Bid-organic farming efficiency on yield and quality of some medicinal plants

Hany Mohammed Ahmed Abd-Elrahman

Efficiency of biofertilization and/or organic manuring combined with biocontrol agent on marjoram growth performance and controlling of root diseases under greenhouse conditionA pot experiment was carried out to investigate the efficiency of marjoram inoculation with Paenibacillus polymyxa, Bacillus megaterium var. phosphaticum and Bacillus circulans combined with Trichoderma harzianum on infection percentage, enzymatic activity, growth characteristics, peroxidase and polyphenol oxidase activity in presence or absence of Fusarium oxysporum in autoclaved or non-autoclaved soil.Antagonistic activity of biofertilizers and biocontrol strains.Antagonistic effect test megaterium var. phosphaticum, harzianum against F. oxysporum under laboratory conditions.Obtained results indicated that tested strains showed high suppression of Fusarium oxysporum . Also, results emphasized that clear zones around tested strains were observed . Such clear zones are likely to be due to the production of antibiotic substances by biofertilizer strains and Trichoderma harzianum.Effect of biofertilization and/or organic manuring combined with T. harzianum on infection percentage and disease suppression of marjoram.Data indicated that there is no observed infection in whether non-sterilized or sterilized soil treatments. While in infested soil, the infection rate ranged between 6.7-71.4 and 7.1-100 % in the non-sterilized and sterilized soil treatments, respectively.of p. polymyxa, B. B. circulans and T. was achieved in vitro2.3.6) Soil inoculation with the mixture of biofertilizers combined with compost in presence of T harzianum showed the lowest record of infection percentage. While the highest record of infection percentage was observed in infested soil with F. oxysporum individually.Chemical fertilization gave higher percentage ofinfection compared to biofertilizat ion and organic manuring treatments.Effect of biofertilization and/or organic manuringcombined with T. harzianum on enzymes activity in soil cultivated with marjoram.The highest DI-TA. recorded in non-sterilized soil treatments was observed with biofertilizers inoculation and compost amendment combined with soil infestation with F. oxysporum in presence of T harzianum. While, the lowestDHA records were observed with the infested and sterilized soil.Higher values of DHA which vs, as observed with dual application interpret the beneficial effect of inoculation and compost in proliferation and enhancement the microbial biomass in rhizosphere.Generally, soil infestation with F. oxysporum decreased phosphatase activity in all treatment compared to un-infested ones. This likely be due to antagonistic effect between indigenous (native) soil fungi besides the introduced inocula and pathogenic fungus. Also, high values of N2-ase and phospatase activity were observed in non-sterilized soil compared with sterilized ones. This result is likely be due to the activity of native microorganisms in non-sterilized soil treatments beside the introduced inocula. The highest records of N2-ase and phospatase activity were observed in non-sterilized and infested soil treated with either biofertilizers and compost in presence ofT harzianum. While, the lowest records were obseved in infested soil with F. oxysporum.Generally, soil infestation with Fusarium oxysporum showed lower values of N2-ase and phospatase activity whether non-sterilized or sterilized soil than un-infested ones. These lower values of N2-ase activity may be due to the antagonistic effect of such fungus against soilmicroflora.Effect of biofertilization and/or organic manuring combined with T. harzianum on growth characteristicsof marjoram.Growth characteristics of marjoram were significantly increased in the inoculated treatments with biofertilizers compared with un-inoculated

ones. This result may be attributed to the beneficial effects of PGRs produced by these microorganisms.Inoculation of marjoram with biofertilizers combined with compost gave higher growth characteristics values rather than those treated with either biofertilizers or compost individually. This result was observed with both sterilized and non-sterilized soil treatments .The highest records of marjoram growth characteristics were observed in non-sterilized soil which inoculated with biofertilizers and amended with compost in presence of T. harzianum. While, the infestation with pathogenic fungus in sterilized soil resulted in death ofplants.Effect of biofertilization and/or organic manuring combined with T. harzianum on peroxidase andpolyphenol oxidase activity.Data clearly indicated that soil infestation with Fusarium oxysporum significantly increased the peroxidase and polyphenol oxidase activity in marjoram