FACULTY OF AGRICULTURE

Minia J. of Agric. Res. & Develop.
Vol. (36), No. 2, pp. 343-355, 2016

EVALUATION OF GLAUCONITE DEPOSITS AS AN AMENDMENT FOR SANDY SOIL 1- PRELIMINARY STUDIES

M. A. Morsy, O .H .Darwish and N. G. Eldawwy

Soil Science Department, Faculty of Agric., Minia University, Egypt.

Received: 8 May (2016) Accepted: 7 August (2016)

ABSTRACT

Glauconite "Green Sand" is an iron potassium phyllosilicate mineral (mica group) , green in color , very low weathering resistance and very friable. Preliminary studies were carried out to study the possibility of using glauconite deposits as an amendment for sandy soils. Two glauconite deposits were used, the coarse textured (CG), and the fine textured (FG) . Two gluaconite types were collected from Al-Bahria Oasis, New valley, Egypt. Two pot experiments were carried out using a sandy soil. Soil was cultivated with faba bean or peas and set up to study the efficiency of using glauconite as a soil amendment. Each glauconite (fine or coarse) was applied to the sandy soil at six rates (0, 2, 4, 6, 8 and 10 ton/feddan). Analysis of the two types of glauconite showed that Ec in FG is higher than that in CG , however pH of FG is lower than that in CG. FG contain clay+silt % ,K and Zn more than CG , however, CG contain organic carbon, P, Fe and Mn more than FG Application of the two glauconite deposits at the rate of 8 ton/feddan to the sandy soil increased the plant height, fresh and dry weight as well as water use efficiency for both "faba bean and peas shoots". In general, application of glauconite improves the water use efficiency and enhances the plant growth. It could be recommended that using of glauconite at 8 ton/feddan is beneficial for the plant growth in sandy soil under the conditions of EI-Minia Governorate, Egypt.

Key words: Sandy soil, glauconite, amendment , faba beans and peas

INTRODUCTION

It is a naturally occurring mineral mined from ocean sedimentary rock known as "greensand". It is often an olive-green colored sandstone rock found in layers in many sedimentary rock formations.The major chemical description of glauconite is ($(K,Na)(Fe^{+3},Al,Mg)_2(Si,Al)_4O_{10}(OH)_2$). Greensand deposits are found all over the world. The pH of the glauconite varies from slightly acidic to slightly alkaline depending on the source and has little effect of soils. (Abudelgawad *et al.*, ,1975).

Glauconite is the name given to a group of naturally occurring iron potassium phyllosilicat mineral (mica group), green in color, very low weathering resistance and very friable. composed of pellets or grains . (Odin and Letolle , 1980).

Greensand has been used for over 100 years as a natural source of slow release fertilizer and soil conditioner .The slow release of potassium and phosphate does not burn plants and the minerals improve the moisture holding properties. Glauconite is often used in compost piles to increase the nutrient content and diversity of beneficial microbes. (El-Amamy *et al.*, , 1982).

A field test by Rutgers University in a sandy loam soil with greensand applied in the row at the time of planting, found that application of greensand increased the yield of potatoes. The benefits of greensand, largely unexplained by scientific research are far more than a laboratory analysis would indicate. However numerous greenhouse and field studies had shown significant improvements in the growth of plants. Other studies had shown that the use of greensand improved the taste, color, nutritional value, the health of plants and the soil health. (Ejlmann *et al.*, , 1963).

Bambalov and Sokolov, (1998) Suggested that the glauconite is an improving agent for accelerated cultivation of soils with low fertility and damage in Belarus, United Arab Emirates and Egypt.

Petkova *et al.*, , (1998) and Pishmanov and Petkova, (2002) reported that Lucerne and Wheat can be grown on glauconite-phosphorite substrate without any addition of mineral fertilizers.

Many agronomic studies discussed the potential of glauconite as soil additive that gradually release potassium essential for plant growth (Prokoshev *et al.*, , 1992; Mazumder *et al.*, , 1993; Rao *et al.*, , 1996; Nosko, 1998; Akhtar and Jenkins., 1999 and Griffioen, 2001).

Vasiljiv and Kozhemayakin , (2007) found that glauconite increased potato yield and stimulated plant adaption capacity.

In Egypt, according to El-Aref *et al.*, (1999) the thickness of the overlying glauconite sediments varies from up to 25 m in the Western and Eastern Wadis areas to less than 1 m in the high central area, El-Gideda mine of Bahria Oasis.

