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ORGANIC FARMING OF COWPEA (*VIGNA UNGUICULATA* L.) UNDER EL-ARISH REGION CONDITIONS

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ABSTRACT

A field experiment was carried out at The Experimental Farm, Fac. Environ. Agric. Sci., Arish University, North Sinai, Egypt, during the summer seasons of 2014 and 2015. The aim of this work was to study the effect of two organic fertilizer rates (100% and 200% of the recommended dose) with natural minerals (mixture of natural mineral ore) and natural rocks (phosphate rock and feldspars) on growth, yield and mineral contents of cowpea (*Vigna unguiculata* L.) cv. "Kafr-El Sheikh" under sandy soil conditions, using drip irrigation . A randomized complete block design, in three replicates was used. The results showed that applying cowpea plants with organic manure (ChM) and natural nutrient sources (mixture of natural mineral ore, phosphate rock and feldspars) had significant and positive effects on almost studied traits of growth and yield. The highest number of leaves/plant, plant height, leaf area, fresh weight and total yield of cowpea plants were achieved when cowpea plants fertilized with double amount of organic manure with combination of natural nutrient sources.

Key words: Cowpea, organic manure, mixture of natural mineral ore, phosphate rock, feldspars, yield.

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp) as a grain legume, is one of the most important vegetables in Egypt. Cowpea grain contains 23% protein and 57% carbohydrate, while the leaves contain 27 – 34% protein **(Belane and Dakora, 2009)**. Cowpea also plays an important role in providing soil nitrogen especially in areas where poor soil fertility is a problem (**Sheahan, 2012)**. It does not require a high rate of nitrogen fertilization; its roots have nodules in which soil bacteria called Rhizobia inhabit and help to fix nitrogen from the air into the soil in the form of nitrates.

Increasing the production of cowpea green pods and dry seeds with high quality is considered an important aim and this aim could be achieved through using organic manures with some natural materials as phosphate rock, potassium rock and feldspar. In addition, their nutritional value is a rich source of protein, good source of vitamins A, B and C, and also contains a high proportion of minerals **(Baloch, 1994)**. As well, replacing the phosphorus and potassium by natural ones will help in reducing environmental pollution and produce safe human food (**Shafeek *et al*., 2005).**

Organic fertilizers contain relatively low concentrations of nutrients as compared to chemical ones, but they perform important functions by which the chemical fertilizers do not do. The use of organic fertilizers and their proper management may reduce the

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need to chemical fertilizers thus allowing the small farmers to save the cost of production. On the other hand, organic fertilizers decompose slowly which makes nutrients available for longer period of time and helps to maintain soil nutrient status.

Phosphate rock (PR) is an important mineral resource with numerous uses and applications in agriculture and the environment. Direct application of PR reduces pollution by acting as a slow-release fertilizer, its effectiveness is limited by several factors (**Abioye and Nwoke, 2016)**. The major limitation of PR in direct application is its low solubility, which reduces its availability for soil reactions or plant uptake. Legumes respond well to rock phosphate; the strong root systems, increased nodulation, good growth, less fungal problems and increased crop production **(Akintokum *et al.,* 2003)**.

Potassium found in natural materials which present as elemental bearing rocks in many parts in the world. In Egypt, these rocks; *i.e.*, potassium sulphate, potassium thiosulphate and potassium rock (feldspar) are spreads in many sites in western and eastern desert. These rocks contain amounts of nutrients differ from little to huge amount also are cheaper than mineral fertilizers and have less pollution effect for land and water resources **(Baligar *et al*., 2001)**.

The main objective of this work was to study the effect of two organic fertilizers (chicken manure) rates (100% and 200% of the recommended dose) combined with natural minerals (mixture of natural mineral ore) and natural rocks (phosphate rock and feldspars) on growth, yield and mineral contents of cowpea (*Vigna unguiculata* L.) cv. "Kafr-El Sheikh".

MATERIALS AND METHODS

Two field experiments was carried out at the Experimental Farm, Fac. Environ. Agric. Sci., Arish University, North Sinai, Egypt, during the summer seasons of 2014 and 2015.