comparedwith the un-infested ones .Inoculation with biofertilizers resulted significant increase in peroxidase and polyphenol oxidase activities of marjoram compared to un-inoculated ones.Furthermore, marjoram inoculation with biofertilizer strains in combination with compost gave higher peroxidase and polyphenol oxidase activity in comparisonwith marjoram treated with either biofertilizers or compost individually.In addition, marjoram inoculation with biofertilizer strains combined with soil infestation with pathogenic fungi significantly increased the peroxidase and polyphenoloxidase activity compared to soil infestation with pathogenic fungus alone.Efficiency of biofertilization and/or organic manuring combined with biocontrol agent on damssisa growthperformance and controlling root diseases under greenhouse conditionA pot experiment was carried out to investigate the efficiency of damssisa plants inoculation with Azotobacter chroococcum , Glumas macrocarpum and Bacillus circulans combined with Pseudomonas fluorescens on infection percentage, enzymatic activities and growth characteristics in presence or absence of Fusarium solani in sterilized or non-sterilized soil.Antagonistic activity of biofertilizer and biocontrol strainsAntagonistic effect of A. chroococcum, B. circulans and Ps. fluorescens against F. solani was achieved in vitro under laboratory conditions. Obtained results indicated thatthe four tested strains showed high suppression effect against Fusarium solani.Results emphasized that clear zones were observed around the tested strains. Such clear zones are likely to be due to the production of antibiotic substances by biofertilizer strains and Pseua'omonas fluorescens.11.1111M1.1•11.1.1111011MINIMMOW.311/1S.M.11.91.8104014.111W11.00 ? MWRAIIEffect of biofertilization and/or organic manuring combined with Ps. fluorescens on infection percentage and disease suppression of damssisa.Damssisa inoculation with biofertilizer strains (Paenibacillus polymyxa, Bacillus megaterium var. phosphaticum and Bacillus circulans) significantly decreased the percentage of Fusarium infection compared to un-inoculated ones. Also, disease suppression significantly increased with damssisa inoculation with biofertilizer strains. These results were observed in presence or absence of Pseudomonas fluorescens.Soil inoculation with biofertilizer strains combined with compost in presence of Ps. fluorescens showed the lowest record of infection percentage. While the highest record of infection percentage was observed in infested soilwith F. solani individually.Concerning the chemical fertilization treatments data showed that they gave higher percentage of infection compared to either Ps. fluorescens or biofertilization and organic manuring treatments.Effect of biofertilization and/or organic manuring combined with Ps. fluorescens on enzymes activity.The highest DHA record was observed in non-sterilized soil treated with biofertilizers inoculation and compost amendment combined with soil infestation with F. solani in presence of Ps. fluorescens. While, the lowest DHA record was observed with the sterilized and infested soil. This result interpret beneficial effect of inoculation and organic manure in proliferation and enhancement the microbial biomass in rhizosphere.Also, data revealed that non-sterilized soil treatments gave higher values of N2-ase activity than sterilized ones.The N2-ase activity which was observed with sterilized treatments due to introduced biofertilizersWineWfsrlDR.,,.inocula activity. Higher values of N2-ase activity was observed in non-sterilized soil compared to sterilized ones.The highest record of N2-ase activity was observed in non-sterilized and infested soil treated with both biofertilizers and compost in presence of Ps. fluorescens.While, the lowest record was observed in infested soil with F. solani individually.Generally, it is important to mention that inoculation with Ps. fluorescens showed significamly increase in N2- ase activity in all treatment whether non-sterilized or sterilized soil as compared to uninoculated ones.Data revealed that damssisa inoculated with the