Glauconites occur in the Western Desert associated with phosphorites and iron ores (Baioumy, 2007) .

For attaining and maintaining self-sufficiency in food and grain production, potassium fertilization is playing an important role in Egyptian agriculture. Egypt is dependent on imports of potash fertilizers to meet its annual requirements. In order to reduce the dependence on imported potash fertilizers, Glauconite (a potash mineral) has been identified as an indigenous alternative source of potash. Its application in the field is economic as well as eco-friendly as there is no losses of nutrients from this mineral and its price is cheaper than the imported potash; huge resources are found in many localities in the Western Desert (Baioumy , 2007)

Glauconite ores can be used instead of K_2SO_4 fertilizer and a base of ecological agriculture because they are not only an alternative of mineral fertilizers but they also can increase soil fertility(Eid, 2012).

The main objective of the present study was to evaluate the impact of the two glauconite types on growth and water use by faba bean and peas plants.

MATERIALS AND METHODS

Soil:

The soil used in this study was sandy loam in texture and was collected from the newly reclaimed desert land at the Western district of the Nile Valley, West of Samalout , El-Minia Governorate, Egypt . Some analytical data of the studied soil are given in Table (1).

Glauconite deposits:

Two glauconite deposits were tested in the current study, these deposits were collected from Al-Bahria Oasis, New Valley governorate , Egypt. Each deposit of glauconite (Fine or Coarse) was thoroughly mixed. A representative sample was taken from each deposit and analyzed for the particle size distribution , pH , EC , P, K, Fe ,Mn , Zn and Cu. Some analytical data of the two tested glauconites are presented in Table(2).

Table 1: Some analytical data of the studied soil

Soil properties		Value
Particle size distribution: (%)	Coarse sand	41.80
	Fine sand	30.08
	Silt	10.20
	Clay	17.92
Texture		Sandy loam
pH (1:2.5)		7.74
$CaCO_3$ (%)		12.80
OM (%)		0.15
EC dS/m (soil paste extract)		2.73
Soluble cations (meq/l) :		
Na^+		3.10
K^+		1.10
Ca^{2+}		2.10
Mg^{2+}		1.70
Soluble anions (meq/l) :		
Cl^-		4.10
HCO_3^-		0.80
CO_3^{2-}		----
SO_4^{2-}		2.10
Available P (ppm)		16.00
Available K (meq/100 g)		0.61
Available Fe (ppm)		2.20
Available Mn (ppm)		0.50
Available Zn (ppm)		0.30
Available Cu (ppm)		0.10

Preliminary studies:

Effect of the tested glauconite deposits (Fine or Coarse) on some vegetative growth parameters and water use efficiency by the faba bean and peas plants.

Set up of the pot experiment.

Two pot experiments were designed for tested glauconites and two plants, the first one was carried out on faba bean plants and the second one on the peas plants. The two tested glauconites were applied to the sandy soil at six application rates (0, 2, 4, 6, 8, and 10 ton/feddan). Each treatment was replicated 4 times. Three kg of air dried treated soil were placed in a plastic pot (14 cm diameter with 20 cm depth). Three seeds of each plant were planted in each pot on 12th December 2013. The plants were thinned and two plants were left to grow in each pot. The plants were received the recommended fertilization of N, P, and K at the equivalent rates of 99 kg N, 62 kg P_2O_5, and 75 kg K_2O/feddan. Irrigation was followed every five days with an amount of water to compensate the loss in moisture which was maintained at the field capacity. After 60 days from planting, the plant height (cm/plant) and water consumptive use by the plants (L/pot) were recorded. The above ground part of each plant was cut. Then, the fresh and dry weights of the plant shoots (g/pot) were recorded. The water use efficiency was calculated as dry matter g/liter of the consumed water.

Laboratory analysis.

a- Physical analysis

Particle size distribution was carried out according to the international pipette method *(Piper, 1950).*

b- Chemical analysis.

1- pH was measured in a 1: 2.5 (soil : water) or (glauconite : water) suspension by pH meter as described by Page *et al., , (*1982).

2- Electrical conductivity was determined in a soil paste extract or glauconite paste extract using an EC meter as described by Page *et al., ,* (1982).

3- Total Carbonates was determined as $CaCO_3$ using the calcimeter apparatus (Scheibler) as described by Houba *et al., ,* (1974*).*

4- Organic matter was determined as total carbon according to Walkley and black`s method (Page *et al., ,* 1982).

