Response of rooted cutting of some olive varieties to urea and gibberlin sprays and mineral fertilization

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This investigation was carried out in the Experimental station of the Horticulture Research Institute at Giza Governorate during three successive seasons of 1987, 1988 and 1989 on rooted cuttings of Picual and Manzanillo olive cvs. The main purpose was to investigate the response of such nursery plants concerning their nutritional status and vegetative growth to GA and some nutritional treatments. Since, two experiments were envolved. The first included some foliar spray treatments with two N sources ”Urea and (NH4)2 SO4” ,”Zn SO4 and gibberellin” either solely or incombinations. Second dealing with the application method,rate and some combinations of soil applied N,P,K fer-tilizers. Treatments of each experiment were arranged in a complete randomized design with 5 replicates each was repre-sented by 2 nursery plants. Thus the different treatments of each experiment were as follows : Experiment, I : 1.Tap water spray ”control” .2.Urea foliar spray at 1% .3.(NH4)z SO4 foliar spray at 1%4.Zn SO4 foliar spray at 500 ppm .5.Gibberellin foliar spray at 100 ppm .6.Urea 1% + Zn SO4 500 ppm .7.Urea 1% + gibberellin 100 ppm .8.(NH4)z SO4 1% + Zn SO4 500 ppm .9.(NH4)z SO4 1% + gibberellin 100 ppm .Experiment, II : 1.No fertilizer application ”control” .2.Nitrogen foliar application ”(NH4)2 SO4 1%”3.NI soil application ”2 gm. actual N/plant as(NH4)2 SO4”4.N2 soil application ”4 gm. actual N/plant as(NH4)2 504”5.PI soil application ”2 gm.P205/plant as superphosphate”6.P2 soil application ”4 gm.PzOs/plant as superphosphate”7.K1 soil application ”2 gm. K20/plant as K2 SO4”8.K2 soil application ”4 gm. K20/plant as K2 SO4”9.(N2+P2) soil application”4 gm. of N and P205/plant” 10.(N2+K2) soil application”4 gm. of N + 4 gm K20 /plant” 11.(N2+P2+K2)soil application”4 gm. from each of N, P205and K20”.12. P foliar application 0.5 % orthophosphoric acid.All foliar spray treatments in this study were applied 8 times at 15 days intervals, started on early May during 1987 and 1988 seasons, as well as on early August in 1989 season. However, the dose of each soil application treatment was fractionated into four equal frequencies at one month interval.The obtained results could be summarized as follows : V. 1. Vegetative growth : V. 1.1. Stem lengthObtained data revealed that all the foliar spray treat-ments used in the experiment”I” i.e. urea 1%, (NH4)z SO4 1%, Zn SO4 500 ppm, GA 100 ppm and their combinations increased significantly stem length in nursery plants of both Picual and Manzanillo olive cvs. over the control during three seasons of study. On the other hand, both (Urea 1% + GA 100 ppm) and (NH4)z SO4 1% + GA 100 ppm) treatments were the su-perior as an average of three seasons was concerned for bothcvs.V. 1.1.b. Experiment ”II” :Obtained data showed that N foliar application ”(NH4)z SO4 at 1%” treatment was more effective than soil application either at 2.0 or 4.0 gm. actual N/plant (NI, Nz) treatments, where the spray application enhanced statisti-cally stem length in both olive cultivars over control. While soil application of (NH4)2 SO4 at the NI rate induced statistically the same stem length value of control, but the Nz soil application (4.0 gm. actual N per plant) suppressed stem elongation. This trend was true either in 1987 and 1988 seasons or in 1988 and 1989 seasons regarding NI and N2 treatments respectively, as well as if the average of the three seasons of both N levels was compared. Moreover, soil application of phosphorus and potassium as each was added solely either at low or high level showed highly significant increase over control, since they were the superior in both cvs. On the

other hand, different treatments of N,P,K com-binations, i.e. (N2+P2), (Nz+Kz) and (N2+P2+K2) treatments showed variable responses, where (N2+P2) induced relative increase, especially in Manzanillo cv. On the contrary the other two combinations i.e. (N2+K2) and (N2+P2+K2) treat-ments stunted shoot length, especially the forward one with Picual cv. In addition,P foliar sprays enhanced stem length.V. 1.2. Stem dry weight :V. 1.2.a. Experiment ”I” :Concerning stem dry weight of Picual and Manzanillo rooted cuttings in response to the different treatments used in experiment ”I” data showed nearly the same trend that previously found with stem length, where all treatments showed a significant increase over control. Meanwhile, the (Urea +GA) and (NH4)2 SO4 treatments were the superior, fol-lowed by GA treatment in a descending order.V. 1.2.b. Experiment ”II” :Data obtained showed that foliar application of ammonium sulphate (1%) increased significantly the stem dry weight than control from one hand and it was more effective than soil application either at 2.0 or 4.0 gm. actual N/plant from the other. Since, stem dry weight of the lower N soil applied rooted cuttings was nearly the same as control, especially in Picual cv., but the higher N level stuntedsignificantly stem growth in both cultivars.Moreover, soil application of both superphosphate and potassium sulphate enhanced significantly stem growth in both olive cultivars. However, the lower rate of each i.e. 2.0 gm. of P205/ K20 per plant was tended to be the superior in this concern. In addition, the P foliar spray with or-thophosphoric acid at the rate of 200 ppm P205 seemed to be uneffective.Nevertheless, treatments of the three N,P,K combinations used were greatly varied. Since, the (N2+P2) treatment was the superior combination and significantly surpassed the control, but the (N2+k2) treatment was the inferior and decreased the stem dry weight below the control. In addi-tion, the (N2+P2+Kz) treatment was in between the above men-tioned combinations, in this respect. V. 1.3. Leaves dry weightV. 