biofertilizer strains gave significant increase in phosphatase activity compared with either organic manuring or chemical fertilization. Also, data announced that inoculation with biofertilizer strains in combination withcompost gave the highest increase of the phosphatase activity.Effect of biofertilization and/or organic manuringcombined with Ps. fluorescens on mycorrhizal infection percentageData showed that mycorrhizal root infection percentage was higher in case of mycorrhizal inoculated treatments compared to un-inoculated ones which depended on the indigenous VAM in the soil. Low percentage of mycorrhizal infection in the un-inoculatedplants indicate that the native VAM fungi are presented in the soil but in a low density.Also data revealed that sterilized soil treatments gave lower values of mycorrhizal infection compared to un- sterilized ones. Moreover, no infection with VAM showed in the un-inoculated and sterilized soil treatments. The highest record of mycorrhizal root infection wasobserved in case of dual application with compost and biofertilization in presence of P. fluorescens.Effect of biofertilization and/or organic manuring combined with Ps. fluorescens on growth characteristicsof damssisa.Growth characteristics of damssisa weresignificantly increased with the inoculation with biofertilizer strains compared to un-inoculated ones.The highest records of damssisa growth characteristics were observed in non-sterilized soil that inoculated with biofertilizers and amended with compost in presence of Ps. fluorescens. While, the lowest records were observed in sterilized soil infested with pathogenic fungusindividually.Effect of biofertilization and/or organic manuring combined with Ps. fluorescens on peroxidase and polyphenol oxidase activity.Inoculation with biofertilizer strains resulted significant increase in peroxidase and polyphenol oxidase activity of damssisa compared to un-inoculated ones. Similar trend of result was observed in non-sterilized andsterilized soil.Furthermore, damssisa inoculation with biofertilizer strains in combination with compost gave higher records of peroxidase and polyphenol oxidase activity in comparison with that treated with either biofertilizers or compostindividually.In addition, damssisa inoculation with biofertilizer strains combined with soil infestation with pathogenic fungus significantly increased the activity of peroxidase and polyphenol oxidase as compared to soil infestation with pathogenic fungus alone. from data it is worthily to mention that damssisa inoculation with Ps. fluorescens gave higher records of peroxidase and polyphenol oxidase rather than un-inoculated ones.Effectiveness of biofertilization and/or organicmanuring on growth performance and yield of marjoram.This experiment was designed to study efficiency of biofertilization (Paenibacillus polymyxa H1, Bacillus megaterium var phosphaticum and Bacillus circulans)and levels of organic manuring in open field on soil enzymes activity, macro-nutrient content, peroxidase and polyphenol oxidase activities, plant growth characteristics, yield and active substances of marjoram oil.Periodical changes of dehydrogenase activity (DHA) under biofertilization and/or organic manuring in soil cultivated with marjoram.Higher records of DHA were observed in soil inoculated with mixture of biofertilizer strains (Paenibacillus polymyxa HI, Bacillus megaterium varphosphaticum and Bacillus circulans) than amended soil with organic manuring.Moreover, data showed that inoculated soil with biofertilizer strains in combination of compost gave higher DHA than the soil treated with either biofertilizers or compost each one individually. This was true through all experimental periods and two growing seasons.Data revealed that inoculated soil with biofertilizerstrains combined with full dose of compost gave the highest values of DHA.Periodical changes of niitrogenase activity under biofertilization and/or organic manuring in soil cultivated with marjoram.higher records of N2-ase activity were observed in inoculated soil with biofertilizer strains than soil treated with compost only. The highest values of N2-ase activity were obtained with full dose of compost + biofertilizers mixture. from the obtained data, it’s worthily to mention2nelIMMIlassesoMma.1.11.191.10.7%V.1.1.Summarythat the N2-ase activity values were higher at flowering stage (90 days from transplanting) rather than vegetativeone.Periodical changes of Phosphatase activity under biofertilization and/or organic manuring in soilcultivated with marjoram.Obtained data emphasized that inoculation of soil with effective biofertilizer strains led to significant increase in phosphatase activity compared to compost amendment.Also, phosphatase activity was enhanced in soil inoculated and treated with compost compared to soil treated with either biofertilizers or compost each oneindividually.The highest records of phosphatase activity were observed in soil treated with full dose of compost in combination with biofertilization.Periodical changes of ammoniacal nitrogen under biofertilization

