Influence of Organic, Bio and NPK Fertilization on Growth of Cowpea Cultivars Under North Sinai Conditions

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Abstract: The aim of the research is to study the effect of organic, bio fertilization and NPK fertilizers on the production of two varieties of cowpea under North Sinai conditions, to achieve this goal. This research was conducted in the Experimental Farm at the Faculty of Agricultural and Environmental Sciences-Al-Arish University, during two successive seasons (2020/2021) on two cultivars of cowpea (Karim 7 and Dokki-331), under treatments of fertilizers *viz*. organic (farmyard manure and chicken manure), bio fertilization (Effective microorganisms "ES1" and Technology of smart fertilizer "TS") and NPK fertilizers (Control 50%NPK, NPK 100%=100kg/fed, EM1+50%NPK, TS+50%NPK and their interactions). The experiment was laid out by using 16 treatments and three replications in Randomized Complete Block Design (RCBD). The data on vegetative characters *viz*. leaves number, plant height, peduncle number, nodules number, leaf area, root length, root number, leaves weight, root weight and shoot weight). The results cleared that the cultivar Karim-7 under EM1 bio- fertilizer + NPK 50% treatment was superior and significantly increased all studied traits.

Keywords: Bio fertilization, cowpea, chicken manure, organic fertilization, NPK.

INTRODUCTION

Cowpea (Vigna unguiculata L.) is a member of the Fabaceae family. The genus *Vigna* contains about 170 species. The most significant grain legume in the world is the cowpea (Onwueme and Sinha, 1991). It is regarded as one of the important summer vegetable crops grown in Egypt for both domestic and international consumption. Due to its high protein content, heat tolerance, low fertilizer needs, and ease of growth in newly reclaimed and soils of various textures, it represents a very interesting class of food crops. (Knany et al., 2002). It is used as feed for animals, cattle and for human consumption. It is a significant crop in the semiarid regions of Africa and Asia because of its tolerance for sandy soil and little rainfall. Its protein usefully complements the supply of protein provided by cereals, whose contents of lysine and tryptophan are relatively low. The protein of it contains a relatively high amount of the essential amino acids, lysine and tryptophan (Singh and Singh, 1990).

Nowadays, there has been a marked increase in the use of chicken manure as an organic fertilizer, especially for boosting crop productivity and soil productivity. Many plant nutrients are thought to be available to soils from chicken manure. Study carried out by Dikinya and Mufwanzala (2010) were demonstrated how adding chicken dung can increase the exchangeable bases in soils, thereby increasing soil fertility. Additionally, it is possible to increase the amount of other nutrients like nitrogen and phosphorus. Due to its high macronutrient content, chicken manure is one of the most popular organic fertilizers (Warman, 1986; Duncan, 2005). Farmyard Manure (FYM) is a more valuable organic manure that enhances soil quality because of the humus macro and micronutrients it contains. It also helps to improve soil structure, aeration, and water holding capacity. Additionally aids in promoting the function of the microorganisms that the plant uses to obtain the macro-micronutrients through biological processes (Sruthi et al., 2022).

Chemical nitrogen fertilization has been shown to increase crop yield (Abyomi et al., 2008); application of nitrogen to cowpea had a favorable impact on yield and the components of cowpea (Gohari et al., 2010). For farmers looking to boost crop productivity, chemical nitrogen fertilization may be used in significant amounts. According to Mousa and Mohamed (2009), the continuous application of mineral fertilizers may have a negative impact on the yield of vegetable crops, soil degradation, soil chemical composition, and nutrients imbalance. From the perspective of sustainable agriculture, bio fertilizers might be important candidates to prevent the environmental pollution brought on by the excessive use of mineral fertilizers. Bio fertilizers as a partial replacement for chemical fertilizers reduce the quantity and cost of chemical fertilizers and thereby prevent environmental pollution from their extensive application, aiding in the sustainability of farms (Kumar et al., 2013 and 2015). Therefore, using bio fertilizers is more crucial for improving fertilizer use efficiency. Inoculating seeds with nitrogen and phosphate-solubilizing bio fertilizers (PSB) significantly increased cowpea plant growth, root proliferation, nodulation, and subsequently pod yield, according to several reviews (Bohra et al., 1990 and Stamford et al., 2013). Effective microorganisms (EM1) are a biofertilizer that uses three major genera of microorganisms that are common in nature: phototrophic bacteria (*Rhodopseudomonas*), lactic acid bacteria (*Lactobacillus*), and yeast (*Saccharomyces*). The main goal of EM is to restore a healthy ecosystem in both soil and water. *Saccharomyces cerevisiae*, *Lactobacillus plantarum*, *L. casei*, *L. fermentum*, *L. delbrueckii*, and *Rhodopseudomonas palustris* are all present in EM. (Abd-Rabou, 2006 and Higa, 2010). In this connect; Wood et al. (1997) demonstrated how the advantageous microorganism contained in EM1 produces plant hormones, advantageous bioactive substances, and antioxidants that solubilize nutrients. Applying EM-activated liquid has been shown to improve germination potential and rate, promote root growth, and encourage

