in reducing shot berries % in comparison to using any material alone. The lowest values of shot berries (٣.٧ and ٢.٧ %) during both seasons were observed on the clusters harvested from vines treated with all materials at the medium concentration. Untreated vines produced clusters with the highest shot berries % (١٠ and ٩.١ % during ٢٠١٠ and ٢٠١١ season, respectively).

The beneficial effect of silicon, boron and folic acid on increasing the withstanding of vines to different stresses as well as enhancing the efficiency of pollination and fertilization may explain the present results. The effect of these nutrients on enhancing cell division and pollen germination (Epstein,١٩٩٩ and Epstein and Bloom, ٢٠٠٣) may add another explanation

The results of Abd El- Wahab (٢٠١٠) who worked on boron confirmed the present results.

٥- Physical and chemical berry characteristics:

One can state from the data in Table (٤) that single and combined applications of potassium silicate, boric acid and folic acid were significantly improved physical and chemical characteristics of the grapes in terms of increasing berry weight, T.S.S % and total sugars % and reducing total acidity % rather than non- application. The promotion on berries quality in descending order was associated with using potassium silicate, boric acid and folic acid.

Table ٤: Effect of spraying silicon, boron and folic acid on yield/ vine (kg.), cluster weight (g.), shot berries % and some chemical characteristics in the grapes of Early Superior grapevines during ٢٠١٠ and ٢٠١١ seasons.

Treatment	Yield/ vine (kg.)		Cluster weight (g.)		Berry weight (g.)		Shot berries %		T.S.S %		Total sugars %		Total acidity %	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Control (untreated vines)	٧.٨	٧.١	٣٠١.٠	٢٩٧.٠	٣.٤١	٣.٤١	١٠.٠	٩.١	١٨.٩	١٩.٠	١٧.٥	١٧.٢	٠.٧٤١	٠.٧٤١
Potassium silicate at ٠.٠٥ %	١٠.٦	١١.٩	٣٩٢.٠	٣٩٥.٠	٣.٨٠	٣.٩١	٨.٠	٧.١	٢٠.٩	٢١.٠	١٩.٣	١٩.٠	٠.٦٢١	٠.٦٣٠
Potassium silicate at ٠.١ %	١٠.٨	١٢.١	٤٠٠.٠	٤٠٢.٥	٣.٨٨	٣.٩٩	٧.٥	٦.٥	٢١.٢	٢١.٣	١٩.٦	١٩.٣	٠.٦٠٠	٠.٦٠٩
Potassium silicate at ٠.٢ %	١٠.٨	١٢.١	٤٠١.٠	٤٠٣.٠	٣.٩٠	٤.٠١	٧.٣	٦.٤	٢١.٣	٢١.٥	١٩.٧	١٩.٤	٠.٦٠٠	٠.٦٠٨
Boric acid at ٠.٠١٢٥ %	٩.٤	١٠.١	٣٦٠.٠	٣٦٢.٠	٣.٦٤	٣.٧٥	٩.٠	٨.١	١٩.٨	١٩.٩	١٨.٥	١٨.٣	٠.٦٦٦	٠.٦٧٥
Boric acid at ٠.٠٢٥ %	٩.٥	١٠.٧	٣٦٦.٠	٣٦٨.٠	٣.٧١	٣.٨٢	٨.٥	٧.٦	٢٠.٠	٢٠.١	١٨.٨	١٨.٦	٠.٦٤٦	٠.٦٥٥
Boric acid at ٠.٠٥ %	٩.٥	١٠.٧	٣٦٧.٠	٣٦٩.٠	٣.٧٢	٣.٨٤	٨.٤	٧.٥	٢٠.١	٢٠.٢	١٨.٩	١٨.٧	٠.٦٤١	٠.٦٥٠
Folic acid at ٥٠ ppm	٨.٤	٨.٤	٣٢٢.٠	٣٢٤.٠	٣.٤٨	٣.٥٩	٩.٥	٨.٦	١٩.١	١٩.٠	١٧.٨	١٧.٦	٠.٧١٥	٠.٧٢٤
Folic acid at ١٠٠ ppm	٨.٩	٩.٣	٣٤١.٠	٣٤٣.٠	٣.٥٥	٣.٦٦	٩.١	٨.٠	١٩.٤	١٩.٥	١٨.١	١٧.٩	٠.٦٩١	٠.٧٠٠
Folic acid at ٢٠٠ ppm	٨.٩	٩.٣	٣٤٢.٠	٣٤٤.٠	٣.٥٧	٣.٦٨	٩.٠	٧.٩	١٩.٥	١٩.٥	١٨.٢	١٨.٠	٠.٦٩٠	٠.٦٩٩
Silicon + boron at mid. conc.	١١.١	١٣.٦	٤١٠.٠	٤١٣.٠	٤.٢٥	٤.٣٦	٥.٠	٤.١	٢٢.٠	٢٢.٦	٢٠.٣	٢٠.٠	٠.٥٤٠	٠.٥٥٠
Silicon + Folic at mid. conc.	١١.٠	١٣.١	٤٠٧.٠	٤١٠.٠	٤.٠٧	٤.١٨	٥.٥	٤.٩	٢١.٨	٢٢.٠	٢٠.٠	١٩.٨	٠.٥٦٠	٠.٥٧١
Boron + Folic at mid. conc.	١٠.٩	١٣.٠	٤٠٥.٠	٤٠٦.٠	٣.٩٩	٤.١٠	٦.٠	٥.١	٢١.٦	٢١.٧	١٩.٩	١٩.٧	٠.٥٨٠	٠.٥٩١
All at mid. conc.	١١.٢	١٣.٧	٤١٤.٠	٤١٦.٠	٤.٤١	٤.٥٢	٣.٧	٢.٧	٢٢.٣	٢٢.٥	٢٠.٥	٢٠.٣	٠.٥٢٠	٠.٥٢٩
New L.S.D at ٥ %	٠.٥	٠.٥	١٧.٥	١٨.	٠.٠٦	٠.٠٧	٠.٤	٠.٤	٠.٢	٠.٢	٠.٢	٠.٢	٠.٠٢٠	٠.٠٢١