5- Soluble cations (Ca^{2+} , Mg^{2+} , Na^{+} and K^{+}) and soluble anions (CO_3 , HCO_3 , Cl^{-} and SO_4^{2-}) were determined according to Page *et al., , (*1982).

6- Available phosphorus was determined by using Olsen`s method according to Page *et al., ,* (1982).

7- Available K was determined in ammonium acetate extract according to Page *et al., ,* (1982).

8- Available Fe , Mn , Zn and Cu were determined in DTPA extract according to Lindsay and Norvell (1978)

Statistical analysis.

All recorded data were subjected to statistical analysis of variance procedure. The means of treatments were compared using the L.S.D according to Gomez and Gomez, (1984).

RESULTS AND DISCUSSION

1- Comparison between the fine glauconite (FG) and coarse glauconite (CG):

As can be seen from results in Table (2), several points and trends are quite clear:

Electrical Conductivity (EC) in FG is higher than that in CG , however, pH of FG is lower than that in CG.

Fine glauconite contains clay + silt % , K and Zn more than CG, however,CG contains organic carbon, P, Fe and Mn more than FG.

2- Effect of glauconite deposits on some vegetative growth parameters and water use by faba bean plants

a- Some faba bean vegetative growth parameters:

Application of the tested Glauconites to the sandy soil generally increased the faba bean vegetative growth parameters (plant height and fresh and dry weights of the plant shoots) compared to those of the untreated soil as shown in Tables 3, 4 and illustrated in figures 1, 2.

Data in Table (3) show that plant height was increased with the increase in FG application rate up to 8 ton/feddan. The relative values of the plant height of the faba bean plants compared to the control were 110, 119 ,119, 121, and 120 % for 2 , 4 , 6 , 8 and 10 ton/feddan , respectively. The corresponding values for CG were 111, 113, 116, 116, and 118 % for 2, 4, 6, 8 and 10 ton/feddan , respectively, (Table 4).

Table 2: Comparison between the two tested glauconite deposits

Glauconite properties		Fine glauconite (FG)	Coarse glauconite (CG)
Particle size distribution (%)	Coarse sand	1.05	29.11
	Fine sand	1.02	20.06
	Silt	7.24	11.68
	Clay	90.69	39.15
Texture		Clay	Sandy clay
pH (1:2.5)		6.10	7.33
Organic Carbon (%)		0.32	0.50
EC, dS/m (soil paste)		17.06	2.83
P (ppm)		7.00	33.00
K (ppm)		846	417
Fe (ppm)		9.80	54.00
Mn (ppm)		3.10	13.60
Zn (ppm)		3.00	1.64
Cu (ppm)		0.50	0.50

Table 3: Effect of fine glauconite (FG) on some vegetative growth parameters and water use by the faba bean plants*

FG treatments (ton/feddan)	Plant height,		Fresh weight,		Dry weight,		Water use			
	Cm	R to C % **	g/pot	R to C %	g/pot	R to C %	WCU ***		WUE ****	
							L/pot	R to C %	g/L	R to C %
0	64.8	100	21.3	100	2.23	100	2.0	100	1.11	100
2	71.3	110	24.4	114	2.48	111	1.9	95	1.31	118
4	77.1	119	29.7	139	2.71	121	2.0	100	1.35	121
6	77.3	119	31.6	148	2.75	123	2.0	100	1.37	123
8	78.3	121	32.0	150	2.98	133	2.0	100	1.49	134
10	77.7	120	31.7	148	2.87	128	2.0	100	1.43	129
L.S.D at 5% level :	0.96		1.32		0.35				0.21	

** Each value is the mean of four replicates.*
*** R to C: Relative to control %*
**** WCU: Water consumptive use (L/pot)*
***** WUE: Water use efficiency (g/L)*

Table 4: Effect of coarse glauconite (CG) on some vegetative growth parameters and water use by the faba bean plants*

CG treatments (ton/feddan)	Plant height,		Fresh weight,		Dry weight,		Water use			
	cm	R to C % **	g/pot	R to C %	g/pot	R to C %	WCU ***		WUE ****	
							L/pot	R to C %	g/L	R to C %
0	66.6	100	24.6	100	2.32	100	2.0	100	1.16	100
2	74.0	111	26.3	106	2.78	119	2.1	105	1.31	112
4	75.8	113	29.0	117	2.92	125	2.0	100	1.46	125
6	77.8	116	30.2	122	2.94	126	2.0	100	1.46	125
8	77.6	116	30.5	123	3.03	130	2.0	100	1.51	130
10	78.6	118	32.5	132	3.12	134	1.9	95	1.65	142
L.S.D at 5% level :	1.67		1.22		0.37				0.22	

Details and symbols as those for Table (3).