and/ro organic manuring in soil cultivated with marjoram.Inoculated soil with biofertilizer strains in combination with compost showed higher NH4-N records than soil treated with either biofertilizers or compost eachone individually.Obtained data also revealed that the values of NI-14- N in inoculated soil with biofertilizer strains were higher than uninoculated one. This result was obtained at allgrowth periods.from the obtained data it is importance to notice that the decrease of NH4-N levels at flowering stage can be attributed to the high multiplication of nitrifying bacteria (which convert ammoniaical nitrogen to nitrite nitrogen) during flowering stage as a result of qualitative and quantitative changes in nature of the root exudates of cultivated plants during different growth stages.Periodical changes of nitrate nitrogen under biofertilization and/or organic manuring in soil cultivated with marjoram.Obtained data showed that inoculated soil with biofertilizer strains gave higher value,; of NO3-N levels than soil amended with full dose of com,)ost.NO3-N records were increased with increasing the compost amount. This result was confirmed by the increasing of NO3-N levels in amended soil with 3/4 dose compost than that amended with 1/2 doseData showed that the higher records of NO3-N were observed at flowering stage. The I-, igher records at flowering stage as a result of the positive qualitative and quantitative changes in nature of the p, ant root exudates during different growth stages.Periodical changes of available phosphorus under biofertilization and/or organic manuring in soil cultivated with marjoram.Data showed that soil amended with the chemical fertilizer gave lower records of available phosphorus compared with soil inoculated with biofertilizer strains and amended with full dose of compost.Also, obtained data showed that available phosphorus concentration significantly decreased in the treatment of soil inoculated with biofertilizer strains compared with soil amended with full dose of compost.Combination between biofertilizat, on and organic manuring, resulted to higher records of available phosphorus than the application of biofertilizers singularly. The available phosphorus was increased with the increasing of compost amendment.Periodical changes of soluble potassium under biofertilization and/or organic manuring in soil cultivated with marjoram.Obtained data showed that soluble-K concentration significantly decreased in inoculated soil with biofertilizers compared with amended soil with full dose of compost.The soluble-K was increased with increasing the compost amount. In this respect, results showed that highly significant increases in soluble-K values occurred during the two successive growing seasons in amended soil with full dose of compost than that amended with ’/2 or 3/4 dose.Effect of biofertilization and/or organic manuring on N, P and K uptake of marjoram.Macronutrients uptake by marjoram were higher in case of dual application with biofertilization and compost than those recorded in either biofertilization or compost each one solely.The highest records in case of dual application can be attributed to the higher DHA, N2-ase and phosphataseactivity.It worthily to mention that NPK uptake was affected with the levels of compost dose. In this respect, obtained results showed that uptaked macro-nutrients increased withthe increasing of compost dose.Effect of biofertilization and/or organic manuring on polyphenol oxidase and peroxidase enzymes inmarjoram.Marjoram inoculation with biofertilizer strains significantly increased the peroxidase and polyphenol oxidase activity compared to un-inoculated onesAlso, marjoram inoculation with biofertilizer strains combined with compost gave higher records of peroxidase activities and polyphenol oxidase in comparison withmarjoram inoculated with either biofertilizer strains or compost individually.Marjoram inoculation with biofertilizers combined with full dose of compost significantly increased the activity of peroxidase and poly3phenol oxidase compared to soil amended with either 1/2 or /4 dose of compost.Effect of biofertilization and/or organic manuring on growth characteristics and herb yield ,Df marjoram.Significant increases were observed in most plant growth characteristics and herb yield when compost amendment compared to biofertilizers inoculation.whereas, marjoram plants with dual application of biofertilizers and compost gave higher:records of growthcharacteristics and herb yield than the application of each one singularly.The highly significant increase in marjoram growth characteristics and herb yield were observed in inoculated marjoram with biofertilizers plus full dose of compost. These results could be attributed to the high levels of N2’ ase activity as well as the high levels of NE-14-N, NO3-N and available phosphorus which were observed in this treatmentIt is worthy to mention that improvement the growth characteristics and herb yield occurred Ey increasing the compost dose. This could explain that increasing the doseof compost led to increase nutrients availability and activity of