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root development. Spraying EM liquid on rice seedlings can increase their leaf surface area, stem thickness, and chlorophyll content (Xiaohou et al., 2008).

Furthermore, using efficient microorganisms, when the citrus plants were in bloom and fruits were forming in late winter, the EM treatments' higher yield can be linked to improved soil's physical and chemical conditions (Paschoal et al., 1999). Organic and biological fertilizers provide an alternative to agricultural chemicals as more sustainable and ecologically sound practice to increase crop productivity Pankhurst and Lynch, (1995). This approach has been the most recent scope of many researchers. Recent investigations revealed that the application of organic fertilizers and/or biofertilizers to the soils can promote nutrients availability and plant uptake, increase crop yield, reduce inputs of chemical fertilizers, and minimize environmental risks (Khalid et al., 2000; Koreish, 2003; Koreish et al., 2004).

Few research works have been carried out on the use of biofertilizers and organic as well as NPK fertilizers and its interactions in the crop production. El-Fawakhry et al. (2004) on three species of Ficus mentioned that fertilizing transplants with 1 g/pot every two weeks (equal to 50% recommended NPK) in presence of biofertilizers gave the highest values of plant height, leaf number, leaf area, stem diameter, root volume and dry weight, as well as the greatest content of total chlorophylls and N in the leaves. Abido et al. (2017) found that the combination among microbein + 50 % NPK of recommended fertilization +1m3/fed. organic manure chicken manure or among microbein + 25% NPK of recommended fertilization +10 m3/fed. of chicken manure; regarded as the most effective combination treatment because it provided the highest mean values of Cucumber vegetative growth. Shaheen et al. 2013 indicated that the highest values of vegetative growth parameters were obtained by combination among 50% (compost, rock phosphate and feldspar) + 50% of the NPK mineral recommended fertilizers and K O+ bio-fertilizer.

Therefore, the objectives of this study were to investigate the effects of the application of organic, bio fertilizers and chemical fertilizers on the vegetative characters and it yield production of two varieties of cowpea as a summer forage crop under North Sinai conditions.

MATERIALS AND METHODS

-Plant materials: Two cowpea cultivars (Karim-7 and Dokki-331 CV.) were obtained by Forage Research Department, Field Crops Research Institute (FCRI), Agricultural Research Center (ARC), Giza, Egypt.

-Experimental location and growing seasons: This investigation was carried out at the Experimental Farm of Faculty of Environmental Agricultural Sciences, Arish University, Egypt for two summer successive seasons 2020 and 2021.

-Experimental design and its management: Randomized complete block design (RCBD) in a split split plots system with four replications was used in this field experimental. The main plot size was 160 m2, while the sub plot size was 80 m2 and the sub sub plot size was 10 m2. The sowing distances were 40 cm between rows and 15 cm within each row. Seeds were sown on 8th April in both seasons. After one month of planting, the plants were thinned to four plants per hill, and then they singled to one plant after 45 days from planting. All cultural practices for cowpea production were applied as recommended at the proper time.

