

**STUDY ON SOME AGRICULTURAL
TREATMENTS ON SOYBEAN CROP**

By

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SUMMARY

A study was made to trace performance of some soybean varieties, i.e. Giza 21, Giza 22, Hybrid 30 and Giza 111 under some agricultural treatments.

For this purpose three experiments in two seasons were designed and executed at the farm of the Faculty of Agriculture, Fayoum University, Egypt, in summer of the two years of 2006 and 2007. Soil site was mechanically and chemically analyzed for assaying its fertility status. The three experiments over the two seasons could be explained as follows:

The experiment I was consisted of 16 treatment combinations of four soybean varieties and four *Bradyrhizobium* inoculation + starter N doses. The statistical design was split-plots in randomized complete block arrangement where the whole plot was assigned for soybean varieties and the sub-plots were assigned for inoculation + starter N dose with four replicates.

A split-plot design with four replicates was used in the second experiment, the same four soybean varieties were allocated in the main plot, whereas the sub-plots were to four nitrogen levels (40, 60, 80 and 100 kg/feddan) without *Bradyrhizobium* inoculation.

The same design was used in the third experiment, where the phosphate dissolving bacteria (PDB) application or not allocated in the whole plots and the four phosphorus sources (Single supper phosphate, Rock phosphate, Triple supper phosphate and Phosphoric acid) in the sub-plots with four replicates on soybean variety Giza 111.

Phonological soybean characters were followed progressively during the growth season and were recorded. An analysis of plant growth and development was made. Soybean leaves were sampled at three plant ages and chemical analysis for pigments was made. Yield and yield attribute were studied under every treatment. Soybean seeds were sampled and analysis for oil and protein percentage as well as phosphorus percentage in only the third experiment. Oil and protein yield were calculated.

The obtained data were statistically analyzed. The treatment mean were compared according to LSD test at 5% level of significance. The results could be summarized as follows:

Experiment I: Effect of *Bradyrhizobium* inoculation and starter nitrogen dose on some soybean varieties.

a) – Variety effects:

- Soybean varieties had a significant effect at all growth stages in the first season, and highly significant effect at 75 and 90 days from planting on in the second season chlorophyll (a) content. Giza 22 and Hybrid 30 genotypes being insignificantly gave the highest leaf chlorophyll (a) content as compared to other genotypes.
- Total chlorophyll content was significantly affected by soybean varieties at all growth stages in the first season and 90 days in the second one. This effect was highly significant at 75 days in the second season. Hybrid 30 and Giza 22 genotypes being insignificantly differed gave the highest total chlorophyll content in both seasons.
- Soybean varieties had a significant effect on plant height at 60 days from planting in both seasons, and 75 days in the first season, and highly significant effect at 75 days in the second season. At this plant ages Giza 22 and Hybrid 30 gave the tallest plants as compared with Giza 21 and Giza 111 varieties.
- In the first season at 60 days from planting, number of green leaves per plant was significantly affected by soybean varieties. Giza 111 variety gave the highest number of green leaves per plant.
- The differences among soybean varieties were significant on top dry weight at 75 and 90 days in the first season and 60 days in the second season. Soybean Hybrid 30 surpassed all other soybean varieties.
- Soybean varieties had a significant effect on length of lower unbranched part, 100-seed weight, straw and protein yield per feddan in only the second season. Giza 22 gave significantly the lowest lower unbranched part and the highest 100-seed weight and protein yield per feddan as compared with other soybean varieties.
- Soybean varieties had a highly significant effect on seed protein percentage in only the second season. Giza 22 and Giza 21 varieties surpassed other varieties.

- Soybean varieties had no significant effect at all growth stages in both seasons on number and dry weight of root nodules per plant, chlorophyll (b) content, carotenoids content, dry weight of leaves and roots per plant.
- In both seasons at harvest, plant height, stem diameter, number of branches and pods per plant, biological, pod and seed yield per plant, seed and oil yield per feddan and seed oil percentage did not significantly affected by soybean varieties. However, Giza 22 variety gave the highest values of these traits especially in the 2007 season.

b) – Bradyrhizobium inoculation plus starter N dose effects:

- Inoculation + starter N dose had a highly significant effect on number and dry weight of root nodules per plant at most growth stages in the first season and at 75 days for number of nodules per plant in the second season. This effect was only significant on these traits at plant ages of 60 and 90 days in the second season and at 60 days in the first season for dry weight of root nodules. Inoculation only significantly surpassed all starter N doses in this respect.
- Increasing starter nitrogen dose up to 45 kg/feddan had a highly significant effect at all growth stages in both seasons on chlorophyll (a) content and total chlorophyll content.
- N-dose had a highly significant effect at 60 days in the first season and 75 days in both seasons on chlorophyll (b) content, while this effect was significant at 60 and 90 days in the second season. The results indicated that increasing starter N dose significantly increased chlorophyll (b) content.
- Carotenoids content was highly significantly affected by inoculation starter N dose at 90 and 75 days in the first and second season, respectively.
- Inoculation + N fertilizer as starter dose had a significant effect on plant height at 75 and 90 days from planting in the first and second season, respectively and highly significant effect at 75 days in the second season. The treatments of inoculation +15 or 30 kg N/feddan gave the tallest plants, while, inoculation only produced the shortest plants.
- Number of green leaves per plant was significantly affected by inoculation + starter N dose at 90 and 75 days in the first and second seasons, respectively. The treatment of inoculation only gave significantly

lower number of leaves compared with other treatments which were statistically similar.

