Effect of some irrigation tratments, bacterial inoculation and nitrogen fertilization on soybean productivity

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Two field experiments were conducted during 1991, 1992and 1993 seasons at the Agricultural Research and ExperimentCenter of the Faculty of Agriculture at Moshtohor, ZagazigUniversity, Egypt. The aims of this study were to determine theeffect of some irrigation treatments, bacteria inoculation andnitrogen fertilizer on soybean productivity ”Clark” variety. Cloverwas preceding winter crop in the three seasons.First experiment:To study the effect of some irrigation treatments andnitrogen fertilizer rates on growth, yield, yield components andchemical contents of soybean plants. It included 35 treatmentswhich were the combinations of seven irrigation treatments(normal irrigation, skipping 3rd+41h or 3rd+51h or 3rd+61h or4th+51h or 41h+6th or 51h+61h irrigations) and five rates ofnitrogen fertilizer (zero, 15, 30,45 and 60 kg N/feddan) as a ureafertilizer. The experiment was designed in a split plot design withfour replications. The seven irrigation treatments were arranged atrandom in the main plots, whereas the five nitrogen fertilizer rateswere alloted randomly in the sub plots. The sub plots area was1/400 fed. (10.5 m2).The most important results could be summarized as follows:-1_Effeet of irrigation treatments.A- Growth characters1- Plant height and number of pods per plant decreasedsignificantly by skipping 3rd+4th or 3r.d+5th or 3r.d+6thirrigations as compared by normal irrigation.2- The maximum number of branches of soybean plant wasobtained by skipping 4th+5th irrigation, without anysignificant difference with normal irrigation and skipping4th+6th irrigations.3- Irrigation treatments did not affect significantly number ofleaves per soybean plant.4- Leaf area and leaf area index of soybean plant decreasedsignificantly by skipping 3rd+5th or 3rd+6th irrigations ascompared with the other treatments.5- Fresh weight of leaves, stems and pods per soybean plantincreased significantly by normal irrigation and skipping4th+6th or 5th+6th irrigations than the other treatments.whereas, total fresh weight of soybean plant decreasedsignificantly by skipping 3r.d+4th or 3r.d+5fu or 3rd+6fuirrigations than the other treatments.6- Dry weight of leaves, pods and total dry weight of soybean plantdecreased significantly by skipping 3rd+4th irrigations,whereas dry weight of stems per plant decreased significantlyby skipping 3rd+5th irrigations.B- Yield and yield components:1- The number and weight of pods per soybean plant increasedsignificantly by normal irrigation and skipping 51h+6thirrigations than the other treatments.2- Irrigation treatments did not affect significantly number ofseeds per pod.3- Weight of too-seed increased significantly by normal irrigationand skipping 3rd+6th or 4th+6th irrigations than the othertreatments.4- Yield per plant (g) and seed yield (kg/feddan) increasedsignificantly by normal irrigation and skipping 51h+61hIrngations. whereas biological. yield (kg/feddan) increasedsignificantly by normal irrigation than the other treatments.C-Chemical contents:1- Chlorophyll ”a”, ”b’’ and total chlorophyll ”a+b” in soybeanleaves decreased significantly by skipping 3rd+41h or 3rd+51hirrigations as compared with other treatments. whereascarotenoides in soybean leaves increased significantly byskipping 5th+6th irrigations, but without any significant ~difference between normal irrigation and skipping 3rd+61h or4th+6th irrigations.2- Irrigation treatments did not affect significantly oil, protein,carbohydrate, nitrogen, phosphorus and potassium percentages.3- Oil yield (kg/feddan) decreased significantly by skipping3rd+5th irrigations treatment than the other treatments.4- Protein yield (kg/feddan)