The obtained results also indicated that the plant fresh weight was increased with the increase in FG application rate up to 8 ton/feddan . The relative values of the fresh weight of the plant shoots of the faba bean plants were 114, 139 ,148, 150, and 148 % for 2 , 4 , 6 , 8 and 10

ton/feddan , respectively, relative to that of the control treatment (Table 3). The corresponding values for CG were 106, 117 ,122, 123, and 132 % for 2 , 4 , 6 , 8 and 10 ton/feddan ,respectively, (Table 4).

Data in Table (3) and illustrated in figure(1) show that plant dry weight was increased with the increase in the FG application rate up to 8 ton/feddan. Whereas the plant dry weight was increased with the increase in the CG application rate up to 10 ton/feddan. The relative values of the dry weight of the plant shoots of the faba bean plants were 111, 121 ,123, 133, and 128 % for 2 , 4 , 6 , 8 and 10 ton/feddan , respectively, relative to that of the control treatment . The corresponding values for CG were 119, 125 ,126, 130, and 134 % for 2 , 4 , 6 , 8 and 10 ton/feddan , respectively, (Table 4).

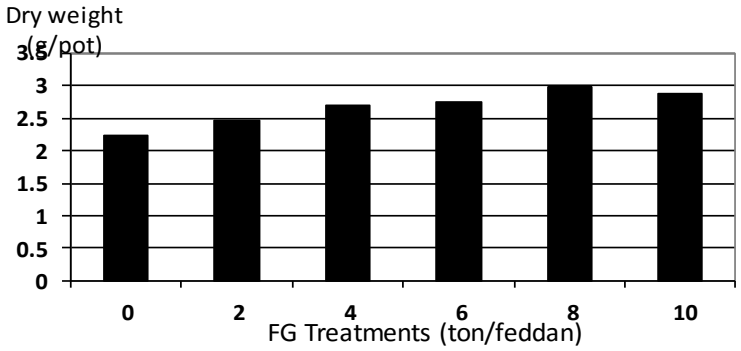

Figure 1: Effect of fine glauconite (FG) on dry weight of the faba bean plants

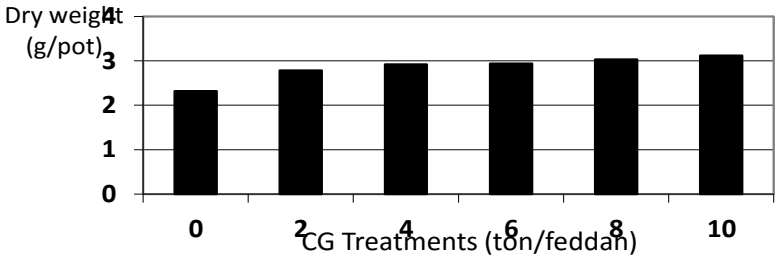

Figure 2: Effect of coarse glauconite (CG) on dry weight of the faba bean plants*

The insignificant decrease in the above mentioned vegetative growth parameters of faba bean plants when using 10 ton/feddan of FG ,compared to 8 ton/feddan, may be due to negative effect of the gradual increase in the salt content of the added FG (EC = 17.06 dS/m) . However, in case of using CG (EC =2.83), the general increase in the above mentioned parameters was proportional to the increase in CG application rate .

The improvement in the studied growth parameters of faba bean plants may be due to the richness of glauconite in P, K, Fe, Mn, Zn, and Cu nutrients (Table 2). Consequently, the faba bean growth was enhanced. The obtained results and the prevailing discussion are in consistent with the findings of Prokoshev *et al.*, ,(1992); Mazumder *et al.*, ,(1993); Rao *et al.*, , (1996); Nosko, (1998); Akhtar and Jenkins, (1999) and Griffioen,(2001).

b - Water consumptive use and water use efficiency by faba bean plants

The water consumptive use by the faba bean plants was slightly affected by increasing the application rate of the glauconite, while, the water use efficiency by the faba bean plants was increased by increasing the application rate of the glauconite (Tables 3 , 4 and figures 3 , 4).

