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Manure Fertilization for Soybean Crop Production Inoculated with Rhizobium Bacteria Catalyzed by some Micronutrients Foliar Spraying

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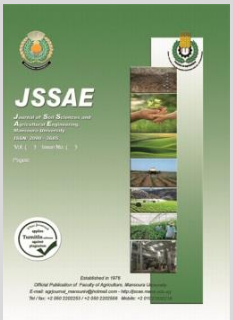

ABSTRACT

A field study was carried out during two consecutive summer seasons of 2019 and 2020 at the Experimental Farm, Faculty of Agriculture, Al-Azahar University, Assiut Governorate (27° 12′ 16.67″ N latitude and 31° 09′36.86″ E longitude) to examine the impact of manure and some micronutrients application company with Rhizobium bacteria on soybean crop growth and its yield The experiment was laid out in a randomized complete block design with three replicates. The trial consisted of nine treatments as follows (T_1: control, T_2: inoculation with Rhizobium, T_3: sheep manure addition, T_4: pigeon manure addition, T_5: Rhizobium+ iron + manganese + zinc, T6: Rhizobium + sheep manure, T_7: Rhizobium + sheep manure + micro-nutrients, T_8: Rhizobium + pigeon manure, T_9: Rhizobium + pigeon manure + micronutrients. Inoculation of soybean seeds with Rhizobium and organic fertilization and spraying with micronutrients (T9) resulted in a significant increase in the tested traits (plant height, leaves No./ plant, branches No/ plant, pods No./ plant, seeds No./ pod, seeds No./ Plant, 100-seedweight, seed and biological yields. The T9 treatment gave the highest seed yield of 1.46 and 1.49 ton/ fed that increased by 25.86 and 26.27% in the 1st and 2nd season respectively compared to control treatment (T_1) that realized 1.16 and 1.18 ton/ fed for the corresponding seasons. Seed yield was the strongest positively significant correlated with all tested traits in both seasons. So, implement balanced and timely nutrient management practices for soybean contributes to the sustainable growth yield in a good quality.

***Keywords**:* Soybean, Rhizobium bacteria, Sheep manure, Pigeon manure, Micronutrients, Production.

INTRODUCTION

The explosion population in Egypt forces the governorate to figure out many approaches to ingrate different disciplines to secure their food, clothing and shelter. Nitrogen is considered one of the main nutrients that significantly contribute to crop production. Most lands of Egypt are poor in their nitrogen content. Therefore, mineral nitrogen fertilizers are applied in huge amounts which are considered a very high expensive item for agricultural production. So, great efforts must be directed towards increasing nitrogen fertilizer use efficiency as well as better biological nitrogen usage.

Soybean is a leguminous crop highly nutritious food commodity as a source of vegetable protein and low in cholesterol. Soybean is a promising crop in Egypt as it enjoyed many byproducts such as hand lotion, diesel fuel, high protein meal, bean sprouts, soy milk, soy sauce, and soy flour as well as a source of soil fertility. In Egypt, soybean cultivated area was 33320 fed. In 2019 that produced 44000 ton, with an average production of 1.321 ton fed^{-1} (FAO, 2019).

Microorganisms play an important biological role in atmosphere nitrogen (N_2) fixation especially rhizobium bacteria, which live symbiotically with leguminous plants. Biological N_2 fixation partially contributes to nitrogen requirements for crop production. Symbiotic N fixation is major source of fixed N in agriculture soils as well as each legume species requires specific rhizobium strain for effective nodulation and N fixation (Shahid *et al.,* 2009). Inoculation with rhizobium improved soybean yield and yield components compared to non-inoculated seed (Ahmed, 2013). Ekaette (2017) found a great benefit of using micronutrients, rhizobium inoculation, and organic fertilizers for improving soybean productivity. Allito *et al.* (2021) revealed that nodulation and biomass production depend on the compatibility among faba bean genotypes and rhizobium strain and its interaction with soil biophysical conditions. The presence of these bacteria formed nodules that are capable to fix free nitrogen from the air so it can supply the crop by nitrogen.