-Soil Experiment Field analysis and its treatments: There are some analytical data of the soil experiment field before cultivation were done for the mechanical and chemical condition of the research soil experiment. These analytical data of the experiment soil and the treatments related to the work research as follows: -

1-Soil mechanical and chemical analysis: The soil mechanical and chemical analysis were done average of the two seasons at Soil and Water Department (SWD) and are presented in Tables (1 and 2).

Table (1): Soil mechanical analysis (Average of the two seasons).

Soil Depth (cm)	Coarse Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Soil Texture
0-45	66.3	19.7	2.9	11.1	Sandy loam

2- Organic fertilization: Two organic manure sources (farmyard manure and chicken manure) at the rate of 15 m3/fed-1were added during land preparation. The organic manure analysis is shown in Table (3). Total nitrogen, organic carbon and available phosphorus were determined according to American Public Health Association (APHA, 1985).

3- Bio- fertilizer: EM1 (Effective microorganisms) bio-fertilizer and TS (Technology of smart fertilizer) bio-fertilizer were added at a rate of (5 ml/m2) in two equal portions. This is based on the manufacturer's recommendations: EM1 solution injected through the drip irrigation system in the sandy lands), the first portion after the second thinning, while the second was added at the beginning `of the emergence of floral siliqua at the studied rates. Biofertilization compositions are shown in Table (4).

4-NPK fertilization: NPK (20:20:20) was added as a rate of 100kg/fed. The all-experimental treatments were designated as follow: -

- T1: Dokki - 331 + farmyard manure + control (50% of recommended NPK).
- T2: Dokki - 331 + farmyard manure + NPK (100%. of recommended NPK).
- T3: Dokki - 331 + farmyard manure + EM1+ (50% of recommended NPK).
- T4: Dokki - 331 + farmyard manure + TS+ (50% of recommended NPK).
- T5: Dokki - 331 + chicken manure + control (50% of recommended NPK).
- T6: Dokki - 331 + chicken manure + NPK (100%. of recommended NPK).
- T7: Dokki - 331 + chicken manure + EM1+ (50% of recommended NPK).
- T8: Dokki - 331 + chicken manure + TS+ (50% of recommended NPK).

- T9: Karim- 7 + farmyard manure + Control (50% of recommended NPK).
- T10: Karim- 7+ farmyard manure + NPK (100%. of recommended NPK).
- T11: Karim- 7 + farmyard manure + EM1+ (50% of recommended NPK).
- T12: Karim- 7 + farmyard manure +TS+ (50% of recommended NPK).
- T13: Karim- 7 + chicken manure +control (50% of recommended NPK).
- T14: Karim- 7 + chicken manure + NPK (100%. of recommended NPK).
- T15: Karim- 7 + chicken manure + EM1+ (50% of recommended NPK).
- T16: Karim- 7 + chicken manure + TS+ (50% of recommended NPK).

- Data recorded:

At harvesting 17July, at the first and second season, 10 plants of cowpea were pulled up from each sub sub plot experiment unit and some characters were recorded. These characters, which were recorded as they are following: leaves number per plant, plant height (cm), peduncle number per plant, nodules number per plant, leaf area (cm2), root length (cm), roots number per plant, leaves weight (g), root weight (g), and shoot weight (g).

-Statistical analysis: Data obtained of the present study were, statistically, analyzed according to the design used by the MSTAT-C computer software program (Snedecor and Cochran, 1990). Mean values were compared at $P \leq 0.05$ using the multiple range test (Duncan, 1955).

Table (2): Soil chemical analysis (Average of the two seasons)

Soil Depth (cm)	Organic carbon g kg $^{-1}$	pH	EC (dS m^{-1})	CaCO3 (%)	Organic matter g kg^{-1}
0-45	1.08	8.619	1.8	3.91	2.07
Soluble Cations (meq L^{-1})				Soluble Anions (meq L^{-1})	
K^+	Na^+	Mg^{++}	Ca^{++}	Cl^-	$HCO3^-$
0.46	2.63	2.17	2.5	1.277	2.405