The increase in the water use efficiency by the faba bean plants could be attributed to the increase in the dry weight of the plant shoots. The increase in the water use efficiency by the faba bean plants ranged between 118 to 134 % for 2 and 8 ton/ feddan ,relative to that of the control treatment by using FG , while the range was 112 to 142 % for 2 and 10 ton/ feddan ,relative to control by using CG

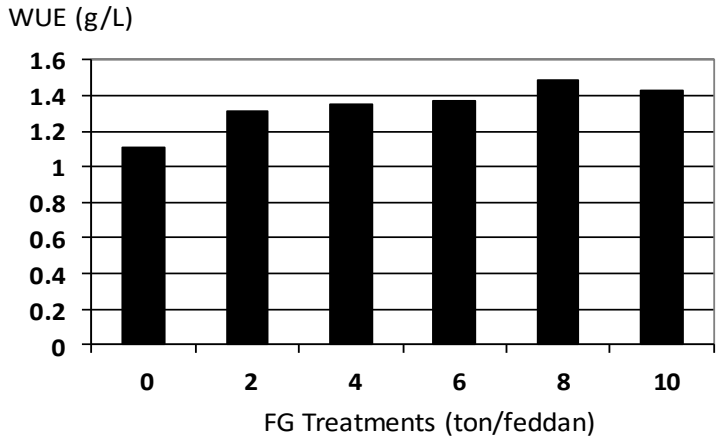

Figure 3: Effect of fine glauconite (FG) on water use efficiency by the faba bean plants

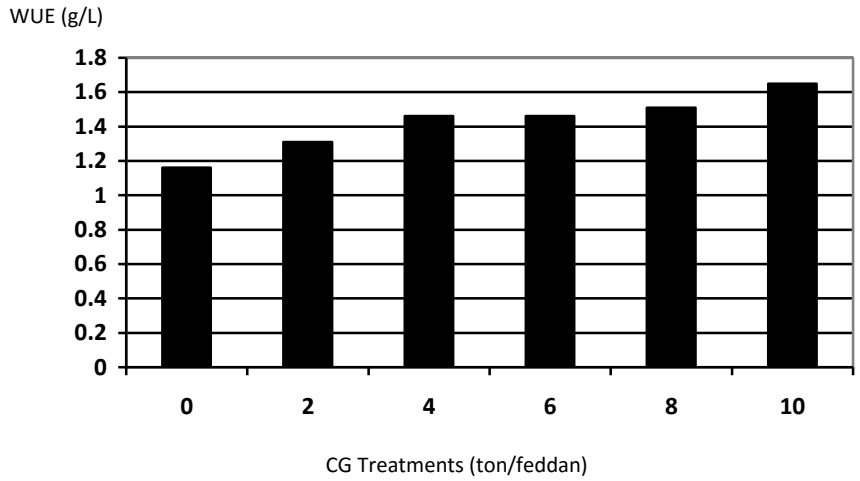

Figure 4: Effect of coarse glauconite (CG) on water use efficiency by the faba bean plants

The increase in water use efficiency by faba bean plants grown in the treated soil with glauconite may be due to the increase in dry matter with the constancy of water consumption. These results are in harmony with those reported by Pishmanov and Petkova (2002).

3 - Effect of the two tested glauconite deposits on some vegetative growth parameters and water use by peas plants

a- Some peas vegetative growth parameters

Application of the tested Glauconites to sandy soil generally increased the peas vegetative growth parameters (plant height , fresh and dry weights of the plant shoots) compared to those of the untreated soil as shown in Tables (5) and (6) .

Without going in more details, it is preferable to compare the effect of glauconite on faba bean with it's effect on peas.

The results obtained from both experiments showed several points which can be summarized as follows:

1- The increase in vegetative growth parameters (plant height , fresh and dry weight) and water use by peas plants due to the application of glauconite had the same trend as observed with faba bean plants

2- The relative improvement in almost all studied parameters by the peas plants was less compared with faba bean plants. This may be due to the difference between the plant types.

3- The highest improvement in almost all studied parameters was obtained at 8 ton/ feddan

glauconite treatment with the two tested crops.

Similar results were obtained by Petkova *et al.*, , (1998) ; Pishmanov and Petkova(2002); Prokoshev *et al.*, (1992); Mazumder *et al.*, , (1993); Rao *et al.*, (1996); Nosko(1998); (Akhtar) and Jenkins (1999) and Griffioen, (2001).