Manure application realizes an improvement of soil organic matter content and helps the crop to benefit from mineral fertilizer applied as well as aids in regulation soil chemical and physical properties which influence nutrients storage and availability (Abd El-Gawad and Morsy, 2017). On the other hand, organic fertilizers application can reduce the use of chemical fertilizers to a great extent (Gao *et al*., 2020). The combined application of rhizobium inoculant, P-fertilizer and manure markedly increased nodulation, shoot biomass, straw and harvest index of soybean compared to the control (Ulzen *et al*., 2020).

Soybean is a sensitive crop for micronutrients deficit especially iron, manganese and zinc that are required for normal plant growth which may be affected directly or indirectly root nodules formation and nitrogen fixation. Zinc

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plays a vital role that enhances photosynthesis at early growth of plants, improves N fixation, grain protein and yields of mungbean plants (Ahmed *et al.,* 2013). Barbosa *et al*. (2016) stated that micronutrient fertilizer application (6.8% Mn, 3.9% Zn, 2.1% Fe, 1.2% Cu and 1.1% B) leads to increase soybean crop production. Iron is very important for nodule proteins formation as nitrogen, molecular N reduction and energy yields electron transfer reactions of respiration and photosynthesis (Sahar Zakaria, 2017).

The current research aims to examine the impact of manure and some micronutrients application company with rhizobium bacteria on soybean crop growth and its yield under Assuit Governorate Conditions.

MATERIALS AND METHODS

The study was carried out during two successive summer seasons of 2019 and 2020 at The Experimental Farm, Fac. of Agric., Al-Azhar Univ., Assiut Governorate (latitude 27° 12ˉ 16.67˭N and longitude 31° 09ˉ 36.86˭E).The experimental was a completely randomized block design with three replicates and it included two manure sources (sheep and pigeon) and rhizobium bacteria alone or in combinations forming total number of 9 treatments as follows:

T1: Control (without any addition).
T2: Rhizobium Bacteria (Strain144) donated as R_h.
T3: Sheep manure donated as S_m.
T4: Pigeon manure donated as P_m.
T5: Rhizobium bacteria + Micronutrients donated as R_hM
T6: Rh+ S_m
T7: Rh M+ S_m
T8: Rh+ P_m
T9: Rh M+ P_m

The rhizobium inoculation is produced by the bio-fertilizer production unit laboratories, Soil, Water & Envier., Res. Inst., Agric. Res. Center, in plastic jars of 100 to 200 g capacity. According to its instructions, the rhizobium bacterial inoculation was mixed with 3-5 tablespoons of sugar that dissolved in about 300- 400 cm^3 cold water. Then soybean seeds were treated by this solution and placed over a plastic sheet in a shaded place for a quarter of an hour to dry then they planted immediately within an hour. The treated soybean seeds (Giza 22) that obtained from Crops Dept., Agric. Res. Center were planted on 25th and 28th of May 2019 and 2020 in plots (3.5 x 3.0 m^2) at 40 cm row spacing and 15 cm away between hills. The tested manures (Sheep and Pigeon) are available in big quantities at The Animal Production Farm, Fac. of Agric., Assiut Univ. and one gram of each material was digested in 12 ml concentrated H_2SO_4 and 4 ml perchloric acid in a conical flask as described by Chapman and Pratt (1961) then analyzed for some chemical properties (Table 1) according to Page *et al*. (1982).

Table 1. The chemical composition of tested sheep and pigeon manure (Dry weigh basis).

Characteristic	Sheep manure	Pigeon manure
Total-N %	2.15	3.38
Total-P %	1.39	1.95
Total-K %	3.91	2.88
Organic matter %	37.95	57.43
pH (1:2.5) Susp.	8.39	7.11
EC (dSm^{-1}) (1:5)	5.050	3.593

A representative soil sample (0- 30 cm depth) was collected from the experimental site before cultivation. The sample was air dried, sieved to pass through a 2.0 mm sieve and subjected for some physical and chemical analysis according to Page *et al*. (1982) (Table 2).