Seeds were sown on 15th and 18th April in the first and second seasons, respectively. The plot area was 10m^2 (1.0m in width × 10m in length). The planting density was 26.6 plants/m^2 (15 cm between hills in two drill rows, 50 cm between drills and two plants/hill). Seeds of cowpea were inoculated with rhizobium bacteria (*Bradyrhizobia sp. japonicum*) about two hours before sowing in a wet soil.

Drip irrigation system was used. Chicken manure (ChM) was added during soil preparation by two rates (100% and 200% of the recommended dose (15m^3/fad). Mixture of natural mineral ore (4 ton/fad), phosphate rock and feldspars (2 ton/fad) were added for nine treatments including the control. These nine treatments were randomly arranged in a randomized complete block design with three replicates.

The physical and chemical analyses of the used soil and irrigation water are presented in Tables 1 and 2.

Conventional culture practices were done as needed and were similar to those used in commercial cowpea production in North Sinai region.

Experiment treatments:

T_1. 100% of recommended dose as the (control treatment).
T_2. 100% of Organic manure (kg/fad.).
T_3. 100% of Organic manure + Mixture of nitrogen minerals.
T_4.100% of Organic manure + Phosphate rock (PR) + Feldspars.
T_5. 100% of Organic manure + Mixture of nitrogen minerals + Phosphate rock + Feldspars.
T_6. 200% of Organic manure.
T_7. 200% of Organic manure + Mixture of nitrogen minerals.
T_8. 200% of Organic manure + Phosphate rock + Feldspars.

Table 1: The chemical properties of irrigation water.

pH	EC (dsm^{-1})	Soluble ions (mgl^{-1})							
		Cations				Anions			
		Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	Cl^{-}	HCO_3^{-}	SO_4^{-2}	CO_3^{-2}
7.3	5.4	16.33	17.60	35.87	0.27	42.26	6.13	21.41	18.53

Table 2: The physical and chemical properties of the experimental soil*

Property	1st season (2014)	2nd season (2015)
Physical properties		
Texture	**Sandy clay loam**	**Sandy clay loam**
Chemical properties		
pH	7.18	7.22
EC (dsm^{-1})	1.30	0.98
Total N (ppm)	15.22	16.83
Total P(ppm)	0.33	0.36
Total K (ppm)	0.68	0.71

* Soil samples were taken from the 25 cm of the soil surface.

T_9. 200% of Organic manure + Mixture of nitrogen minerals + Phosphate rock + Feldspars.

These nine treatments were randomly arranged in a randomized complete block design, with three replicates.

Data Recorded

Vegetative growth parameters

Three plants from each replicate were randomly taken at 45 and 60 days after sowing (DAS) and the following data were recorded

Fresh weight / plant (g)

Fresh weight of root, stem, leaves and nodules/plant were determined from total fresh weight /plant was calculated.

Dry weight / plant (g)

Different plant parts of cowpea plant samples were oven dried at 70°C until constant weight and the dry weight of root, stem, leaves and nodules/plant were determined and total dry weight was calculated.

Yield and its components

Plants were harvested after about four months at seed maturity stage and the following data were calculated.

Number of pods /plant, pod length (cm), number of seeds/pod, weight of seeds/pod (g), dry seeds yield (ton/fed.) and seed index (weight of 100 seeds) (g).

Statistical analysis

The obtained data were subjected to statistical analysis of variance according to **Snedecor and Cochran (1980)** and means separation was done according to **Duncan's** multiple range test **(Duncan, 1955)**.

RESULTS AND DISCUSSION

Fresh Weight

Results presented in Table 3 illustrate that fertilizing cowpea plant with T_6, T_7 and T_9 significantly ($p \geq 0.05$) increased fresh weight of roots at 45 and 60 DAS, while insignificant differences was observed with T_8 at 60 DAS in the 1st season. However, all treatments included 200% organic manure and their combinations showed the best values of root fresh weight at 60 DAS in both seasons.

Concerning leaves fresh weight, results revealed that the application of T_6 (200% ChM) achieved the highest value at 45 and 60 DAS in the 1st season. However, in the 2nd season T_7 (200% ChM + mix. natural mineral) was the best treatment at both times with no significant differences compare with (T_6) at 45 days after sowing. Regarding stem fresh weight, the application of 200% ChM (T_6) and 200% ChM + PR + feldspar (T_8) were superior treatments at 45 DAS in the first season. On the other hand, the highest values of stem fresh weight were obtained with applications of (T_6) and (T_7) in the second season. These results may be in connection with **Taura and Fatima (2008)** who reported that the highest value obtained for cowpea stem circumference was in treatment with organic manure.