- Inoculation + starter N dose had a highly significant effect at 90 days in the first season and a significant effect at 75 days from planting in the second season leaves dry weight per plant. Inoculation + 30 kg N/feddan gave the highest values.
- The effect of inoculation + starter N dose was significant at plant age of 75 days in both seasons and highly significant at 90 days in the first season on top dry weight per plant. The treatment of inoculation + 30 kg N/feddan gave the highest values in this respect.
- Inoculation + starter nitrogen dose had a highly significant effect on root / top ratio at 90 days from planting in the first season and a significant effect at 75 and 90 days in the first and second season, respectively. Inoculation only surpassed all other treatments in this respect.
- Starter N dose had a significant effect on leaf area (LA) per plant at 60 and 75 days in the first season and at 75 and 90 days in the second season and highly significant effect at 90 days in the first season. The treatment of inoculation + 30 kg N/feddan surpassed all other treatments on LA per plant.
- At harvest inoculation + starter N dose had a highly significant effect in both seasons on plant height and pod yield per plant. The treatment of inoculation +15 and inoculation +30 kg N/feddan being insignificantly gave the higher values of these traits as compared to other treatments.
- In the second season, inoculation + starter N dose had a highly significant effect on stem diameter and 100-seed weight. The differences did not reach to the level of significance in the first season. The highest values were recorded by the inoculation + 30 kg N/feddan.
- Inoculation + N dose had a significant and highly significant effect in the first and second season, respectively on biological and seed yield per plant. The treatment of inoculation + 30 kg N/feddan followed by inoculation +15 kg N/feddan gave the highest values.
- Number of pods per plant and straw yield per feddan significantly increased by increasing starter N dose in only the second season.
- In only the first season, inoculation + starter N dose had a significant effect on seed, oil and protein yields per feddan. The differences in the second season did not significant. The inoculation +30 and inoculation+45 kg N/feddan being insignificantly gave the highest values.

- Increasing starter N dose highly significantly increased seed protein percentage in both seasons, in contrast increasing starter N dose had a highly significant and significant decrease on seed oil percentage in the first and second season, respectively.
- At all growth stages in both seasons root dry weight per plant did not significantly affected by inoculation + starter N dose.

c)- Interaction effects:

- Highly significant effects were observed on chlorophyll (a) content and carotenoids content at 75 and 90 days, also total chlorophyll content at 90 days in the second season due to the interaction between soybean varieties and inoculation + starter N doses.
- The interaction between soybean varieties and inoculation +N dose was significant on chlorophyll (b) content at 90 days in both seasons, total chlorophyll content at 75 days in the second season and carotenoids content at 60 days in the second season.
- The interaction between soybean varieties and inoculation + starter N dose was significant on plant height at harvest and seed oil percentage in only the first season.

Experiment II: Effect of nitrogen levels on some soybean varieties

a) – Variety effects:

- Soybean varieties had a significant effect on leaf chlorophyll (a) content at 90 days in both seasons, also leaf chlorophyll (b) content and total chlorophyll content at 90 days in only the second season. Giza 22 variety significantly surpassed other varieties at these plant ages.
- The differences among soybean varieties were significant on number of green leaves per plant at 75 days in the first season and leaves dry weight per plant at 90 days in the second season. Giza 22 and Giza 111 varieties surpassed other varieties on number and dry weight of leaves, respectively.

- The differences on top and root dry weight per plant were significant due to soybean varieties at 90 days from planting in the second season. Giza 21 and Giza 111 surpassed the other varieties in this age.
- Root / top ratio in the first season and leaf area per plant at the same plant ages in the second season at 75 and 90 days were significantly affected by soybean varieties.
- Specific leaf weight at 90 days in only the second season was significantly affected by soybean varieties.
- Varieties had a significant effect on length of lower unbranched part at harvest in only the first season Giza 21 variety surpassed all other varieties under study in this trait.
- Soybean varieties had no significant effect at harvest in both seasons on plant height, number of branches and pods per plant, biological, pod and seed yields per plant, 100-seed weight, and straw, seed, oil and protein yields per feddan. Giza 22 insignificantly surpassed all other genotypes under study on above mentioned traits.
- Soybean varieties had a significant effect on seed protein percentage in only the second season. Hybrid 30 gave the highest values as compared with other varieties.
- Soybean varieties had no significant effect at all growth stages in both seasons on plant height, number of branches per plant, crop growth rate, relative growth rate, net assimilation rate, leaf carotenoids content and seed oil percentage in the two growing seasons.

b) – Nitrogen fertilizer level effects:

- Nitrogen levels had a highly significant effect at all growth stages in both seasons on leaf chlorophyll (a), (b) and total chlorophyll content, plant height and leaf area per plant, except on leaf chlorophyll (b) content at 90 days in the first season, this effect did not significant on. At all growth stages in both seasons, increasing N-levels up to 80 or

100 kg/feddan significantly increased all previous traits. However, the differences between 80 and 100 kg N/feddan were not significant.