Table 2. Some initial physical and chemical properties of the experimental site

Particle size distribution				OM	$CaCO_3$	EC	pH
Clay (%)	Silt (%)	Sand (%)	Texture grade	(%)	%	(dS m^{-1}) (1:2.5)	(1:2.5)Susp.
24.20	23.30	52.50	Sandy Clay Loam	1.51	1.24	0.919	7.68
Total-N (%)		Total-P (%)	Total-K(%)	Available N mg kg^{-1}	Available P (Olsen) mg kg^{-1}		Available K mg kg^{-1}
0.11		0.06	0.08	51	9.45		97.31

The tested manures at rate of 5 ton fed^{-1} and 150 kg fed^{-1} calcium superphosphate (15.5% P_2O_5) were added during soil preparation. 30 days after planting (DAP), the recommended rate (50 kg fed^{-1}) of potassium sulphate (48% K_2O) was applied. According to Agric. Res. Center, iron, manganese and zinc were added in the form of sulphateat rate of 40, 60 and 40 g fed^{-1}, respectively, in two equal doses. The 1st and 2nddoses were dissolved in 200 and 300 L fed^{-1}then sprayed 15 and 30DAP, respectively. 75 DAP, 5 plants were randomly chosen from the middle ridges of each plot to measure plant height, leaves No./ plant and branches No./ plant. At full pod maturity stage, 5 plants were randomly chosen from two rows in the middle of each plot to measure pods No./plant, seeds No./ pod and 100-seeds weight. The seed and biological yields of each plot were estimated, tying in bundles and sun dried. The bundles were weighted for biological yield. The weight of seeds obtained from each plot after threshing was expressed as ton fed^{-1}.Seed nitrogen content was determined by micro-kjeldahl method (Page et al., 1982) using half gram of seed that digested in 10 ml H_2SO_4 and 2 ml perchloric acid in a conical flask as described by Chapman and Pratt (1961). The N-uptake was estimated by multiplying seed dry weight by its nitrogen content. Seed nitrogen content was multiplied by 5.75 to determine seed crude protein according to (A.O.A.C, 2010). The data were statistically analyzed using analysis of variance and (LSD) level with MSTAT computer programmer according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

1- Growth parameters

*** Plant height**

Data in Table (3) showed that plant height was significantly increased by rhizobium inoculation, manure and micronutrients application. The tallest plants were recorded with R_h M+ P_m treatment (T9) which was 97.11 and 99.33 cm in the 1st and 2ndseason, respectively. The shortest plants were observed in the control treatment (without any addition, T1) which was 82.98 and 83.60 cm for the corresponding seasons. The plant height increased by 17.03 and 18.82% for T9 compared to T1 in the 1st and 2nd seasons, respectively. This might be attributed to the symbiotic fixation of nitrogen resulting from the rhizobium bacteria in the root nodes where nitrogen increases plant growth, elongates meristematicissues and stimulates cell division leading to an overall increase in plant height. Inoculation with rhizobium produced significantly taller soybean plants (53.4 cm) compared to that (48.9 cm) of un-inoculated plants at the same stage (Lamptey *et al.,* 2014). The results are in accordance with those of Adissie *et al.* (2020) and Ben *et al.* (2019).

Table 3. The effects of rhizobium inoculation, organic manure and micronutrients application on growth and pod characters of soybean crop during 2019 and 2020 seasons.

Treatment	Growth parameters						Pod characters			
	Plant height (cm)		Leaves No./ plant		Branches No./ plant		pods No./ plant		Seeds No./ pod	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
T1: Control	82.98	83.60	26.68	26.19	1.33	1.41	71	75	2.8	2.8
T2: Rhizobium bacteria (R_h)	85.70	86.30	31.91	31.67	2.57	2.28	88	91	3.0	3.0
T3: Sheep manure (S_m)	85.97	87.99	29.21	29.05	1.65	1.82	77	84	3.0	3.0
T4: Pigeon manure (P_m)	90.67	94.24	31.04	30.27	2.24	2.08	85	92	3.0	3.0
T5: R_h + Micronutrients (R_hM)	86.10	87.11	31.98	31.69	2.83	2.76	93	97	3.0	3.0
T6: $R_h + S_m$	88.61	91.10	32.87	32.10	2.97	3.06	94	101	3.0	3.0
T7: $R_hM + S_m$	89.49	92.40	33.90	33.63	3.38	3.69	99	108	3.0	4.0
T8: $R_h + P_m$	94.00	95.57	34.73	34.34	3.61	3.80	107	116	3.0	4.0
T9: $R_hM + P_m$	97.11	99.30	35.34	35.48	3.85	3.92	118	129	4.0	4.0
F test	**	**	**	**	**	**	**	**	NS	NS
L.S.D. at 1%	0.13	0.14	0.71	0.75	0.17	0.17	1.07	1.12	---	---

NS, * and ** Not significant and significant at 0.05 and 0.01 level of probability, respectively.