In addition, nodules fresh weight of cowpea plant at 45 DAS in 1st season had high significant values with application of double organic manure and their combinations with natural nutrient sources. On the other hands, cowpea plants treated with T_7 (200% ChM + mix. natural mineral) exhibited the best result in the 2nd season without significant differences compare with T_9 (200% ChM + mix. natural mineral + PR + feldspar) at 60 DAS.

Organic manures had significant effect on the production of more nodules in cowpea plants. This agreed with the findings of **Madukwe *et al.* (2008)** who found that the maximum quantity of nodules was observed from plots that received poultry manure treatment as compared with untreated plots. Concerning total fresh weight of cowpea plants, the results showed that fertilizing with 200% ChM (T_6) was the superior treatment at both times in 1st season. However, in 2nd season (T_7) gave the highest values for total fresh weight/plant.

Generally, it could be concluded that the best treatment for increasing fresh weight of cowpea plant was the application of T_6 (200% ChM) and T_7 (200% ChM + mix. natural mineral). The increment in total fresh weight due to the high amounts of organic manure may be due to the increments in fresh weight of different plant organs as fresh weight of leaves, stems, roots, and nodules. The relative increasing in total fresh weight due to applications of the same previous treatments (T6 and T7) were 143.1% and 138.3% in the 1st season at 45 and 60 DAS, respectively and 146.5% and 141.4% in the 2nd season at 45 and 60 DAS, respectively. The increment in plant growth as well as fresh weight of cowpea plant due to applications of 200% ChM and 200% ChM + mix. natural mineral may be owe to application of high dose of organic manure under sandy soils. Organic manure enhanced physical and chemical properties of sandy soil by increasing its ability to reserve water and nutrients and increasing its cation exchange capacity.

Table 3: Effect of organic fertilizer, natural nutrient sources and their combination on fresh weight of root, leaves, stem, nodules and total fresh weight of cowpea plant

Treatment	F.W of Root (g.)/plant		F.W of Leaves (g.)/plant		F.W of Stem (g.)/plant		F.W of Nodules (g.)/plant		Total fresh weight of Plant(g.)	
	Days after sowing (DAS)									
	45	60	45	60	45	60	45	60	45	60
	First Season (2014)									
T_1: The recommended dose (control)	6.400d	8.460bc	66.67f	74.20fg	42.47de	46.77e	2.540de	3.403de	118.1f	132.8f
T_2: 100% ChM	6.220d	7.710c	64.07f	73.80g	38.60fF	43.37f	1.963e	3.037e	110.8g	127.9g
T_3: 100%ChM+mix. natural mineral	6.990cd	7.760c	73.93e	78.27e	41.33ef	46.83e	2.253de	3.627d	124.5e	136.5e
T_4: 100%ChM+PR+feldspar	7.370cd	8.727bc	65.67f	76.63ef	43.07de	47.50e	2.743cde	3.877cd	118.8f	136.7e
T_5: 100%ChM+mix. natural mineral+PR+feldspar	7.353cd	9.337b	78.13d	84.43d	45.33d	50.43d	3.080bcd	4.197bc	133.9d	148.4d
T_6: 200% ChM	10.61a	12.03a	91.97a	99.93a	62.87a	67.27ab	3.670ab	4.477ab	169.1a	183.7a
T_7: 200% ChM+ mix. natural mineral	9.350ab	11.85a	86.93b	95.97b	58.70b	65.47b	4.243a	4.803a	159.2b	178.1b
T_8: 200% ChM+PR+feldspar	8.447bc	11.87a	83.53c	90.60c	63.77a	68.50a	3.827ab	4.323abc	159.6b	175.3bc
T_9: 200%ChM+mix. natural mineral+PR+feldspar	9.933ab	11.99a	85.40bc	93.97b	54.67c	61.53c	3.513abc	4.543ab	153.5c	172.0c
	Second Season (2015)									
T_1: The recommended dose (control)	6.607b	8.437b	70.37f	79.37g	43.10g	46.63f	2.230ef	2.963f	122.3g	137.4g
T_2: 100% ChM	6.357b	8.073bc	67.17g	76.73h	40.97h	44.30g	1.810f	2.530f	116.3h	131.6h
T_3: 100%ChM+mix. natural mineral	7.420ab	8.607b	78.27e	86.37f	45.20f	48.67e	2.377e	2.937e	133.3f	146.6f
T_4: 100%ChM+PR+feldspar	7.540ab	8.597b	80.73d	89.07e	50.80d	54.60d	2.467de	3.260d	141.5e	155.5e
T_5: 100%ChM+mix. natural mineral+PR+feldspar	7.767ab	9.100b	85.77c	95.53d	49.00e	54.73d	2.673cde	3.597c	145.2d	163.0d
T_6: 200% ChM	9.247a	11.18a	98.80a	107.2b	64.70ab	68.57a	3.107bc	4.183b	175.9b	191.1b
T_7: 200% ChM+ mix. natural mineral	8.663a	9.850ab	100.9a	110.9a	65.63a	69.03a	3.970a	4.600a	179.2a	194.4a
T_8: 200% ChM+PR+feldspar	10.45a	11.58a	94.30b	104.5c	58.60c	64.50c	2.953bcd	4.300b	166.3c	184.9c
T_9: 200%ChM+mix. natural mineral+PR+feldspar	9.470a	10.99a	92.20b	107.9b	63.50b	66.67b	3.403b	4.457ab	168.6c	190.0b