Using silicon, boron and folic acid to promote yield quantitatively and qualitatively

There was a gradual promotion on quality of the grapes with increasing concentrations of each compound from low to high concentrations. A slight promotion was noticed with increasing concentrations of each compound from medium to high. The best results with regard to quality of the berries were obtained with using all materials together at the medium concentration. Berry weight reached ٤.٤١ and ٤.٥٢ g, while, T.S.S was ٢٢.٣ and ٢٢.٥ % with application of the previous recommended treatment comparing with ٢.١١ and ٢.١٢ g berry weight and ١٨.٩ and ١٩ % T.S.S produced by the control treatment during both seasons, respectively. Unfavourable effects on quality of the berries were recorded on untreated vines. These results were similar during both seasons.

The beneficial effects of silicon, boron and folic acid on growth and vine nutritional status possitively reflected on enhancing the formation of plant pigments and organic foods that may explain the present results.

These results are in harmony with those obtained by Kanto (٢٠٠٢) who worked on silicon, Madian and Refaai (٢٠١١) who worked on vitamins and Abdelaal (٢٠١٢) who worked on boron.

As a conclusion, it is suggested to spraying a mixture of potassium silicate at ٠.١ %, boric acid at ٠.٠٢٥ % and folic acid at ١٠٠ ppm three times/ year (before bloom, just after berry setting and at three weeks later) to promote yield quantitively and qualitatively. These treatment caused a great decline on shot berries problem of Early Superior grapevines grown under the conditions of this study .

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"استخدام السليكون والبورون وحامض الفوليك لتحسين المحصول كماً ونوعاً في كرمات العنب الإيرلى سوبيريور "

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أجريت هذه الدراسة خلال موسمي ٢٠١٠ ، ٢٠١١ لاختبار التأثير الفردي والمشترك لاستخدام سليكات البوتاسيوم بتركيز ما بين ٠.٠٥ إلى ٠.٢ % ، حامض البوريك ما بين ٠.٠١٢٥ إلى ٠.٠٠٥٠ % وحامض الفوليك بتركيز ما بين ٥٠ إلى ٢٠٠ جزء في المليون في علاج مشاكل انخفاض كمية المحصول والحبات الصغيرة في كرمات العنب الإيرلى سوبيريور النامية تحت ظروف منطقة المنيا.

تأثرت صفات النمو الخضري والحالة الغذائية للكرمات ، كمية محصول الكرمة ووزن العنقود وكذلك الخصائص الطبيعية والكيمائية للحبات إيجابياً باستخدام سليكات البوتاسيوم ، حامض البوريك وحامض الفوليك إما في الصورة الفردية أو المشتركة وذلك بالمقارنة بمعاملة الكونترول. وكانت صفتي النسبة المئوية للحبات الصغيرة والحموضة الكلية تميل إلى الانخفاض بصورة واضحة عند تطبيق هذه المعاملات. وكان التحسن متوافقاً مع زيادة التركيز المستخدم من هذه المواد وتم الحصول على أفضل النتائج عند استخدام حامض الفوليك وحامض البوريك وسلفات البوتاسيوم مرتبة ترتيباً تصاعدياً. ولم يكن لزيادة التركيز المستخدم من هذه المواد من التركيز الأوسط إلى الأعلى أية تأثيرات واضحة على الصفات تحت الدراسة. وكان الاستخدام المشترك له تأثيرات إيجابية واضحة بالمقارنة بالاستخدام الفردي لهذه المواد.

كما أظهرت ألنتائج أن رش كرمات العنب الإيرلى سوبيريور ثلاثة مرات بمخلوط من سليكات البوتاسيوم بتركيز ٠.١ % ، حامض البوريك بتركيز ٠.٠٢٥ % وحامض الفوليك بتركيز ١٠٠ جزء في المليون إلى أنتاج أعلى محصول وأقل نسبة من الحبات الصغيرة فى العناقيد بالإضافة إلى تحسين جودة الحبات.