V. SUMMARY AND CONCLUSIONS

The present investigation was carried out during the two successive 1993 and 1994 seasons on one year old rooted cuttings of Ruby seedless grape cv. under out door condition in an open place belonging to (Atomic Energy Organization), Enshas region-Sharkia Governorate. This work aimed to: 1- Investigate potentiality of such imported grape cultivar to grow under three egyptian soil types (clay loam, sandy and calcareous) through studying response of both vegetative and nutritional status, 2- Testing the suitablitiy of different vine's organs and what one could be recommended for chemical analysis and consequnthy determining the nutritional status of each nutrient element, and 3-Throwing some lights on the physiological relationship between application method "soil/foliar" of some micro nutrient elements from one hand and their absorption, translocation and finaly utilization by vines grown in the aforesaid three soil types from the other through using the radioactive isotops of these nutrient elements. Thus the following three potted experiments were conducted each for achieving one of the previously mentioned purposes.

V.I. Experiment, 1: Growht and mineral composition as influenced by soil type and nutritional treatments:

A factorial experiment included 12 treatments representive the different combinations between three soil types i.e. clay loam, sandy and calcareous (1st. factor) from one hand and four mineral fertilization treatments namely; T1 "tap water as control", T2 "NPKMg fertilizers soil applic.", T3 "NPKMg soil applic. + Fe Mn Zn soil appl." and T4 "NPKMG + Fe Mn Zn folair applic.". (The 2nd factor) was conducted during 1993 & 1994 seasons. During 1st week in both seasons 120 rooted cuttings were carefully selected, then pruned back each to a single spur (2 buds/each) and classified into 5 categoreis (blocks) according to their vigour, whereas one third of each class were devoted for planting individually in pots of each soil type.

On early May nutritional treatments were started using the complete randomized block design with five replications per each treatment and every replicate was presented by two plants within every block. During the last week of October in each season, experiment was terminated and the following measurements were done.

V.I.I. Vegetative measurements:

Plant height, stem (cane) thickness, number of lateral shoots and number of leaves / plant. Moreover, fresh and dry weights of the three plant portions i.e. root, shoot and leaves as were as the total plant dry weight of the plant, beside top/root ratio were determined.

V.I.II. Chemical analysis:

N,P, K, Mg, Fe, Mn and Zn were chemically analysed and estimated as% for former four elements or ppm with the latter three one.

V.II. Experiment, 2: Changes in mineral composition of different vine organs as affected by omission/ laking of some nutrient elements:

This experiment aimed to determine what plant organ can reflect a real settlement about the sufficiency or shortage in each nutrient element supply. To achieve this gool Ruby seedless vines were supplied with different (8) nutrient solutions 7 were deprived of only one of N, P, K, Mg, Fe, Mn and Zn nutrient elements beside a complete nutrient solution as (control). The mineral composition of different vine organs (leaf blade, leaf petiole, shoot and root) collected from three locations of shoot at two growth stages) (mid and late season) in response to different nutient solutions was studied.

On early March during every season 80 rooted cuttings were deveoted after they had pruned back to a single supr (2 eyes/ each), then graded into five categories (blocks) and transplanted individualy in pots containing clean sand (15 kg/each) and only one shoot was allowed to grow per each. Two months later i.e. early May feeding with 8 nutrient solutions was started at 2 days intervals till late october. The treatments were arranged in a complete randomized block design with 5 replications (2pots/each). To prevent salts accumulation tap water was applied once at the end of each week.

V.II.I. Chemical analysis:

On mid July and late October leaves were sampled, separately from three sites along the shoot length basal, middle and termina)l, then divided into blades and petioles for chemical analysis. Moreover, at late october shoot and root samples were also analysed-N, K, Mg, Fe, Mn and Zn contents were determined in the plant materials of the aforesaid four vine organs.

V.III. Experiment 3 : Absorption, translocation and utilization of some micro elements in vines grown under 3 soil types as related to application method using their radioactive istops:

In this field of study, experimental work was carried out during 1994 season extending from mid July till late July. Ruby seedless grape rooted cuttings grown in pots (2 kg capacity) containing three soil types (clay loam, sandy and calcoreous) were foliar on soil applied with only a single solution of FeSO4, MnSO4 and ZnSo4 labelled with the corresponding radioactive isotops i.e. Fe-59, Mn-S4 and Zn-65 carrier - free, respectively. In this study each treatment i.e foliar or soil applied solution of each labelled elements (Fe-59, Mn-54, Zn-65) was replicated three times (one pot, each replicate) in every soil type. Therefore 54 pots were devoted (3 soil type, 2 application method, 3 micro elements, 3 replicates). In foliar application 1.0 ml. of each labelled solution was added in a fine droplets onto the leaf surface located at middle node of each plant "using micropipette". Meanwhile in soil application 20.0 ml of each labelled solution were added per pot. Two weeks later (late July) treated plants were taken out to evaluate absorption, translocation and utilization rate of each element in relation to application methods under different 3 soil types through the following procedures. Absorbed and translocated % of a given radioactive isotop in each case was estimated by determining its activities in different plant samples (root, treated leaves, above and below treated leaves) using Gamma counter. On the base of both quantity and concentrations of solutions used for either foliar or soil applications and the determined absorbed quantity of each specific element in every soil type, utilization rate of such element was estimated for every case.