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test.

Dry weight

Results in Table 4 show the effect of combinations among organic fertilizer and natural nutrient sources on dry weight of cowpea plant. The data revealed that application of 200% ChM (T_6) and their combinations had significant effect on dry weight of roots in 1st season at 45 and 60 DAS. However, in 2nd season, the applications of T_4, T_5, T_6, T_7, T_8 and T_9 increased dry weight of roots at 45 and 60 DAS while insignificant differences was observed with application of T_3 (100% ChM + mix. natural mineral) at 60 DAS. For leaves dry weight, results showed that cowpeas treated with T_6 (200% ChM) gave the highest values of leaves dry weight at both times (45 and 60 DAS) without significant differences than T_7 (200% ChM + mix. natural mineral) at 60 DAS in the 1st season. Moreover, all combinations in the 2nd season of multiplier organic manure and natural nutrient sources increased this trait at 45 DAS. Applications of 200% ChM + mix. natural mineral (T_7) and 200% ChM + mix. natural mineral + PR + feldspar (T_9) recorded the best values for leaves dry weight at 60 DAS. In this respect, **Esmat *et al.* (2014)** reported that effect of chicken manure on fresh weight, dry weight and number of leaves of cowpea plants was very significant.

Concerning stem dry weight, the same data indicate that application of T_6 (200% ChM) and their combinations increased the dry weight of stem at 45 DAS in both seasons. Applications of T_6, T_7 and T_8 in the first season and T_6 and T_7 in the second season recorded the high values at 60 DAS. This result is in harmony with the findings of **Yan and Xu (2002)** who indicated that dry weights of stem, leaves and root of groundnut grown in organic fertilizer were significantly higher than those in chemical fertilizer.

Concerning nodules dry weight, the data revealed that applications of T_6, T_7, T_8 and T_9 had the highest significant effect on dry weight of nodules in both seasons at 45 DAS, except T_8 in the second season. In addition, both of T_7 and T_9 recorded the high values for dry weight of nodules at 60 DAS in the both seasons. In this connection, **Ofori (2016)** found significant differences in cowpea nodule dry weight, where the application of rock phosphate fertilizer blend (34.35 kg P_2O_5) gave the highest nodule dry weight. In addition, **Joshi, Deepa *et al.* (2016)** reported that different organic manure treatments had significant influence on the growth attributes of cowpea such as plant height, leaf area index and dry weight of the root nodules plant^{-1}. Higher dry weight of root nodule with organic manure application was might be due to favourable effect of organic manures in improving the overall physical, chemical and biological properties of the soil and enhancing symbiosis with nodule bacteria thereby increasing activity of rhizobium in the roots.