Table 5: Effect of fine glauconite (FG) on some vegetative growth parameters and water use by the peas plants*

FG treatments (ton/feddan)	Plant height,		Fresh weight,		Dry weight,		Water use			
	Cm	R to C % **	g/pot	R to C %	g/pot	R to C %	WCU ***		WUE ****	
							L/pot	R to C %	g/L	R to C %
0	49.5	100	8.2	100	0.87	100	1.6	100	0.54	100
2	55.6	112	9.3	113	0.96	110	1.6	100	0.60	111
4	60.9	122	10.0	121	1.02	117	1.6	100	0.63	116
6	62.1	125	10.3	125	1.06	121	1.6	100	0.66	112
8	65.7	132	10.9	132	1.11	127	1.6	100	0.69	127
10	63.9	129	10.6	129	1.08	124	1.6	100	0.67	124
L.S.D at 5% level :	0.88		0.83		0.09				0.08	

Details and symbols as those for Table (3).

Table 6: Effect of fine glauconite (CG) on some vegetative growth parameters and water use by the peas plants*

CG treatments (ton/feddan)	Plant height,		Fresh weight,		Dry weight,		Water use			
	Cm	R to C % **	g/pot	R to C %	g/pot	R to C %	WCU ***		WUE ****	
							L/pot	R to C %	g/L	R to C %
0	52.2	100	8.7	100	0.90	100	1.6	100	0.56	100
2	61.2	117	10.2	117	1.06	117	1.7	106	0.62	110
4	65.2	124	10.8	124	1.11	123	1.6	100	0.69	123
6	68.7	131	11.2	128	1.14	126	1.5	93	0.76	135
8	69.6	132	11.4	131	1.15	127	1.5	93	0.77	137
10	70.2	134	11.7	134	1.18	131	1.5	93	0.79	141
L.S.D at 5% level :	3.37		0.80		0.08				0.08	

Details and symbols as those for Table (3).

REFERENCES

Abudelgawad, G. , A.L. Page and L. Lund (1975). " Chemical Weathering of Glauconite" Soil Science of America Proceeding, 39 :567-571

Akhtar, M. and D. Jenkins (1999). Mineralogical charaterization of glauconite sandstone from Chichali formation of Surghar range. Pakistan Jornal of Scientific and Industrial Research, 42: 215-219.

Baioumy, H.M. (2007). Iron-phosphorus relationship in the iron and phosphorite ores of Egypt. Chemie der Erde – Geochemistry, 67: 229-239.

Bambalov, N. and G. sokolov (1998). New soil improving agents for accelerated cultivation of soils with low fertility or damaged. International Agrophysics, 12: 357-360.

Eid, M.A. (2012). Success usage for the glauconite ores as a natural Egyptian potassium fertilizer source. (C.F. Eid, M. A., 2013. Some Adsorption Characterization of the Egyptian Glauconite Ore. Egypt. J. Soil Sci. , 53 (1): 75-88.

Ejlmann, A. , N. Hulings and E. Golve (March 1963). "Stages on Glauconite Formation in Modern Forminiferal Sediments", Jornal of Sedimentary Research, 33 (1): 87-96.

El-Amamy, M. , A. Page and G. Abudelgawad (1982). "Chemical and Mineralogical Properties of Glauconite Soil as Related to Potassium Depletion" Soil Science of America Proceedings, 46: 426-430.

El-Aref, M.M. , M.A. Elsharkawi and M.A. khalil (1999). The geology and genesis of stratabound to straitform Cretaceous-Eocene iron ore deposits of El Bahariya Region, Western Desert, Egypt. International conference on Geol. Arab World (GAW4), 450-475.

Gomez,K.A. and A.A.Gomez.(1984). Statistical procedures in Agricultural Research.New York,chichester:Wiley 2nd edition,paper back 68

Griffioen, J. (2001). Potassium adsorption ratios as an indicator for the fate of agricultural potassium in groundwater . Journal of Hydrology, 254: 244-254.

Lindsay, W.L. and W.A. Norvell, (1978). Development of a DTPA soil test for zinc,iron,manganese,and copper.Soil Sci.Soc.Am.J.42: 421- 428.

Mazumder, A. , T. Sharma and T. Rao (1993). Extraction of potassium from glauconitic sandstone by the roast-leach method. International Jornal of Mineral Processing, 38: 111-123.