***Leaves No. /plant:**

Rhizobium inoculation, manure and micronutrients application significantly increased leaves No./plant during both seasons (Table 3). Soybean plants treated by R_hM + P_m(T9) sustained the largest leaves No./ plant of 35.34 and 35.48 in the 1st and 2nd season, respectively. The leaves No./ plant of R_h+P_m treatment (T8) was 34.73 and 34.34 followed by R_hM+S_m treatment (T7) that realized leaves No./ plant of 33.90 and 33.63. The control treatment (T_1) realized the least leaves No./ plant of 26.68 and 26.19 leaves for the corresponding seasons. The greater leaves No./ plant might be due to the benefit from nutrient supply contained in combination rhizobium bacteria, sheep manure and micronutrients (T9) that are associated with increasing availability of nutrients and their uptake during the early stages and improving meristematic expansion surface area of the leaves and physiological activates in the plants. Also, Singh (2012) and Yagoub *et al.* (2015) reported similar results on soybean crop. Adeyeye *et al.* (2017) found that inoculation of soybean seed with rhizobium significantly improved the leaves No./ plant.

***Branches No. /plant**

The seeds treated by rhizobium inoculation, manure and micronutrients attained a significant positive effect on branches No./ plant during both seasons (Table3). The R_hM+P_m treatment (T9) and R_h+P_m treatment (T8) increased the branches No./ plant by 3.85 and 3.61% in the 1st season, respectively compared to control treatment (T1). It increased by 3.92 and 3.82 in the 2nd season for the corresponding treatments. This might be due to its ability to fix more atmospheric N, increase microbial activates and tallest plants produces which enhanced the utilization of solar radiation and in turn increased the branches No. / plant. This is in agreement with Yagoub *et al.* (2015) whom reported the highest branches No./plant in the combination of organic and inorganic fertilizers.

2- Pod characters

*** Pods No./plant and seeds No./ pod**

In both seasons, seeds inoculated with rhizobium and fertilized by sheep manure plus foliar application with micronutrients (T9) showed an appreciable increase in pod traits (Table 3). The highest pods No./ plant (118) and seeds No./ pod (4.0) were recorded in R_hM + P_m treatment (T9) in the 1st season and they were 129 and 4.0 in the 2nd season. On the other hand the lowest values of pods No./plant (71-75) and seeds No./ pod (2.8) were recorded in the control treatment (T1) in both seasons. The seeds treated by rhizobium inoculation, manure and micronutrients showed a significant influence on pods No./ plant while insignificant differences on seeds No./ pod (Table 3). The increases in pods No./ plant as a result of rhizobium inoculation, manure and micronutrients application might be due to the their beneficial effect on nutrients availability considerably result in improved nodule development, energy transformation, metabolic processes and root growth. Desta *et al.* (2015) and Aziz *et al.* (2016) reported that pods No./ plant was significantly increased by inoculation with rhizobium strain and Brady rhizobium. Also, Adissie *et al.* (2020) reported that application of rhizobium strain and micronutrients showed insignificant effect on pods No./ plant in both growing seasons.