For total dry weight, cowpea plants at 45 and 60 DAS in the 1st season were significantly increased with application of 200% ChM (T_6) and 200% ChM + mix. natural mineral (T_7) while insignificant differences were observed with application of 200% ChM + PR + feldspar (T_8) at 60 DAS. However, total dry weight was increased with application of double organic manure (T_6) and their combinations (T_7, T_8 and T_9) at both times in the 2nd season. In general, it could be noticed that application of 200% ChM and application of 200% ChM + mix. natural mineral were the best treatments for increasing total dry weight of cowpea plants. The increment in dry weight of cowpea plant may be owe to the increment in fresh weight of plant (Table 3).

Yield and Its Components

Results in Table 5 reveal that all treatments of combinations among organic manure and natural nutrient sources had

significant effects p value < 0.05, except number of pods/plant in both seasons and seed index in the 1st season, (T_9) recorded the highest value for all studied traits. There were no significant differences with application of T_6, T_7 and T_8 in both seasons plus T_5 in the 1st season for pod length. Concerning weight of seeds/pod data indicated that only two combinations (T_7 and T_9) recorded the highest values in both seasons. For yield, it was obviously increased with application of 200% ChM and their combinations in the 1st and 2nd seasons, as well as, application of T_5 (100% ChM + mix. natural mineral + PR + feldspar) in both seasons and T_1, T_3 and T_4 in the 2nd season without significant differences among the previous treatments.

Regarding the weight of 100 seeds/plant (seed index), no significant differences were observed between treatments in 1st season. However, in the 2nd season the application of most treatments (T_3, T_4, T_5, T_6, T_7, T_8 and T_9) increased seed index and T_9 recorded the highest value. These results are coincide with those reported by **El-Hadidi *et al.* (2014)** who studied using some natural materials as fertilizers (phosphate rock, sulfur ore, potassium rock and feldspar) on yield and weight of 100 seeds after harvesting of pea and found a significant increase with using these natural materials. Moreover, under any level of fertilization with some natural materials pea plants were superior for increasing the values of all traits than those obtained from the untreated plants. Cowpea yields from phosphate rocks combined with poultry manure were superior **(Akande *et al*. 2005)**. The residual effect of one time application of the phosphate rock was able to sustain four successive cropping of maize and cowpea.

Shafeek *et al*. (2005) reported that the highest growth, yield, yield components, protein, N and K in plant and seeds contents of legumes crop were obtained by adding 360 kg/fed natural rock potassium (feldspar). They added that using natural rock phosphorus and potassium fertilizers at reclaimed lands will give pods, seed yield and quality close to those obtained by chemical phosphorus and potassium application, with no significant difference among them. Phosphorus application also improved some yield attributes taken into consideration in this study: number of pods, length of pods, number of seeds, seed yield and weight of 100 seeds. This is in conformity with the findings of other workers **(Okeleye and Okelana, 2000; Ntare and Bationo, 2002; Singh *et al*., 2011; Ndor *et al*., 2012; Haruna and Usman, 2013; Nyoki *et al*., 2013)** who also discovered significant increase in yield of cowpea in response to phosphorus application.

CONCLUSION

From obtained results it was concluded that using of organic fertilizers and natural nutrient sources as a soil drench management has the prospective to enhance cowpea plant nutrient status and boost plant growth. Fertilizing with (200% of organic manure + mixture of natural mineral ore + phosphate rock + feldspars) is recommended for cowpea production cv. "Kafr-El Sheikh" in El-Arish region and similar areas.

REFERENCES

Abioye, O.F. and Nwoke, O.C. (2016). Phosphate rock: origin, importance, environmental impacts and future roles. Environmental Review 24 (4): 403-415.

Akande, M.O.; Adediran, J.A. and Oluwatoyinbo, F.I. (2005). Effects of rock phosphate amended with poultry manure on soil available P and yield of maize and cowpea. Afr. J. Biotechn. 4 (5): 444-448.

Akintokum, O.O.; Adetunji, M.T. and Akintokun, P.O. (2003). Phosphorus availability to soybean from an indigenous phosphate rock sample in soils from southwest Nigeria. Nutr. Cyclagroeco., 65: 35-41.