Table (3): Chemical analyses of the used organic manure

Organic	(FYM)	(CM)	(FYM)	(CM)
Parameters	2020		2021	
Total nitrogen (gkg^{-1})	36.7	45.3	39.6	52.22
Total phosphors (gkg^{-1})	0.46	0.53	0.49	0.58
Total potassium (gkg^{-1})	21.7	27.9	22.16	30.99
Organic carbon (gkg^{-1})	440	520	452	529
Organic matter (gkg^{-1})	752	865	769	899
C/N Ratio	14.0	15.6	15.0	15.9

Table (4): Biofertilization composition

	EM1	TS
Lactic acid bacteria	*Lactobacillus plantarum, L.casei, Streptococcus lactis*	*Bacillus Polmyxa* *Bacillus circulance* *Bacillus megatherium*
Photosynthetic bacteria	*Rhodopseudomonas plustris, Rhodobacter sphacerodes*	
Fungi	*Apergillus, Penicilium*	
Yeast	*Saccharamyces cereresiae*	

RESULTS AND DISCUSSION

1-Effect of different organic sources, bio fertilization types and NPK on vegetative growth of two cowpea cultivars: Regard to effect of cowpea cultivars, data presented in Tables (5) and (6) shows that Karim-7 cv. produced the highest values of almost studied traits. Concerning effect of organic fertilizers, results were indicated that application of chicken manure significantly increases the leaves number/plant (27.75 of cowpeas, this is because it improves the soil structure and promotes the growth of healthy plants. In addition, the slow release of nutrients allows the plants to take advantage of it. Organic fertilizers have an additive and 35.75), plant height (90.17 and 99.96cm), leaf area (73.00 and 76.50 cm^2), peduncle number (17.83 and 22.79), nodules number (25.83 and 32.95), root length (36.46 and 42.75cm), root number (18.71 and 21.28), leaves fresh weight (140.75 and 149.58 g), root fresh weight (30.41 and 35.75 g) and shoot fresh weight (125.71 and 136.54 g) in both seasons, in respectively. Fertilization with organic manure increases the growth effect. This means that they release nutrients slowly or gradually. These results are agreement with the results obtained by (Yolcu et al., 2010; Ahmed & Elzaawely, 2010; Badar et al., 2015).

Regarding the effect of bio and NPK fertilizations, the recorded data were indicated that the treatment of EM1 bio- fertilizer+NPK50% significantly induced the growth parameters, namely, leaves number/plant (34.25 and 42.25), plant height (104.3 and 114.92cm), leaf area (80.75 and 84.50cm^2), peduncle number (24.42 and 26.50), nodules number (29.83 and 37.42), root length (41.08 and 47.08cm), root number (20.75 and 25.25), leaves fresh weight (159.42 and 168.33g), root fresh weight (34.83 and 40.83 g) and shoot fresh weight (138.83 and 149.00 g) in first and second seasons, in respectively (Table-5). Bio fertilizers could be considered microbial inoculants containing living soil microorganisms that produce significant amounts of water and nutrients, when inoculated on seeds, seedlings, or soils, thereby enriching soil with organic matter, and providing sufficient moisture for better crop performance. (Ananthanaik et al., 2007 and Abd El-Gawad, 2008). Most bio fertilizers come from bacteria, fungi, or cyanobacteria, especially blue-green algae. Blue-green algae has several other benefits (other than improving plant nutrition), such as disease resistance and resistance to poor soil and climate conditions (Ananthanaik et al., 2007 and Boureima et al., 2007). Microsymbionts and biofertilizers include *Mycorrhiza Azospirillum Azotobacter Rhizobium,* these organisms increase nutrients and water uptake in many tropical and temperate crops (Ananthanaik et al., 2007 and Neveen and Amany, 2008). Each bacterial strain closely replicated the growth and yield characteristics found in the field, with increased levels of auxin, protein, peroxidase, and acid phosphate (Shaukat et al., 2006). These results are in harmony with those obtained by each of Itelima et al. (2015); Zagloul et al. (2017); Nadeem et al. (2018); Elkoumy et al. (2018); Bartwal and Patel, (2020 or 2021); Jha and Trived, (2021) and Yürürdurmaz, (2022).