3- Yield components

***Seeds No./plantand 100-Seed weight**

The seeds treated by rhizobium inoculation, manure and micronutrients exhibited significant impact on both seeds No./ plant and 100-Seed weight (Table 4). Treated plants by R_hM+P_m (T9) increased seeds No./ plant by 49.73 and 51.96%and 100-seed weight by 47.10 and 41.74% in the 1st and 2nd seasons, respectively compared to untreated seeds (T_1). Also, the data showed a clear influence of micronutrients addition when comparing R_h+S_m treatment (T6) with R_hM+P_m treatment (T9) since seeds No./ plant increased by 4.25 and 3.70% and 100-seed weight increased by 15.23 and 13.13% in the 1st and 2nd seasons, respectively. This confirms the effective role of micronutrients and their effect on the symbiotic fixation of nitrogen. This results was in line with the study of Adissie *et al.* (2020) whom reported that inoculation of faba bean with both strain and micronutrients could increase seeds No./ plant and 100-seed weight. The highest seeds No./ plant and 100-seed weight produced by R_hM+P_m treatment (T9) may be attributed to its ability to enhanced utilization of growth factors, and improved nodule development, metabolic processes, easy availability of nutrients and root growth. Similer findings are mentioned by El-Howeity & Abdel-Gawad (2017) and Cevheri &Yilmaz (2018).

Table 4. The effects of rhizobium inoculation, organic manure and micronutrients application on yield and yield attributes of soybean during 2019 and 2020 seasons.

Treatment	Yield components				Yield			
	Seeds No./ plant		100-Seed weight (g)		Seed yield(ton/ fed)		Biological yield(ton/ fed)	
	2019	2020	2019	2020	2019	2020	2019	2020
T1: Control	96.97	94.76	13.63	13.80	1.16	1.18	1.69	1.73
T2: Rhizobium bacteria (R_h)	133.40	131.27	15.62	15.87	1.25	1.27	1.84	1.91
T3: Sheep manure (S_m)	128.50	126.90	14.97	14.85	1.20	1.25	1.79	1.86
T4: Pigeon manure (P_m)	130.94	129.97	15.29	15.94	1.23	1.26	1.82	1.88
T5: R_h + Micronutrients (R_hM)	135.44	135.71	17.20	16.72	1.29	1.32	1.94	2.02
T6: $R_h + S_m$	139.27	138.86	17.40	17.29	1.31	1.36	2.00	2.07
T7: $R_hM + S_m$	141.11	140.49	18.28	18.61	1.36	1.42	2.06	2.13
T8: $R_h + P_m$	143.37	142.57	19.72	19.01	1.42	1.45	2.14	2.19
T9: $R_hM + P_m$	145.19	144.00	20.05	19.56	1.46	1.49	2.23	2.31
F test	**	**	**	**	**	**	**	**
L.S.D at 5%	1.68	0.73	0.42	0.17	0.12	0.14	0.17	0.21

NS, * and ** Not significant and significant at 0.05 and 0.01 level of probability, respectively.

4- Yield

***Seed and biological yields**

Soybean seed and biological yields as influenced by the addition of rhizobium, micronutrients and manure are shown in (Table4). The rhizobium inoculation, manure and micronutrients had significant effects on seed and biological yields. The maximum seed yield and biological yield were recorded with R_hM+P_m treatment (T9) since the seed yield was 1.46 and 1.49 ton/ fed and the biological yield was 2.23 and 2.31 ton/ fed in the 1st and 2nd season, respectively. The minimum seed yield and biological yield were recorded with control treatment (T1) since the seed yield was 1.16 and 1.18 ton/ fed and the biological yield was 1.69 and 1.73 ton/ fed in the 1st and 2nd season, respectively. The seed and biological yield could be arranged in descending order of T9 > T8 > T7 > T6 > T5 > T2 > T4 > T3 > T1 in both seasons. This is might be due to foliar application of micronutrients, especially Fe, Mn and Zn catalyst the rhizobium bacteria to increase its activity so increasing nodes root number on a plant and stimulates the process of symbiotic nitrogen fixation. Furthermore, higher assimilation of nutrients and higher number of productive pods and bolder grains should magnify the yields. Also, the increase in seed yield might be attributed to the role of rhizobium inoculation, manure and micronutrients application in improvement early growth, more dry matter accumulation and stimulation the building of metabolic products, consequently enhancement yield components. In addition, seed yield is the end result of much complex morphological and physiological process occurring during the growth and development of crop. The obtained results are in agreement with those of Ahmed (2013), Lamptey *et al.* (2014) and Adeyeye *et al.* (2017). Ekaette (2017) stated that crop nitrogen requirement by nitrogen fixation occurs not at the beginning of the vegetative phase and the end of the reproductive period, but occurred after the formation of nodules that occur because rhizosphere colonization and infection rhizobium in legume root. The result of this symbiosis is expected to increase the production of forage crops. Toleikiene *et al.* (2021) found that the production of seed yield might be due to better growth, development and dry matter accumulation with proper supply of nutrients to plant and increase the availability of other plant nutrients with the respective source of symbiotic fixation of nitrogen.