Table 4: Effect of organic fertilizer, natural nutrient sources and their combination on dry weight of roots, leaves, stem, nodules and total dry weight of cowpea plant

Treatment	D.W of Root (g.)		D.W of Leaves (g.)		D.W of Stem (g.)		D.W of Nodules (g.)		Total dry weight of Plant (g.)	
	Days after sowing									
	45	60	45	60	45	60	45	60	45	60
					First Season(2014)					
T_1: The recommended dose (control)	2.265d	2.720cd	8.957e	9.670d	4.257cd	4.553d	0.5184c	0.7175e	15.99cd	17.66d
T_2: 100% ChM	2.146d	2.437d	8.503e	9.450d	3.863d	4.500d	0.3632d	0.6189f	14.87d	17.00d
T_3: 100%ChM+mix. natural mineral	2.342cd	2.620cd	9.450de	9.823d	4.227cd	4.613d	0.4863c	0.7511de	16.51c	17.81d
T_4: 100%ChM+PR+feldspar	2.417bcd	2.823cd	8.633e	9.800d	4.573abcd	4.397d	0.5454bc	0.7924d	16.17cd	17.81d
T_5: 100%ChM+mix. natural mineral+PR+feldspar	2.484abcd	3.017c	9.997cd	11.18c	4.423bcd	4.840cd	0.6374b	0.8472c	17.32c	19.89c
T_6: 200% ChM	3.114a	4.447a	12.59a	13.15a	5.470a	5.757ab	0.7929a	0.8774bc	21.96a	24.23a
T_7: 200% ChM + mix. natural mineral	3.027ab	3.927b	11.47b	12.74ab	5.170abc	5.723ab	0.8661a	0.9665a	20.53ab	23.36ab
T_8: 200% ChM +PR+feldspar	2.790abcd	4.220ab	10.85bc	12.27b	5.340ab	5.940a	0.8103a	0.8513c	19.78b	23.28ab
T_9: 200%ChM+mix. natural mineral+PR+feldspar	2.927abc	4.267ab	11.26b	12.52b	5.063abc	5.233bc	0.7705a	0.9119ab	20.01b	22.93b
					Second Season(2015)					
T_1: The recommended dose (control)	2.273b	2.500ab	9.257de	9.997e	4.368cd	4.460fg	0.4004d	0.6058f	16.30de	17.56d
T_2: 100% ChM	2.027bc	2.110b	8.857e	9.987e	4.054d	4.250g	0.3880d	0.5322g	15.33e	16.88d
T_3: 100%ChM+mix. natural mineral	2.410b	2.837ab	9.847cd	11.29d	4.533cd	4.833ef	0.4843c	0.5818fg	17.27cd	19.55c
T_4: 100%ChM+PR+feldspar	2.440ab	2.620ab	10.41c	11.81d	4.888bcd	5.113de	0.5237c	0.6725e	18.25bc	20.22c
T_5: 100%ChM+mix. natural mineral+PR+feldspar	2.533ab	3.010ab	11.19b	12.81c	4.631cd	5.057de	0.5563c	0.7335d	18.91b	21.61b
T_6: 200% ChM	3.037a	3.840a	13.09a	13.63b	5.783a	6.053ab	0.7380ab	0.7946c	22.64a	24.32ab
T_7: 200% ChM + mix. natural mineral	2.847a	3.257a	13.14a	14.33a	5.893a	6.397a	0.7907a	0.9306a	22.67a	24.91a
T_8: 200% ChM +PR+feldspar	3.207a	4.027a	12.59a	13.32bc	5.218abc	5.540cd	0.6923b	0.8660b	21.88a	23.65ab
T_9: 200%ChM+mix. natural mineral+PR+feldspar	3.163a	3.740a	12.53a	13.81ab	5.567ab	5.643bc	0.7583ab	0.8925ab	22.01a	24.08ab

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test.

Table 5: Effect of organic fertilizer, natural nutrient sources and their combination on dry seed yield and pod characters