- N-rates had a highly significant effect on leaf carotenoids content at 60 days in both seasons and 75 days in only the first season.
- Number of green leaves per plant was highly significantly affected by N-rates at 60 days in both seasons and 90 days in the second season and this effect was significant at 90 and 75 days in the first and second season, respectively. The rates of 80 and 100 kg N/feddan gave the highest number of leaves per plant with no significant differences from each other
- N-levels had a highly significant effect on leaves dry weight at 90 and 60 days in the first and second season, respectively and a significant effect at other plant ages in both seasons. The two N-rates of 80 and 100 kg/feddan recorded the highest dry weight of leaves without significant differences from each other.
- Top dry weight was highly significantly affected by N-levels at all growth stages in the first season and at 90 days in the second season. In addition in the second season, this effect was significant at 60 and 75 days on top dry weight. The N-rates of 80 and 100 kg/feddan being insignificantly recorded the highest top dry weight per plant.
- Dry weight of root per plant was significantly affected by N-rates at 60 and 90 days in the first season and 75 days in second season.
- N-rates had no significant effect on number of branches per plant, root/top ratio, specific leaf weight, crop growth rate, relative growth rate and net assimilation rate at all growth stages in both seasons.
- At harvest, N-levels had a significant and highly significant effect in the first and second season, respectively on plant height, biological, pod and seed yield per plant and straw yield per feddan. The N-rates of 80 and 100 kg/feddan were recorded the highest values of previous mentioned traits with no significant differences from each other.

- Increasing N-levels up to 80 kg/feddan had a highly significant effect on stem diameter, number branches and pod per plant in only the second season. The differences among N-rates did not reach to the level of significance in the first season.
- Length of lower unbranched part was increased significantly by increasing N-levels up to 100 kg/feddan in only the first season. The differences among other N-rates did not significant.
- Increasing N-levels up to 100 kg/feddan caused high significant increase in 100-seed weight in both seasons. While, the differences between 80 and 60 kg N/feddan did not significant.
- N-rates had a significant effect on seed and oil yield per feddan in both season. Whereas protein yield per feddan was high significantly and significantly affected by N-rates in the first and second season, respectively.
- N-levels had a highly significant effect on seed oil and protein percentage, where every increase in N-levels followed by a significant decrease on oil percentage in both seasons. The opposite trend was found with seed protein percentage, where every increase in N-levels followed by a significant increase in seed protein percentage in both seasons.

c)- Interaction effects:

- The interaction between varieties and N-rates was highly significant at 90 days in the second season on leaf chlorophyll (a), (b), total chlorophyll and carotenoids content.
- Interaction between soybean varieties and N-levels had a significant and highly significant effect on number of green leaves per plant specific leaf weight at 60 and 90 days from planting in 2007 season, respectively.
- Specific leaf weight was significantly and high significantly affected by the interaction at the 60 and 90 days in the second seasons.

- The interaction between soybean varieties and N-rates was significant on seed oil percentage in only the first season.

Experiment III: Effect of phosphate dissolving bacteria and phosphorus sources on soybean variety Giza 111

a)- Phosphate dissolving bacteria inoculation effects.

- At harvest, number of branches, biological yield per plant and straw yields per feddan were significantly affected by using PDB inoculation in only the first season compared with uninoculated ones.
- The 100-seed weight was significantly increased by using PDB inoculation in both seasons.
- PDB inoculation had a significant effect on seed yield per feddan in only the second season.
- Seed oil and phosphorus percentages were significantly affected by using PDB inoculation in only the second season.

b)- Phosphorus fertilizer sources effects:

- The differences among P sources were highly significant on plant height at harvest in the first season and number of branches per plant at harvest in the second season. Rock phosphate surpassed all other P sources with no significant differences with phosphoric acid on plant height and single super phosphate on number of branches per plant.
- Stem diameter at harvest, biological yield per plant, oil and protein yield per feddan in the second season were significantly affected by P sources. Rock phosphate surpassed all other P sources.
- In both seasons, 100-seed weight and seed yield per feddan were significantly affected by P sources. Rock phosphate surpassed all other P sources.
- Phosphorus sources had a significant and highly significant effect on the first and second season, respectively on seed oil percentage. Rock phosphate gave the highest values in this respect.

- Seed protein percentage was high significantly and significantly affected in the first and second season, respectively by P sources.
- P sources had a significant effect on seed phosphorus percentage in the first season. Phosphoric acid gave the highest values in this respect.

c) - **Interaction effects:**

- The interaction between PDB inoculation and P sources had a significant effect on plant height at harvest in only the first season.

Seed oil content was significantly affected by PDB inoculation x P sources interaction in only