Data obtained from each experiment could be summarized as follows:

V.I. Experiment, 1: Effect of soil type and mineral fertilization:

V.I.I. Vegetative growth measuraments:

Plant height, stem thickness, number of both lateral shoots and leaves per vine, as well as fresh and dry weights of different organs (leaves, shoots, root and total plant), besides top/root ratio were the concerned vegetative measurements.

Specific effect:

Referring specific effect of soil type, data obtained during both seasons revealed obviously that all the aforesaid measurements, not only responded significantly to soil type but also followed a firmer trend except number of laterals in this respect. Hence, the tallest and thickest cane and the heaviest leaves, shoots, roots and total plant weights, as well as the greatest values of leaves number/vine and top/root ratio all were always in concomitant to those vines grown in clay loam soil. The reverse was true in calcareous soil, while sandy soil was intermediate except top/root ratio whereas calcareous soil exceeded sandy soil in this regard.

Regarding specific effect of mineal fertilization treatments, it is quite clear that all treatments whereas mineral fertilizers were added irrespective of NPKMg applied alone or together with Fe Mn Zn increased significantly all vegetative growth measurements than control except number of laterals. However, NPKMg + Fe Mn Zn foliar sprays was the superior, followed in a descending order by NPKMg + Fe Mn Zn soil added and NPKMg alone.

Interaction effect:

Regarding the interaction effect of differetn combinations between soil type and mineral fertilization treatments it could be generally concluded that all growth measurements especially organs weights followed nearly the same trend of response. Ruby seedless young vines grown in clay loam soil and fertilized with NPKMg + Fe Mn Zn "Foliar or soil added" wer significantly the superior. Contrary to that unfertilized vines in either calcareous or sandy soils, besides those in calcareous supplied with either NPKMg alone or with Fe Mn Zn soil application were the inferior. In addition other combinations were in between, however those of NPKMg fertilized vines in clay soil and those in sandy supplied with NPKMg + Fe Mn Zn (foliar/ soil application) were more effective and come statistically second to the superior. On the other hand, it could be noticed that foliar application of Fe Mn Zn was more effective than soil added in calcareous soil while in both sandy and clay sils both application methods were nearly the same.

V.I.II. Nutritional status "mineral compostion":

V.I.II.1 Nitrogen content:

Specific effect:

Referring specific effect of soil type, it is quite clear that vins in clay soil having significantly the richest organs N content (blade, petiole, shoots and roots), followed by those either in sandy in case of blade or in calcareous with both petiole and roots, while with shoots both calcareous and sandy were the same.

As for specific effect of mineral fertilization treatments, all fertilized vines showed significant increase in their various organs N% than unfertilized ones "control". However, both T4 & T3 were statistically the superior followed by T2 in most organs except shoots whereas T4, T3 and T2 were statistically the same.

Interaction effect:

Neverthell, all T4, T3 and T2 combinations "regardless of soil type" increased various organs N% than those of infertilized ones "control". However, T4, T3 treated vines grown in clay soil were the superior, but other combinations varied in their response to interaction effect from one organ to another. Since, both petioles and roots and to some extent shoots followed similar trend, while leaf blade showed its own trend in this respect.

V.I.II.2. phosphorus content:

Specific effect:

With regard to specific effect of soil type, it could be generally concluded that various vine organs exerted their maximum P% in clay soil and the opposite was true with calcarous soil except with shoots which did not follow specific trend. However, both clay and sandy soils were statistically the same with both blades and roots.

Nevertheless P content was specifically responded to mineral fertilizations, since supplying vives with NPKMg alone (T2), NPKMg + Fe Mn Zn soil added (T3) or NPKMg + Fe Mn Zn foliar spray (T4) increased it than control (unfertilized vines). However, T4 was statistically more effective than both T3 and T2 with leaf blade, but in case of leaf petiole, roots and shoots T2 was the superior.