Treatment	No. of pods/plant	Pod length(cm)	No. seeds/pod	Weight of seeds/pod(g)	Yield ton/fed	Seed index(g)
				First Season(2014)		
T_1: The recommended dose (control)	18.36a	17.17e	10.11c	1.537e	1.167d	14.47a
T_2: 100% ChM	18.01a	17.00e	10.15c	1.520e	1.100d	14.13a
T_3: 100%ChM+mix. natural mineral	19.46a	17.23de	10.21c	1.600de	1.233bcd	14.67a
T_4: 100%ChM+PR+feldspar	18.43a	17.37cde	10.78bc	1.573e	1.200cd	15.07a
T_5: 100%ChM+mix. natural mineral+PR+feldspar	19.02a	17.53bcde	10.87bc	1.663cd	1.267abcd	15.20a
T_6: 200% ChM	19.90a	18.13abcd	11.35ab	1.740bc	1.367abc	15.73a
T_7: 200% ChM + mix. natural mineral	22.03a	18.30abc	12.15a	1.783ab	1.400ab	16.20a
T_8: 200% ChM +PR+feldspar	20.30a	18.33ab	11.43ab	1.747b	1.433a	15.77a
T_9: 200%ChM+mix. natural mineral+PR+feldspar	21.54a	18.57a	12.20a	1.830a	1.433a	16.30a
				Second Season(2015)		
T_1: The recommended dose (control)	19.87a	17.33bc	10.17de	1.547g	1.200ab	14.40b
T_2: 100% ChM	18.63a	17.30bc	10.00e	1.520g	1.133b	14.33b
T_3: 100%ChM+mix. natural mineral	20.00a	17.57bc	10.43cde	1.607ef	1.267ab	14.97ab
T_4: 100%ChM+PR+feldspar	19.73a	17.17c	10.67cde	1.563fg	1.200ab	15.60ab
T_5: 100%ChM+mix. natural mineral+PR+feldspar	20.50a	18.17ab	11.13bcd	1.623de	1.367ab	15.67ab
T_6: 200% ChM	21.27a	18.63a	11.37abc	1.677cd	1.400ab	15.97ab
T_7: 200% ChM + mix. natural mineral	21.50a	18.77a	12.10ab	1.740ab	1.433ab	16.27ab
T_8: 200% ChM +PR+feldspar	21.93a	18.80a	12.00ab	1.727bc	1.500ab	16.47ab
T_9: 200%ChM+mix. natural mineral+PR+feldspar	21.93a	18.60a	12.20a	1.793a	1.567a	16.97a

Values having the same alphabetical letter(s) did not significantly differ at 0.05 level of significance according to Duncan's multiple range test.

Baligar, V.C., Fageria, N.K. and Z.L.H. (2001). Nutrient use efficiency in plants. Communications in Soil Sci. and Plant Analysis. 32: 921.9 50.

Baloch, A.F. (1994). Vegetable Crops. In: Horticulture. Pp:525-6.Edited by Elena Bashir and Robyn Bantel. National Book Foundation, Islamabad .Pakistan.

Belane, A.K. and Dakora, F.D. (2009). Measurement of N_2 fixation in 30 cowpea (*Vigna unguiculata* L. Walp.) genotypes under field conditions in Ghana, using the15N natural abundance technique. Symbiosis 48 (1-3): 47-56.

Duncan, D.B. (1955). Multiple range and Multiple F test. Biometrics, 11: 1-42.

El-Hadidi, E.M.; Mosa, M.M. and El-Azab, M.F.S. (2014). Pea yield quality and nutrient uptake as affected by using some natural materials. J. Soil Sci. and Agric. Eng., Mansoura Univ., 5 (11): 1427-1439.

Esmat, F., Mobasser, H.R. and Akbarian, M.M. (2014). Effect of organic fertilizer on wet weight, dry weight and number of leaves in cowpea. J. Nov. Appl. Sci., 3 (4): 440-443.

Haruna, I.M. and Usman, A. (2013). Agronomic efficiency of cowpea varieties (*Vigna unguiculata* L. Walp) under varying phosphorus rates in Lafia, Nassarawa state, Nigeria. Asian J. Crop Sci., 5: 209-215.

Joshi, Deepa, Gediya, K.M.; Patel, J.S.; Birari, M.M. and Gupta, S. (2016). Effect of organic manures on growth and yield of summer cowpea (*Vigna unguiculata* L. Walp) under middle Gujarat conditions. Agric. Sci. Digest., 36 (2): 134-137.

Madukwe D.K., Christo, I.E.C. and Onuh, M.O. (2008). Effects of organic manure and cowpea (*Vigna unguiculata* L. Walp) varieties on the chemical properties of the soil and root nodulation. Sci. World J. Vol. 3 No. 1 (2008) Internet Paper Accessed 15/10/09.