1.3.a. Experiment, I :-Data obtained revealed that the response of leaves dry weight in both olive cvs. to the different spray treatments applied in experiment ”I” showed a similar trend to that previously mentioned with both length and dry weight of stem, where all treatments showed a highly significant in-crease over control. On the other hand, urea 1% foliar spray alone and its combinations either with Zn SO4 or GA were the superior followed by those of ammonium sulphate 1% and its combinations, while the foliar spray with GA alone rankedthe last in this concern.V. 1.3.b. Experiment, II :Concerning the leaves dry weight, data obtained showed that N foliar application was more beneficial than soil ap-plication. Moreover, the N2 soil application showed aharmfull effect in this concern.Besides, soil application of superphosphate at both PI and P2 rates as well as K2 SO4 application enhanced statis-tically leaves growth. However, the rate of both P and K fertilizers did not show a specific trend for both cultivars in each season of study. As for the P foliar application and the soil application of the different combinations of N,P,Kfertilizers, obtained data showed the same response that previously detected concerning stem growth to these treat-ments. V. 1.4. Root dry weight :V. 1.4. a. Experiment, I :-from the data obtained, it is quite evident that allthe foliar spray treatments used in the first experiment in-creased significantly the root dry weight in rooted cuttings of both two olive cultivars. Both two N sources were statis-tically of the same effect. However, the GA foliar spray at 100 ppm either alone or combined with urea/ammonium sulphate treatments showed the lowest increase in root dry weight as compared to the other used treatments. On the contrary the foliar spray treatments of Zn SO4 at 500 ppm, (urea + Zinc sulphate) and (ammonium sulphate + zinc sulphate) were the superior ones, since they statistically exceeded all the other treatments in most cases with both olive cultivars.V. 1.4.b. Experiment, II :-As for the root dry weight response to the different treatments applied in the second experiment, data obtained cleared that the foliar application of (NH4)2 SO4 was more effective than soil application at both 2.0 and 4.0 gm. ac-tual N/plant. Since, the (NH4)2 SO4 foliar spray enhanced significantly root growth and N2 soil application retarded it but the NI soil treatment was in between. Moreover, the soil application, of superphosphate produced statistically the heaviest root dry weight, since both PI and P2 levels were the superior with Picual and Manzanillo cvs., respec-tively as an average of three seasons were concerned. In ad-dition, both rates of K2 SO4 soil application enhanced sig-nificantly root dry weight in nursery olive plants of both cvs., however, no definite tendency could be observed regarding K rate response for both cultivars in all seasons of study. Moreover, the N,P,K combinations were varied greatly concerning their effect since the (Nz+Pz) treatment was the superior but the (N2+Kz) was the inferior, as well as the (N2+P2+K2)

came in between, in this concern. Beside P foliar spray was not effective as compared to control.V. 1.5. Total plant dry weight :-V. 1.5.a. Experiment, I :-Data obtained, disclosed that all foliar spray treat-ments investigated in the first experiment increased sig-nificantly the total plant dry weight of nursery olive plants in both cultivars. However, the increase in most cases was appreceably of same value, but it could be generally concluded that urea and its combinations as wellas ammonium sulphate either solely or in combinations espe-cially with GA tended to be the most effective treatments in this respect.V. 1.5.b. Experiment, II :-Data obtained concerning the influence of the different treatments applied in the second experiment on the total plant dry weight "i.e. rate and application method as well as some combinations of N,P,K fertilizers" revealed that (NH4)2 SO4 foliar spray was more effective than the soil ap-plication. Moreover, the N2 soil application suppressed growth. Besides, superphosphate soil application either at 2.0 or 4.0 gm. P205/plant were the superior treatments with Picual and Manzanillo cvs., respectively as an average of three seasons was concerned. In addition, as the K2 SO4 was applied solely a marked increase in total plant dry weight was gained, while the reverse was true as it was added to ammonium sulphate i.e. (N2+K2) treatment. On the other hand, (N2+P2) treatment showed that adding superphosphate to the ammonium sulphate eliminated to great extent the harmfull effect of higher N soil application, where the applied plants exceeded statistically those of control. However, the (N2+P2+K2) applied nursery olive plants of both cultivars were to some extent of the same total plant dry weight as compared with the corresponding ones of control. This prove also that superphosphate showed a beneficial effect in acoming back to health for the nursery olive plants which suffer from (N2+K2) soil