5- Seed chemical composition:

Data in Table (5) showed that seed N%, N-uptake, protein content % and protein yield were significantly increased by rhizobium inoculation, manure and micronutrients application in both seasons. The treatment R_hM+P_m (T9) attained the highest values of seed N% (5.91 and 5.97%), N-uptake (5.67 and 5.91 kg/ fed), protein content (33.98 and 34.33%) and protein yield (496.11 and 511.52 Kg/ fed) in the 1st and 2nd season, respectively. The substantial increase in soybean seed chemical composition could be attributed mainly to nitrogen added from either organic sources and observed in the rhizobium inoculated seeds to the N fixation potential. Similar results were obtained by Ahmed (2013) and El-Howeity & Abdel-Gawad (2017). Cevheri and Yilmaz (2018) stated that the nodes root in the rhizosphere is reflected on crop production as well as reduce the amount of nitrogen mineral fertilizers.

Table 5. The effects of rhizobium inoculation, manure and micronutrients application on seed N%, N-Uptake and protein content%during 2019 and 2020 seasons.

Treatment	N (%)in seed		N-Uptake (Kg fed^{-1})		Protein Content (%)		Protein yield (Kg fed^{-1})	
	2019	2020	2019	2020	2019	2020	2019	2020
T1: Control	5.51	5.52	3.64	3.75	31.68	31.74	367.49	374.53
T2: Rhizobium bacteria (R_h)	5.59	5.61	4.19	4.26	32.14	32.26	401.75	409.70
T3: Sheep manure (S_m)	5.54	5.58	3.88	4.19	31.86	32.09	382.32	401.13
T4: Pigeon manure (P_m)	5.59	5.66	4.08	4.36	32.14	32.55	395.32	410.13
T5: R_h + Micronutrients (R_hM)	5.70	5.74	4.50	4.71	32.76	33.01	421.44	435.73
T6: $R_h + S_m$	5.73	5.77	4.64	4.96	32.95	33.18	431.65	451.25
T7: $R_hM + S_m$	5.76	5.80	4.95	5.34	33.12	33.35	450.43	473.57
T8: $R_h + P_m$	5.83	5.86	5.36	5.57	33.52	33.70	475.98	488.65
T9: $R_hM + P_m$	5.91	5.97	5.67	5.91	33.98	34.33	496.11	511.52
F test	*	*	*	*	**	**	**	**
L.S.D at 5%	0.03	0.04	0.10	0.09	0.11	0.10	13.07	11.21

NS, * and ** Not significant and significant at 0.05 and 0.01 level of probability, respectively.

6- Correlation coefficient

The correlation coefficient among examined factors is presented in Table (6). The strongest correlations were observed between seed yield and some traits such soil reaction (pH r=0.878 and o.825), leaves No./ plant (NL r=0.988 and 0.612),branches No./ plant (NB r = 0971 and 0591), pods No./ plant (NP r = 0.989 and 0.981), seeds No./ pod (NS r=0.679 and 0.903), 100-Seed weight (SW r=0.799 and 0.826), N-Uptake (0.999 and 0.997) and Seed protein content (SP r = 0.989 and 0.977) in the 1st and 2nd seasons, respectively. NL and NB were insignificant correlated with seed yield in the 2nd season and seed N% was negatively and insignificantly correlated with seed yield in 2020 season. Indeed the positive correlation among seed yield via different traits are an important indicator soybean seed yield increases.

This might be due to the beneficial impact of rhizobium inoculation, manure and micronutrients application in improving N fixation which ultimately enhanced soybean yield. Ahlijah (2016) showed a positive linear relationship between seed yield and pods No./ plant. Cevher and Yilmaz (2018) observed a positive significant correlations between seed yield and branches No./plant(r=0.964), pod No./ plant(r=964) and 100-seed weight (r=578) were.

Table 6. Correlation among seed yield and soybean plantstraits during 2019 and 2020 seasons.