decreased significantly by skipping3rd+4th or 3rd+5th irrigations as compared with normalirrigation and skipping 5th+6th irrigations.11_Effect of nitrogen fertilizer:A- Growth characters:1- Plant height and number of branches per soybean plant were notaffected significantly by nitrogen fertilizer rates as comparedwith control (without fertilizer).2- Number of leaves and pods as well as leaf area and leaf areaindex of soybean plant increased significantly by increasingnitrogen fertilizer rates up to 15 kg N/feddan. Further increasein nitrogen rates up to 60 kg N/feddan decreased thesecharacters.3- Fresh weight of leaves, stems and pods per soybean plantincreased significantly by adding nitrogen fertilizer up to 15 kgN/feddan. Further increase in nitrogen rates did not affectthese characters, whereas total fresh weight per plant increasedsignificantly by appling nitrogen lip to 30 kg N/feddan.4- Leaves and stems dry weight increased significantly byincreasing nitrogen fertilizer up to 15 kg N/feddan,whereas dry weight of pods and total dry weight per soybeanplant increased up to 30 kg N/feddan.B- Yield and yield components:1- Number and weight of pods per soybean plant increasedsignificantly by applying nitrogen fertilizer up to 30 and 15 kgN/feddan, respectively.1662- Nitrogen fertilizer rates did not affect significantly number ofseeds per pod and weight of 100-seed.3- Yield of plant (g) and biological yield (kg/feddan) increasedsignificantly by adding nitrogen fertilizer up to 15 kg N/feddan,wheras seed yield (kg/feddan) increased significantly byincreasing nitrogen fertilizer up to 45 kg N/feddan.C- Chemical contents:1- Chlorophyll ”a”, ”b’’, total chlorophyll ”a+b” and carotenoidesincreased significantly as nitrogen rates increased up to 15 kgN/feddan.2- Nitrogen fertilizer rates did not affect significantly oil,carbohydrate, phosphorus and potasium percentages.3- Protein and nitrogen percentages increased significantly byincreasing nitrogen fertilizer up to 15 kg N/feddan. Furtherincrease in nitrogen fertilizer rates up to 45 kg N/feddan didnot affect protein and nitrogen percentages.4- Oil yield and protein yield (kg/feddan) increased significantlyby nitrogen fertilizer rates up to 15 and 30 kg N/feddan,respectively.111- Effect of the interaction between irrigation treatments andnitrogen fertilizer rates:A- Growth characters of soybean plants:All growth characters were not significantly affected by theinteraction, except, plant height, fresh and dry weight of pods perplant.B- Yield and yield components:The effect of interaction on weight of pods, number of seedsper pod, weight of 100-seed and biological yield (kg/fed dan) werenot statistically significant. On the other hand, the effect ofinteraction on number of pods per plant, yield of plant and seedyield (kg/feddan) were significant.C- Chemical contents:Chemical contents of soybean plant were not significantlyaffected by the interaction, except, oil yield (kg/feddan) wassignificantly affected.Second experiment:To study the effect of bacterial inoculation and nitrogenfertilizer rates on growth, yield, yield components and chemicalcontents of soybean plants. It included 10 treatments which werethe combinations of two bacterial inoculation (uninoculation andinoculation) and five rates of nitrogen fertilizer (zero, 15,30,45and 60 kg N/feddan) as a urea fertilizer. The experiment wasdesigned in a split plot design with four replications. The twobacterial inoculation were arranged at random in the main plots,whereas the five nitrogen fertilizer rates were alloted randomly inthe sub plots. The sub plot area was 1/400 feddan (10.5 m2).The most important results could be summarized as follows:-1_Effect of bacterial inoculation:A- Growth characters:1- There was significant decrease in plant height, number ofactive, unactive and total number of nodules per soybean plantby uninoculation treatment as compared with inoculation one.2- There were no significant differences in number of branches,number of leaves, leaf area, leaf area index, fresh and dryweight of leaves, stemes, roots and total fresh and dry weightof soybean plant as a result of bacterial inoculation.B- Yield and yield components.1- Number and weight of pods per plant, yield of plant, seed yield(kglfeddan) and biological yield (kglfeddan) increasedsignificantly by inoculation treatment than that ofuninoculation one.2- There were no significant differences in number of seeds perpod and weight of IOO-seed as a result of bacterial inoculation.C- Chemical contents:1- There was a significant decrease in chlorophyll ”b’’ and totalchlorophyll ”a+b” in soybean leaves in uninoculation treatmentas compared with inoculation one. whereas there was nosignificant difference in chlorophyll ”a” and carotenoides insoybean leaves as a result of bacterial inoculation.2- There were no significant differences in oil, protein,carbohydrate, nitrogen, phosphorus and potassium percentagesin soybean seeds as a result of bacterial inoculation. whereasthere was a significant increase in oil yield and protein yield(kg/feddan) by inoculation treatment as compared

withunioculation one.11_Effect of nitrogen fertilizer:A-Growth characters:1- There were no significant differenc;es in plant height, number ofbranches per plant, number of leaves per plant, leaf area andleaf area index of soybean plant as a result of nitrogen fertilizerrates.2- Nitrogen fertilizer rates did not affect significantly differenceactive and total number of nodules per soybean plant, whereasthere was a significant decrease in number of unactive nodulesper plant by increasing nitrogen fertilizer rate up to 45 kgN/feddan.3- Nitrogen fertilizer rates had no significant effect on fresh anddry weight of leaves, stems, total fresh and dry weight ofsoybean plant. whereas there were significant differences infresh and dry weight of roots per soybean plant amongnitrogen fertilizer rates.B- Yield and yield components:1- Number and weight of pods per soybean plant increasedsignificantly by increasing nitrogen fertilizer up to 45 and 15kg N/feddan, respectively.2- There were no significant differences in number of seeds perpod and weight of 100-seed as a result of nitrogen fertilizerrates.3- Yield of soybean plant increased signifIcantly by increasingnitrogen fertilizer rate up to 15 kg N/feddan, whereas seedyield and biological yield (kg/feddan) increased by increasingnitrogen fertilizer up to 30 kg N/feddan Further increase innitrogen fertilizer up to 60 kg N/feddan decreased yield ofplant, seed yield and biological yield.C- Chemical contents:1- Chlorophyll ”a”, ”b”, total chlorophyll ”a+b” and carotenoides insoybean leaves increased significantly by nitrogen fertilizerrates up to 30 kg N/feddan. Further increase in nitrogen ratesup to 60 kg N/feddan decreased these characters.2- There were no significant differences in oil, protein,carbohydrate, nitrogen, phosphorus and potassium percentagesin soybean seeds as a result of nitrogen fertilizer rates.3- Oil yield and protein yield (kg/feddan) increased significantlyby increasing nitrogen rates up to 45 and 30 kg N/feddan,respectively.Effect of interaction between bacterial inoculation andnitrogen fertilizer rates:A- Growth characters of soybean plant:All growth characters were not significantly affected by theinteraction.B- Yield and yield components:The effect of interaction on weight of pods per soybeanplant, number of seeds per pod and biological yield (kg/feddan)was not significant. On the other hand, the effect of interaction onnumber of pods per plant, weight of IOO-seed, yield of plant (g)and seed yield (kg/feddan) of soybean were significant.C- Chemical contents:The effect of interaction on carotenoides in soybean leaves,oil, protein, carbohydrate, nitrogen, phosphorus and potassiumpercentages in soybean seeds was not significant. On the otherhand, chlorophyll ”a”, ”b” in soybean leaves, oil yield and proteinyield (kg/feddan) were affected significantly by the interaction.