application.V. 1.6. Top/root ratio :V. 1.6.a. Experiment, I :-Regarding the top/root ratio in nursery plants of both Picual and Manzanillo olive cvs. as influenced by the foliar sprays treatments used in the first experiment, data ob-tained declared that gibberellin application either solely or combined with urea/ammonium sulphate resulted in the highest ratio. On the contrary, foliar sprays with zinc sul-phate at 500 ppm either alone or in combination showed the least value of top/root ratio. These responses were generally more pronounced with Manzanillo than Picual cul- tivar.V.1.6. b. Experiment, II :-With respect to the top/root ratio in response to the different treatments applied in the second experiment, it is clear that N foliar spray was not effective, while with N soil application especially at level of 4.0 gm. actual N / plant the ratio tended to be decreased. Moreover, superphos-phate soil application decreased the ratio especially when it was added at the rate of 4.0 gm. P205/plant. As for the effect of K2 SO4 treatments, however no definite trend was occurred, but the ratio tended to be generally decreased with the higher rate of K2 SO4 application.In addition, soil application of the (N2+P2+K2) com-bination showed the lowest value of top/root ratio as com-pared with those of both the other two combinations i.e.(N2+132) and (N2+K2) treatments.Generally it could be concluded that superphosphate soil application at both levels, N soil application of am-monium sulphate especially at the higher rate as well as the (Nz+P2+K2) combination, all resulted in decreasing the top/root ratio. Besides, nursery olive plants of Manzanillo cv. were more responded to such treatments than those ofPicual.V. 2. Leaves, stem and roots mineral contents:-V. 2.1. Experiment, I :1.Spraying both Picual and Manzanillo rooted cuttings either with urea or (NH4)2 SO4 solutions each at 1% concentra-tion increased significantly leaf N, Ca and Mg contents as well as stem and roots N and Ca %. On the contrary, both N foliar spray treatments resulted in a significant decrease in P and K contents below the control in the three plant organs of the rooted cuttings of both olivecvs. 2.Foliar application with Zn SO4 at 500 ppm decreased sig-nificantly leaves, stem and roots P and Ca %, but it in-crea.sed significantly leaf mg %. In addition, leaf, stem and root N and K percentages were not affected as com-pared with the control treatments in both Picual and Man-zanillo olive rooted cuttings.3.GA foliar sprays caused a significant increase in leaf, stem and root N, K and Ca % in both two olive vareities, except in Manzanillo where the increase in Ca % was not significant in all plant organs. Moreover, leaf mg % showed the same trend of both N and K leaf %.Meanwhile, leaves, stem and root P % was sig-nificantly decreased in two olive cvs. during the twoseasons of study.4.spraying both Picual and Manzanillo olive rooted cuttings either with (urea + Zn SO4) or ((NH4)2 SO4 + Zn SO4) treatments increased significantly N and Mg contents in leaves, stem and root while P,K and Ca was significantly decreased in both two olive cvs. Besides, roots P con- tent was increased as compared

with the control during the study. 5.In addition, foliar sprays with both combinations of (urea + GA) and ((NH4)2 SO4+ GA) caused a significant in-crease in leaf, stem and root N, Ca and Mg contents, but the reverse was true with P and K contents in both Picualand Manzanillo rooted cuttings during the study.6. Urea foliar sprayed rooted cuttings showed a significant increase in P and Ca levels in their different plant or-gans as compared with (NH4)2SO4 sprayed ones. Meanwhile, N level in Manzanillo rooted cuttings showed the same trend that previously mentioned with P and Ca but the reverse was found with Picual cultivar. In addition, K % did not show a specific effect concerning the effect of N source in this respect.V. 2.2. Experiment, II :-1 (NH4)2 SO4 application either as foliar spray at 1% or soil application at (2.0 gm. - 4.0 gm. N/plant) caused highly significant increase in leaf, stem and root N, Ca and Mg contents. While it decreased significantly P andcontents as compared with the control in both Picual and Manzanillo rooted cuttings during the study.2. P soil application at the rate of (2.0 gm. - 4.0 gm. PzOs/plant) increased significantly N, P, Ca and Mg contents in leaf, stem and root in both two olive cvs., while K content was decreased significantly. Rising the supply of P fertilizer from (2.0 gm. to 4.0 gm. P20s/plant) in-creased significantly P and Mg contents in leaves, stem and roots, while N,K and Ca levels were not affected inboth Picual and Manzanillo rooted cuttings during the study.3.K soil application caused a significant increase in leaves ,stem and root N,P,K and Mg contents as compared with the control in both two olive cvs., while Ca content was decreased significantly. On the other hand, rising the K supply from (2.0 gm. to 4.0 gm. K20 /plant) increased N,P.K and mg contents in both Picual and Manzanillo olive rooted cuttings during the two seasons of study.4 In addition, all combinations of N,P,K fertilizers,i.e.(Nz+Pz), (N2+I(2) and (N2+P2+Kz) treatments caused a sig-nificant increase in leaf,• stem and root N,P,K,Ca and Mg contents in Picual and Manzanillo olive rooted cuttings. However, few exceptions could be neglicted i.e. K and P levels in both (N2+P2) and (N2+K2) applied nursery olive plants, respectively.