Traits	Coefficient (*r*)	
	2019	2020
	Seed yield (ton/ fed)	Seed yield(ton/ fed)
Plant height (PH)	0.878**	0.825**
Leaves No./ plant (NL)	0.988**	0.612ns
Branches No./ plant (NB)	0.971**	0.591ns
Pods No./ plant(NP)	0.989**	0.981**
Seed No./ pods (NS)	0.679*	0.903**
100-Seed weight (SW)	0.799**	0.826**
Seed N%	0.991**	-0.467ns
Seed N-Uptake (NU)	0.999**	0.997**
Seed protein content (SP)	0.989**	0.977**

*** and ** Denote correlation is significant at $P < 0.05$ and $P < 0.01$**

CONCLUSION AND RECOMMENDATIONS

Based on the obtained results, legumes inoculation with effective rhizobium in combination with manure and micronutrients are believed to increase soybean growth and its yield in mean time increases soil fertility. It could be concluded that the best treatment was R_hM+P_m (T9) that positively significant affected all the tested traits. Similarly, the highest seed chemical composition was also obtained from the combination rhizobium bacteria, organic manure and micro-nutrients (T9). Seed yield was the strongest positively significant correlated with all tested traits in both seasons. So, implement balanced and timely nutrient management practices for soybean contributes to the sustainable growth yield in a good quality.

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التسميد العضوى لانتاجية محصول فول الصويا المعامل ببكتريا الريزوبيوم والمحفزة برش بعض المغذيات الصغري

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أجريت هذه الدراسة خلال موسمي الصيف 2019 و 2020 بالمزرعة التجريبية بكلية الزراعة جامعة الأزهر بمحافظة أسيوط. بهدف دراسة تأثير السماد العضوي (روث الأغنام والحمام) وبعض المغذيات الدقيقة (الحديد ، المنجنيز والزنك) على نمو وإنتاج محصول فول الصويا (صنف جيزة 22) وكذلك على النيتروجين القابل للتثبيت بواسطة بكتريا الريزوبيوم. وقد تضمنت الدراسة 9 معاملات كانت كالتالي (م1: كنترول ، م2: التلقيح ببكتريا الريزوبيم ، م3: التسميد العضوي (روث الأغنام) ، م4: التسميد العضوي (روث الحمام) ، م5: الريزبيوم + بعض المغذيات الصغرى (حديد - منجنيز - زنك) ، م6: الريزوبيم + روث الأغنام ، م7: الريزوبيوم + روث الأغنام + المغذيات الصغري ، م8: الريزوبيوم + روث الحمام ، م9: الريزوبيوم + روث الحمام + المغذيات الصغري). تم توزيع المعاملات فى تصميم القطاعات كاملة العشوائية فى ثلاث مكررات وتم دراسة الصفات التالية : أدى تلقيح بذور فول الصويا (صنف جيزة 22) ببكتريا الريزوبيزم والتسميد العضوي بروث الحمام والرش بالمغذيات الصغرى (م9) إلى زيادة معنوية فى جميع الصفات (إرتفاع النبات ، عدد أوراق النبات ، عدد فروع النبات ، عدد قرون النبات ، عدد البذور للقرن ، عدد بذور النبات ، وزن 100 بذرة ، محصول البذور و المحصول البيولوجي) وذلك مقارنة بمعاملة الكنترول (م1). أعطت نفس المعاملة أعلى محصول من الحبوب (1,46و 1,49 طن للفدان) بزيادة قدرها (25,86 و 26,27 %) عن المعاملة رقم1 (1,16 و 1,18 طن للفدان) خلال موسمى الدراسة على الترتيب .
توصي الدراسة بمعاملة تقاوى فول الصويا صنف جيزة 22 قبل الزراعة ببكتريا الريزوبيوم + تسميد التربة بروث الأغنام اوالحمام بمعدل 5 طن للفدان + رش النباتات عند عمر15 و 30 يوم بالمغذيات الصغري (حديد ، منجنيز , زنك) بهدف تعظيم الإنتاجية كمية وجودة ، وكذلك الحفاظ على خصوبة التربة وإنتاجيتهامن خلال الإستخدام الأمثل والمتوازن للأسمدة تحت ظروف محافظة أسيوط.