2-Effect the interaction of bio, organic and NPK fertilization in two cultivars of cow pea vegetative growth: Data presented in Tables (7) and (8) indicated that, interaction effect bio, organic and NPK fertilization were significantly increased growth characters. These characters *viz*., leaves number/plant, plant height, leaf area, peduncle number, nodules number, root length, root number, leaves fresh weight; root fresh weight and shoot fresh weight were sored (39 and 47), (121.3 and 134.67cm), (98.00 and 92.33cm^2), (29.00 and 38.00), (38.00 and 48.33), (48.67 and 54.33cm), (32.00 and 38.63) , (174.3 and 184.7g), (47.00 and 57.00g) (167.30 and 177.70 g) in first and second seasons, respectively. These findings were obtained when Karim-7 cultivar was fertilized with chicken manure combined with EM1 + (50%NPK) in both seasons in respectively. Increases came about because of bio fertilized treatments due to the addition of nitrogen, which is regarded as a vascular osmoticum and a precursor to protein synthesis. The osmotic compounds in the cell sap are crucial for enabling cell growth (Sharaf et al., 2013).

The advantage of EM1 is due to its stimulation of photosynthetic activity in plants, which raises the production of proteins, enzymes, and various other compounds, most notably peroxidase activity (Winget and Gold, 2007). This is an essential component for encouraging the growth and development of plants. Chlorophyll-green pigment, which is necessary for the processes of absorbing carbon dioxide, sunlight, and other substances and promoting plant growth and development, can be produced more quickly by EM1. The higher leaf area may be due to the effect of EM1 on plant root development, followed by better nutrients fostering. This suggests increased biomass synthesis and photosynthesis. On the other hand, a study was done by (Yamada and Xu, 2000) assert that phytohormones and other biologically active substances found in EM1 keep plants from going dormant and increase photosynthetic activity. These results are in harmony with those obtained by each of Fawakhry et al. (2004); Shaheen et al. (2013); Abido et al., (2017).

Table (5): Effect of different organic sources, bio fertilization types and NPK in (leaves number, plant height, leaf area, peduncle number and nodules number) of two cultivars of cowpea during two successive growing seasons 2020 and 2021.

Characters / Fertilization	Leaves n.	Plant height	Leaf area	Peduncle n.	Nodules n.
			First season (2020)		
Dokki-331	24.25^b	76.21^b	60.96^b	14.38^b	24.29^a
Karim-7	27.50^a	93.87^a	79.13^a	17.50^a	23.00^b
FYM	24.00^b	79.92^b	67.08^b	14.04^b	21.46^a
CHM	27.75^a	90.17^a	73.00^a	17.83^a	25.83^b
Control(50%npk)	18. 25^d	61.08^d	55.67^c	8.25^d	17.17^d
NPK (100%npk)	22. 50^c	94.67^b	78.33^a	12.50^c	26.33^b
Ts+(50%npk)	28.50^b	80.08^c	65.42^b	18.58^b	21.25^c
Em1+(50%npk)	34.25^a	104.3^a	80.75^a	24.42^a	29.83^a

*Second season (*2021)					
Dokki-331	32.25^{b}	83.88^{b}	65.04^{b}	17.50^{b}	30.71^{a}
Karim-7	35.50^{a}	105.00^{a}	82.54^{a}	26.92^{a}	30.58^{a}
FYM	32.00^{b}	88.92^{b}	71.08^{b}	21.63^{b}	28.33^{b}
CHM	35.75^{a}	99.96^{a}	76.50^{a}	22.79^{a}	32.95^{a}
Control(50%npk)	26.25^{d}	69.33^{d}	60.25^{d}	16.50^{d}	23.75^{d}
NPK (100%npk)	30.50^{c}	103.92^{b}	81.08^{b}	24.75^{b}	32.83^{b}
Ts+(50%npk)	36.50^{b}	89.58^{c}	69.33^{c}	21.08^{c}	28.58^{c}
Em1+(50%npk)	42.25^{a}	114.92^{a}	84.50^{a}	26.50^{a}	37.42^{a}

Table (6): Effect of different organic sources, bio fertilizations types and NPK in (root length, root number, leaves weight, root weight, shoot weight) of two cultivar of cowpea during two successive growing seasons 2020 and 2021.