Ndor E., Dauda, N.; Abimuku, E.; Azagatu, D. and Anzaku, H. (2012). Effect of phosphorus fertilizer and spacing on growth, nodulation count and yield of cowpea (Vigna unguiculata L. Walp) in southern guinea savannah of Nigeria. Asian J. Agric. Sci., 4: 254-257.

Ntare, B.R. and Bationo, A. (2002). Effects of phosphorus on yield of cowpea cultivars intercropped with pearl millet on Psammentic Paleustalf in Niger. Spring. Link 32(2): 143-147.

Nyoki, D. and Ndakidemi, P.A. (2013). Economic benefits of bradyrhizobium japonicum inoculation and phosphorus supplementation in cowpea (*Vigna unguiculata* L. Walp) grown in northern Tanzania. Amer. J. Res. Communication, 1(11): 173-189.

Ofori, P. (2016). Yield response of soybean and cowpea to rock phosphate fertilizer blend and rhizobial inoculation on two Benchmark soils of Northern Ghana, Thesis Ph.D., Fac. Agric. College Agric. and Natural Resources, Kwame Nkrumah Univ. Sci. and Techno., Kumasi, Ghana.

Okeleye, K.A. and Okelana, M.A.O. (2000). Effect of phosphorus fertilizer on nodulation, growth, and yield of cowpea (*Vigna unguiculata*) varieties. Indian J. Agric. Sci., 67(1): 10–12.

Shafeek , M.R., El-Zeiny, O.A.H. and Ahmed, M.E. (2005). Effect of natural phosphate and potassium fertilizer on growth, yield and seed composition of pea plant in new reclaimed soil. Asian J. Plant Sci., 4: 608-612.

Sheahan, C.M. (2012). Plant guide for cowpea (*Vigna unguiculata* L. Walp) USDA- Natural Resources Conservation Service, Cap May Plant Materials Center, Cap May, Nj.

Singh, A.; Baoule, A.L.; Ahmed, H.G. Aliyu, U. and Sokoto, M.B. (2011). Influence of phosphorus on the performance of cowpea (*Vigna unguiculata* L. Walp) varieties in the Sudan Savannah of Nigeria. Agric. Sci., 2: 313-317.

Snedecor, G.W. and Cochran, W.G. (1980). Statistical methods 7th Ed. Iowa State Univ. Press. Ames. Iowa, USA

Taura D.W. and Fatima, M.S. (2008). Effects of organic and inorganic fertilizers on the vegetative and reproductive parts of some selected varieties of cowpea (*Vigna unguiculata*). African J. General Agri., 4 (2):79-86.

Yan Pei-Sheng and Xu Hui-Lian. (2002). Influence of EM Bokashi on nodulation, physiological characters and yield of peanut in nature farming fields. J. Sustain Agric; 19(4): 105-12.

الملخص العربي

الزراعـــة العضـــوية لمحصـــول اللوبيـــا تحـــت ظـــروف منطقـــة العريـــش

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أجريت تجربة حقلية بالمزرعة التجريبية لكلية العلوم الزراعية البيئية، جامعة العريش، محافظه شمال سيناء، مصر في صيف موسمي ٢٠١٤ و٢٠١٥. كان الهدف من هذه التجربة هو دراسة تأثير التوليفات من معدلين من السماد العضوي (١٠٠% و٢٠٠% من الكمية الموصي بها) مع استخدام المعادن والصخور الطبيعية (مخلوط المعادن الطبيعية وصخر الفوسفات و صخر الفلسبار) على نمو وإنتاجية محصول اللوبيا صنف "كفر الشيخ" تحت ظروف الأراضي الرملية بشمال سيناء باستخدام نظام الري بالتنقيط. تم استخدام تصميم القطاعات كاملة العشوائية في ثلاث مكررات. كانت أهم النتائج التي تم التوصل إليها هي أن معاملة نباتات اللوبيا بالكميات المضاعفة من السماد العضوي (سماد الكتكوت) وبمصادر المغذيات الطبيعية (مخلوط المعادن الطبيعية، صخر الفوسفات، الفلسبارات) نتج عنها تأثيرا معنويا على معظم الصفات التي تم دراستها (النمو الخضري، المحصول ومكوناته).

الكلمات الاسترشادية: اللوبيا، المادة العضوية، مخلوط المعادن الطبيعية الخام, صخر الفوسفات، الفلسبارات، المحصول.