Nosko, B. (1998). A good use of local resources is the guarantee of an increase in soil fertility in modern practice in the Ukraine. Visnik Agrarnoi Nauki. Kiev, Ukraine, 11: 5-10.

Odin, G. and R. Letolle (1980). Glauconitization and phosphatization environments: a tentive comparison. SEPM Special Publication, 29: 227-237.

Page, A.L. , R.H. Miller and D.R. Keeny (1982). "Methods of Soil Analysis. Part 2. Chemical and Microbiological Properties" 2nd ed., American Society of Agronomy. Inc. Soil Sci. Society of American, Inc. publisher, Madison, Wisconsin , USA.

Petkova, D. , D. Donov , D. Stojchev , G. Angelov , T. Rajchev and D. Stojcheva (1998). Nutrient uptake by glauconit-phophorite rock material. Soil Science Agrochemistry and Ecology, 33: 15-17.

Piper, C.S. (1950). Soil and Plant Analysis. Inter . Science Publisher , New York, 42-110.

Pishmanov, N. and D. Petkova (2002). Nutrient uptake by glauconite-phophorite rock matericbccals. Pochvoznanie, Agrokhimiya I Ekologiya. National Centre for Agrarian Sciences in Bulgaria, Sofia, Bulgaria, 37: 161-163.

Prokoshev, V. , Z. Gosudareva , S. Chekin and T. Voznesenskaya (1992). On the problem of the utilization of glauconite sands of the Egorievsk deposit of phosphorites as potassium-phosphorus fertilizers. Agrokhimiya, 5: 31-38.

Rao, C. , A. Rao and S. Bansal (1996). Potassium supply and management through non-conventional sources for optimizing K nutrition and crop production. Fertiliser News, 41: 33-40.

Vasiljev, A.A. and V.S. Kozhemyakin (2007). Glauconites are effective natural mineral fertilizers at potato growing. Potato growing in Russia: actual problems of science and practice. Materials of the international congress Potato. Moscow, Russia, 158-162.

الملخص العربي

تقييم رواسب الجلوكونايت كمصلح للأراضي الرملية
1- دراسات مبدئية

محمود أحمد مرسى، أسامه حافظ درويش، ندى جمال الضوي
قسم علوم الأراضي – كلية الزراعة – جامعة المنيا

الجلوكونايت المعروف بالرمل الأخضر هو معدن فيلوسيليكات يحتوي على البوتاسيوم والحديد (مجموعة الميكا) ويتصف باللون الأخضر وله مقاومة ضعيفة جداً للتجوية مما يجعله هش وشديد التفتت.

أجريت دراسات مبدئية لدراسة إمكانية إستعمال نوعين من رواسب الجلوكونايت كمصلح للأراضي الرملية ، أحدهما خشن القوام والآخر ناعم القوام ، جمعتا من الواحات البحرية بمحافظة الوادي الجديد ، جمهورية مصر العربية .

وفي تجربتي أصص باستخدام أرض رملية زرعت إحداهما بنباتات الفول البلدى والأخرى بالبسلة لدراسة كفاءة استعمال الجلوكونايت كمصلح تربة – تمت إضافة نوعي الجلوكونايت للأرض الرملية بستة معدلات(صفر، 2 ،4 6 ،8 ،10 طن /فدان).

وقد أظهرت تحليلات نوعي الجلوكونايت المستخدمة أن التوصيل الكهربي للجلوكونايت الناعم أعلى من مثيله في الخشن بينما رقم الحموضة له أقل من مثيله في الخشن. وكان محتوى الجلوكونايت الناعم من (طين+سلت%) والبوتاسيوم والزنك أعلى من مثيله في الخشن ، بينما محتوى الجلوكونايت الخشن من الكربون العضوي والفوسفور والحديد والمنجنيز أعلى من مثيله في الناعم .

أدت إضافة كل من نوعي الجلوكونايت بمعدل 8 طن/ فدان للأرض الرملية إلى زيادة طول النبات، الوزن الأخضر والجاف وكذلك كفاءة إستعمال المياه بواسطة نباتات الفول البلدي والبسلة .

وتشير النتائج إلى أن إضافة معدن الجلوكونايت للأراضي الرملية يكون مفيداً لنمو النباتات تحت الدراسة عند معدل 8 طن/ فدان وذلك تحت ظروف محافظة المنيا .