Characters / Fertilization	Root length	Root n.	leaves weight	Root weight	Shoot weight
First season (2020)					
Dokki-331	34.38^{a}	14.46^{b}	131.08^{b}	27.58^{a}	128.07^{a}
Karim-7	33.83^{a}	19.67^{a}	133.70^{a}	21.58^{b}	97.25^{b}
FYM	31.75^{b}	15.42^{b}	124.04^{b}	18.75^{b}	100.25^{b}
CHM	36.46^{a}	18.71^{a}	140.75^{a}	30.41^{a}	125.71^{a}
Control(50%npk)	27.75^{d}	13.58^{d}	103.75^{d}	14.75^{c}	82.25^{d}
NPK(100%npk)	36.08^{b}	18.08^{b}	137.58^{b}	25.33^{b}	119.67^{b}
Ts+(50%npk)	31.50^{c}	15.83^{c}	128.83^{c}	23.42^{b}	111.17^{c}
Em1+(50%npk)	41.083^{a}	20.75^{a}	159.42^{a}	34.83^{a}	138.83^{a}
Second season (2021)					
Dokki-331	39.75^{a}	17.25^{b}	135.21^{b}	32.63^{a}	140.83^{a}
Karim-7	41.08^{a}	23.00^{a}	141.79^{a}	25.42^{b}	107.38^{b}
FYM	38.08^{b}	18.88^{b}	127.42^{b}	22.29^{a}	111.67^{b}
CHM	42.75^{a}	21.28^{a}	149.58^{a}	35.75^{b}	136.54^{a}
Control(50%npk)	34.17^{d}	13.75^{d}	113.25^{b}	18.33^{c}	94.17^{d}
NPK(100%npk)	42.50^{b}	22.00^{b}	134.83^{ab}	28.83^{b}	130.42^{b}
Ts+(50%npk)	37.92^{c}	19.50^{c}	137.58^{ab}	28.08^{b}	122.83^{c}
Em1+(50%npk)	47.08^{a}	25.25^{a}	168.33^{a}	40.83^{a}	149.00^{a}

Table (7): Effect the interaction of organic, NPK and bio fertilization in (leaves number, plant height, leaf area, peduncle number and nodules number) of Cowpea cultivars in two successive growing seasons 2020 and 2021.

Characters / Fertilization	Leaves n.	Plant height	Leaf area	Peduncle n.	Nodules n.
First season (2020)					
T_1	15.00^{l}	52.00^{h}	42.67^{i}	5.00^{l}	17.67^{gh}
T_2	19.00^{j}	73.00^{f}	72.67^{de}	9.00^{j}	22.00^{ef}
T_3	25.00^{g}	59.00^{gh}	54.67^{g}	15.00^{g}	22.00^{ef}
T_4	30.00^{d}	84.33^{e}	64.00^{f}	20.33^{d}	24.00^{de}
T_5	19.00^{j}	63.00^{g}	48.67^{h}	9.00^{j}	18.33^{gh}
T_6	23.00^{h}	92.33^{cd}	73.33^{de}	13.00^{h}	30.33^{c}
T_7	29.00^{e}	80.33^{ef}	56.00^{g}	19.33^{e}	24.67^{de}
T_8	34.00^{b}	105.67^{b}	75.67^{d}	24.33^{b}	35.33^{b}
T_9	18.00^{k}	72.67^{f}	62.33^{f}	8.00^{k}	17.00^{gh}
T_{10}	23.00^{h}	106.33^{b}	81.00^{c}	13.00^{h}	28.00^{c}
T_{11}	28.00^{f}	86.00^{de}	74.00^{d}	18.00^{f}	19.00^{g}
T_{12}	34.00^{b}	106.00^{b}	85.33^{b}	24.00^{b}	22.00^{ef}
T_{13}	21.00^{i}	56.67^{gh}	69.00^{e}	11.00^{i}	15.67^{h}
T_{14}	25.00^{g}	107.00^{b}	86.33^{b}	15.00^{g}	25.00^{d}
T_{15}	32.00^{c}	95.00^{c}	77.00^{cd}	22.00^{c}	19.33^{fg}
T_{16}	39.00^{a}	121. 3^{a}	98.00^{a}	29.00^{a}	38.00^{a}