beneficial microorganisms.The highest records of growth characteristics and herb yield were observed in treatment of the soil amended with compost and inoculated with biofertilizers.Effect of biofertilization and/or organic manuring on oil percent and oil yield of marjoram.Inoculated plants with biofertilizer strains caused significant increase of volatile oil percentage and oil yield per feddan compared to un-inoculated one.AemplIMI11.40151•101119.1*11•010114.4111.17M10110111(01110140AMIPOM11110.14011111081010.1.111111111111111•1111111111.11•0111•1.11.1.111•41111MMONOMMINOMMION10.11.1.1MThe highest values of essential oil percentage of the two seasons appeared with chemical fertilization, while the highest yield of the essential oil per feddan was observed in both treatment of biofertilization combined with organicmanuring or chemical fertilization.from obtained results, it could be concluded that biofertilizers inoculation in combination with compost increased essential oil percentage and oil yield per feddan. Since, there isn't significant different between this treatment and chemical fertilization one, the increase in oil yield might be due to either increase in vegetative growth or changes in leaf oil gland population and monoterpenesbiosynthesis.Effect of biofertilization and/or organic manuring on essential oil composition.Fourteen compounds, accounting for more than 97 % of the total volatiles components in most marjoram samples were detected and identified. There were differences in oil composition as affected by biofertilizationand organic manuring.Obtained data revealed that dual application of compost and biofertilization recorded the highest percent of terpinen-4-ol (the major compound in marjoram oil), y-, a-terpinene, a-pinene, myrcene, sabinene, a-terpineol, (+)-2- carene and linalool accompanied y a decrease in the proportions of phellandrene and limonene compared to either compost or biofertilization treatments individually.Also, obtained data showed that (+)-2-carene compound was ont found in detected amounts treatments of biofertilization, biofertilization + 3/4 dose of compost and full dose of compost. On the contrary , compost treatment recorded the highest percent of phellandrene and limonene .whereas, camphene amount was not detectable. Effectiveness of biofertilization and/or organicmanuring on growth performance and yield of damssisa.This experiment was designed to study efficiency of biofertilization (Azotobacter chroococcum, Glomus macrocapum and Bacillus circulans)ard levels of organic manuring in open field on soil enzyrr es activity, macro-nutrient content, peroxidase and polyphenol oxidaseactivities, plant growth characteristics, yield and active substances of marjoram.Periodical changes of dehydrogenase activity (DHA)under biofertilization and/or organic manuring in soil cultivated with damssisa.Obtained data revealed that higher records of DHA was observed in treatment of inoculated soil withbiofertilization than the amended soil with organic manuring.Moreover, data showed that inoulation of soil with biofertilizers in combination with compost gave higherDHA than soil treated with either bioferlilizers or compost each one individually.Also, data revealed that soil inoculated with biofertilizer strains and manured with full dose of compost gave the highest values of DHA.Periodical changes of nitrogenase activity underbiofertilization and/or organic manuring in soil cultivated with damssisa.Data showed that higher records of N2-ase activitywere observed in soil inoculated with biofertilizers than soil treated with compost only.Also, obtained data showed that Soil treated with compost in combination with biofertilization gave higherSAP.9.417.010.4*.WiXieve,,,AMVAelf...MM,values of N2-ase activity in rhizosphere compared to the treatment of soil with each one solely.The highest values of N2-ase activity were obtained with full dose of compost combined with biofertilizers.Periodical changes of Phosphatase activity under biofertilization and/or organic manuring in soilcultivated with damssisa.Obtained data emphasized that inoculation of soil with effective biofertilizer strains led to significant increase in phosphatase activity compared to manured soil withoutinoculation.Also, phosphatase activity was enhanced in soil inoculated and treated with compost compared to soil treated with either biofertilizers or compost each one individually.The highest records of phosphatase activity were showed in treated soil with full dose of compost in combination with biofertilization. Records of phosphataseactivity were higher at flowering stage.Periodical changes of ammoniacal nitrogen under biofertilization and/or organic manuring in soilcultivated with damssisa.Soil inoculated with biofertilizer strains in combination with compost showed higher NH4-N records than soil treated with either biofertilizers or compost eachone individually.Data showed that soil inoculated with biofertilizerstrains gave lower values of NH4-N levels than itamended with full