Interaction effect:

Concerning the interaction effects it could be safely concluded that two trends were detected, 1st. dealing with leaf blade whereas combinations between T4 and clay or sand ysoils beside that of T3 treated vines grown in sandy soil were the superior. Meanwhile, second trend was related to leaf petioles, shoots and roots whereas T2 treated vines in clay soil was the superior followed by those received the same fertilization treatment in either sandy or calcareous soils. In additions, all combinatins of unfertilized vines in different soil types produced organs having the poorest P content especially those in sandy soil irreespective of plant organ.

V.I.II.3. Potassium Content:

Specific effect:

Nevertheless, various vine organs responded specifically to soil type and followed typically the same trend. The richest vine organs were closely related to sandy soil, followed by those in clay soil while calcareous was the least donor.

As for the specific effect of mineral fertilization, all vine organs showed the same trend. Potassium content was significantly increased by T2, T3 or T4 as compared to control (T1), however T4 and or T3 was statistically more effective than T2 in most cases.

As for interaction effect, vines grown in sandy soils had statistically the richest organs when supplied with T4 or T3 and to great extent T2, followed by those in clay soils after supplying with the corresponded fertilization treatments. Contrary to that was found with combinations of the unfertilized vines regaredless of soil type. In addition, leaf petiole was the richest organ followed by shoots, while leaf blade was the poorest one.

V.I.II.3. Magnesium content:

Specific effect:

Data obtained during two seasons declared that magnesium content was specifically responded to both soil type and mineral fertilization, each showed its own firmer trend with all vine organs. Vines in clay had richest organs, but lowest Mg% was found in calcareous. On the other hand, adding NPKMg alone (T2) was the superior followed by NPKMg + Fe Mn Zn (soil or foliar) i.e T3 or T4 respectively. However, differences in response were more pronounced in petiole than other organs from one hand, beside trend of response to soil type was firmer then to fertilization treatments from the other.

Interaction effect:

Conclusively, NPKMg fertilized vines in clay soil exerted statistically the highest Mg% followed by T3, T4 treated vines in the same soil.

Nevertheless, leaf petiole Mg% was higher than other, followed descindingly by blades, roots and shoots.

V.I.II.5. Iron content:

Specific effect:

It could be safely concluded that diffrent vine organs followed two distinct trends each for individual studied factor. Highest Fe content was closely related to clay soil but the opposite was found in calcareous soil.

Moreover T4 was the most effective nutritional treatment followed by T3, T2 and T1 (control). However, both trends were firmer and differences were markedly stricking with both leaf organs (blade and petiole) than two other vine organs (roots and stems).

Interaction effect:

Specific effects of both soil type and mineral fertilization were reflected on interaction effect of their combinations on Fe content. The richest organs were always coupled with those vines grown in clay soil and supplied with NPK Mg + Fe Mn Zn. However those vines received neither macro nor micro nutrients (T1 or T2) when grown in calcareious or sandy soils prouduced the poorest organs especially both combinations of former soil. On the other hand Fe Mn Zn foliar application was more effective in both clay and calcareous soils but soil application was more benificial in sandy soil.

V.I.II.6. Manganese content:

Specific effect:

Data obtained during both seasons revealed that manganese content in response to specific effect of both soil type and mineral fertilization followed typically the same trends previously found with iron.

Interaction effect:

Data obtained revealed that T4, T3 treated vines in 3 soil types except T3 fertilized ones in calcareous soil having significantly the richest organs in manganese content, however T4 x clay was superior. Contrary to that unfertilized and those supplied with NPKMg only in either sandy or calcareous soils, beside NPKMg + Fe Mn Zn soil applied ones in latter was the inferior.

V.I.II.7 Zinc Content:

Specific and interaction effects:

Different vine organs zinc content in relation to soil type, mineral fertilization treatments and their combinations followed the same pattern of response previously detected with manganese and iron.

V.II. Experiment, 2: Changes in mineral composition of vine organs in response to sampling date and omission of some nutrient elements:

In this regard changes in mineral composition of N, P, K, Mg, Fe, Mn and Zn in different vine organs collected from three locations at mid and late season were investigated in response to some nutrient solutions each deprived of one of the aforesaid 7 elements. Data obtained regarding the specific and interaction effects of sampled plant material and nutrient solutions as well as their combinations were as follows:

V.II.1. Changes in nitrogen content:

Specific effect:

With regard to speceific effect of nutrient solution, it was clear that N level of all vines deprived of any nutrient element was reduced however N omission was the most effective followed by minus P. On the other hand, leaf blade was generally the richest N content, while petiole was the poorest organ. Moreover N% in both leaf organs were increased with the upward direction of shoot, but it decreased with aging. Thus, blades of the terminal leaves collected on mid July were richer, while petiole of basal leaf collected latter in October was poorer.

Interaction effect:

Specific effects of both investigated factors were reflected on interaction effect, whereas leaf blades especially of middle leaves taken in July or October, showed generally: a) higher N content that b) reduced