Second season (2021)					
T_1	23.00^{l}	58.00^{j}	48.33^{i}	12.33^{j}	23.67^{hi}
T_2	27.00^{j}	80.33^{h}	73.33^{e}	19.00^{fg}	28.00^{ef}
T_3	33.00^{g}	66.67^{i}	58.67^{g}	15.33^{i}	30.00^{de}
T_4	38.00^{d}	92.00^{ef}	69.33^{f}	18.67^{gh}	30.00^{de}
T_5	27.00^{j}	70.00^{i}	52.67^{h}	15.33^{i}	25.00^{gh}
T_6	31.00^{h}	99.00^{d}	77.67^{d}	21.67^{de}	36.33^{c}
T_7	37.00^{e}	89.00^{fg}	60.0^{g}	17.33^{h}	31.33^{d}
T_8	42.00^{b}	116.00^{b}	80.33^{d}	20.33^{ef}	41.33^{b}
T_9	26.00^{k}	83.33^{gh}	67.00^{f}	23.00^{d}	23.67^{hi}
T_{10}	31.00^{h}	116.33^{b}	84.00^{c}	29.67^{b}	35.00^{c}
T_{11}	36.00^{f}	97.67^{de}	78.67^{d}	26.00^{c}	26.33^{fg}
T_{12}	42.00^{b}	117.00^{b}	89.33^{b}	29.00^{b}	30.00^{de}
T_{13}	29.00^{i}	66.00^{i}	73.00e	15.33^{i}	22.67^{i}
T_{14}	33.00^{g}	120.00^{b}	89.33b	28.67^{b}	32.00^{d}
T_{15}	40.00^{c}	105.00^{c}	80.00d	25.67^{c}	26.67^{fg}
T_{16}	47.00^{a}	134.67^{a}	92.33^{a}	38.00^{a}	48.33^{a}

Table (8): Effect the interaction of organic, NPK and bio fertilization in (root length, root number, leaves weight, root weight, shoot weight) of cowpea cultivars in two successive growing seasons 2020and 2021.