dose of compost. The highest values of NH4-N level were showen in the soil treated withbiofertilizer strains and full dose of compost.IMIINIMIN.11•1•1••••11111•10•141.10110111M.IRIMMIRW*11•07.09.41.....we,Periodical changes of nitrate nitrogen under biofertilization and/or organic manuring in soil cultivated with damssisa.Inoculated soil with biofertilizer strains and manured with compost showed higher NO3-N levels than soil treated with either biofertilizers or compost each one individually. Moreover, NO3-N records were increased with increasing the compost amendment.The highest values of NO3-N was observed in inoculated soil and manured with full dose of compost. Periodical changes of available Phosphorus underbiofertilization and/or organic manuring in soil cultivated with damssisa.Obtained data showed that available phosphorus concentration in rhizosphere of damssisa was significantly increased in soil inoculated with the biofertilizers compared with soil amended with full dose of compost.It is worthily to mention that the soil amended with full dose of compost in combination with biofertilizers showed higher records of available phosphorus than soil treated with compost or biofertilization individually.The highest values of available phosphorus wereshowen in inoculated and manured soil with full dose of compost.Periodical changes of soluble potassium under biofertilization and/or organic manuring in soil cultivated with damssisa.Soluble-K concentration significantly decreased in the treatment of soil inoculated with biofertilizers compared with manured soil with full dose of compost.Concerning the combination between biofertilization and compost, obtained data showed that the dual treatments showed higher records of soluble-K than soil treated with each one singularly.25Soluble-K values were higher at flowering stage. This result can be explicated by increasing the microbial activity in this stage where root exudates are highly.Effect of biofertilization and/or organic manuring on N, P and K uptake of damssisa.Macronutrients uptake of damssisa were higher in case of dual application with biofertilizers and compost than those recorded in inoculated treatments with eitherbiofertilizers or compost each one solely.The highest uptake of total nitrogen, phosphorus and potassium was observed in inoculated plants with the biofertilizers combined with full dose of compost. This result can be attributed to the higher DHA, N2-ase andphosphatase activity.Effect of biofertilization and/or organic manuring on polyphenol oxidase and peroxidase enzymes ofdamssisa.Data clearly indicated that the treated soil with either biofertilizers or compost increased the activity of peroxidase and polyphenol oxidase in plants.Chemical fertilization treatment gave lower values of both peroxidase and polyphenol oxidase rather than soil treated with either biofertilizers or compost.Damssisa inoculation with biofertilizers significantly increased the peroxidase and polyphenol oxidase activitiescompared to un-inoculated ones.The highest activity of peroxidase and polyphenol oxidas was observed in damssisa inoculated with biofertilizers combined with full dose of compost.Effect of biofertilization and/or organic manuring on growth characteristics and herb yield of damssisa.Significant increases were observed in most plant growth characteristics and herb yield with compostamendment treatment compared to biofertilizers inoculation.Dual application of biofertilization and compost with damssisa gave higher records of g-owth characteristics and herb yield than the application of each one singularly. Also, dual application gave significant increase in growth characteristics and herb yield with the increasing of compost dose.Effect of biofertilization and/or organic manuring onactive substance percentage and yield of damssisa.Except chemical fertilization treatment, application of biofertilizers combined with full dose of compost gave significant higher values of herb yield in the two seasons. While, biofertilization treatment only was the lower one.The highest value of active substance (sesquiterpene lactone) percentage of the two seasons appeared with chemical fertilization in the both season. while the highest yield of active substance per feddan was obtained from the treatment of full dose of compost combined with biofertilizers inoculation.from obtained results, it could be concluded that applying the biofertilizers inoculation in combination with compost increased active substance percentage and yield per feddan. Since, there isn't significant difference between this treatment and chemical fertilization treatment, the increase yield of sesquiterpene lactones might be due to the increase of vegetative growth.