Characters / Fertilization	Root length	Root n.	leaves weight	root weight	shoot weight
First season (2020)					
T_1	27.33^{j}	11.00^{l}	104.67^{h}	17.00^{fg}	85.00^{j}
T_2	34.33^{de}	18.00^{g}	125.00^{f}	24.33^{e}	124.00^{e}
T_3	30.67^{gh}	16.00^{i}	119.67^{fg}	18.67^{f}	120.67^{e}
T_4	37.67^{c}	20.00^{f}	133.67^{e}	29.67^{d}	131.00^{d}
T_5	31.00^{f-h}	13.00^{k}	113.33^{g}	19.00^{f}	113.67^{f}
T_6	38.00^{c}	20.00^{f}	143.33^{cd}	36.00^{c}	154.00^{b}
T_7	33.00^{d-f}	17.00^{h}	135.33^{e}	35.67^{c}	145.67^{c}
T_8	43.00^{b}	23.00^{d}	173.67^{a}	40.33^{b}	155.67^{b}
T_9	24.33^{k}	15.00^{j}	91.67^{i}	8.00^{i}	60.33^{l}
T_{10}	34.67^{d}	24.00^{c}	137.33^{de}	18.33^{f}	96.33^{hi}
T_{11}	30.00^{hi}	21.00^{e}	124.33^{f}	11.67^{h}	83.33^{j}
T_{12}	35.00^{d}	26.00^{b}	156.00^{b}	22.33^{e}	101.33^{gh}
T_{13}	28.33^{ij}	16.00^{i}	105.33^{h}	15.00^{g}	70.00^{k}
T_{14}	37.33^{c}	26.00^{b}	144.67^{c}	22.67^{e}	104.33^{g}
T_{15}	32.33^{e-g}	24.00^{c}	136.00^{e}	27.67^{d}	95.00^{i}
T_{16}	48.67^{a}	32.00^{a}	174.3^{a}	47.00^{a}	167.30^{a}
Second season (2021)					
T_1	33.00^{i}	14.33^{g}	115.33^{c-f}	21.33^{hi}	99.33^{i}
T_2	39.33^{f}	19.00^{g}	91.00^{f}	28.33^{ef}	136.33^{e}
T_3	36.33^{gh}	15.67^{fg}	129.33^{b-e}	22.67^{gh}	132.67^{e}
T_4	43.33^{d}	18.00^{c-g}	143.00^{b-d}	33.67^{d}	143.00^{d}
T_5	36.00^{h}	16.00^{e-g}	123.67^{c-f}	23.00^{gh}	126.00^{f}
T_6	43.33^{d}	21.33^{b-f}	152.33^{a-c}	40.00^{c}	166.67^{b}
T_7	38.67^{fg}	17.67^{d-g}	144.33^{b-d}	44.67^{b}	157.67^{c}
T_8	48.00^{b}	22.33^{b-d}	182.67^{a}	47.33^{b}	165.00^{b}
T_9	31.33^{i}	18.33^{c-g}	100.33^{ef}	11.00^{k}	70.33^{k}
T_{10}	41.67^{de}	23.33^{b-d}	144.33^{b-d}	21.33^{hi}	105.33^{h}
T_{11}	37.00^{gh}	21.00^{b-f}	133.00^{b-e}	14.67^{j}	96.00^{i}
T_{12}	42.67^{d}	25.00^{b}	163.00^{ab}	25.33^{fg}	110.33^{gh}
T_{13}	36.33^{h}	21.67^{b-e}	113.67^{d-f}	18.00^{i}	81.00^{j}
T_{14}	45.67^{c}	25.00^{b}	151.67^{a-d}	25.67^{fg}	113.33^{g}
T_{15}	39.67^{ef}	23.67^{bc}	143.67^{b-d}	30.33^{e}	105.00^{h}
T_{16}	54.33^{a}	38.633^{a}	184.7^{a}	57.00^{a}	177.70^{a}

CONCLUSION

Generally, this research result showed that growth characters *viz*., leaves number/plant, plant height, leaf area, peduncle number, nodules number, root length, root number, leaves fresh weight; root fresh weight and shoot fresh weight were significant increased when Karim-7 cultivar was fertilized with chicken manure combined with EM1 + (50%NPK) in both seasons in respectively.

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تأثير التسميد العضوي والحيوي وNPK على نمو صنفين من اللوبيا تحت ظروف شمال سيناء

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هدف البحث الى دراسة تأثير التسميد العضوي والحيوي وNPK على نمو صنفين من اللوبيا تحت ظروف شمال سيناء. ولتحقيق هذا الهدف، أجري هذا البحث في المزرعة البحثية بكلية العلوم الزراعية البيئية-جامعة العريش خلال موسمين زراعيين متتاليين2021/2020 على صنفين من لوبيا العلف (كريم7 ،و الدقي-331) وذلك تحت ظروف معاملات التسميد الحيوى (سبلة الكتكوت والسماد البلدي)، التسميد العضوى (EM1 وTs)، و المعدنى NPK (المعاملة القياسية 50% منNPK، و معاملة100=100%NPKكجم /الفدان، EM1+50%NPK، TS+50%NPK)وكذلك دراسة التداخل بين تأثير جميع عوامل الدراسة). تم تصميم التجربة باستخدام 16 معاملة سمادية بواقع ثلاث مكررات باستخدام تصميم القطع المنشقة ذات القطاعات العشوائية الكاملة، حيث تم تسجيل القراءات الخضرية لصفات: عدد الأوراق، ارتفاع النبات، عدد السويقات، عدد العقد، مساحة الورقة، طول الجذر، عدد الجذور، وزن الأوراق، وزن الساق ،ووزن الجذور. أوضحت النتائج أن المعاملة كريم-7 + NPK50%+EM1 متفوقة عن بقية المعاملات وأدت الى زيادة معنوية لجميع الصفات الخضرية المدروسة.