J.Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 8 (10): 545 - 551, 2017

A Study of some Sandy Soil Characteristics Treated with Combinations of Bentonite and Vinasse which Reflected on Productivity of Pea Crop

Wafaa M. El-Etr and Wagida Z. Hassan
Soil, Water and Environ. Res. Inst., Agric. Res. Center, Giza, Egypt

ABSTRACT

This study examined the different rates of both bentonite and vinasse as mineral and organic soil conditioners, in combinations, to improve soil chemical properties which should be reflected on pea (*Pisum sativum.* L,Variety Master B) productivity during the two winter seasons of 2014 and 2015, on sandy soil under drip irrigation system. The experiment was implemented in Ismailia Agricultural Research Station (latitude, 30^{o} 35' 41.901" N and longitude, 32^{o} 16' 45.834" E). The objective of the work is to study the effect of the treatments for bentonite applied were rates of 2, 4 and 6 ton fed.$^{-1}$ but vinasse with five rates treatments at 0, 0.25, 0.5, 0.75 and 1.0 ton fed^{-1}, respectively. The obtained results revealed that pH values decreased as affected by applied all treatments compared to control treatment, especially with the gradual concentration increase of vinasse. Conversely, both EC and organic matter values increased with increased rates of vinasse and bentonite, in combination. Furthermore, data indicated that values of soil availability nitrogen, phosphors and potassium rise with high rates of bentonite and vinasse as combination compared to control treatment. Moreover, evaluation of pea yield (pods, seeds, straw), as affected by treatments, revealed an increase in yield components. Similar trend was found with total content of macronutrients in pea crop (straw and seeds) in both two studied seasons. Finally, the combination of bentonite and vinasse, working together as mineral and organic soil conditioners respectively, improved the chemical properties of sandy soil, which reflected on the developed pea plant.

Keywords: Bentonite , vinasse, chemical soil properties, pea yield.

INTRODUCTION

Nowadays, the term of soil conditioner is widely used in worldwide; improves the soil characteristic either physical or chemical properties especially in sandy soils. The most problem obvious in the sandy soils is its very limited microbial activity which leads to analysis of organic matter. This low fertility is one of the constraints in this region limiting agricultural production mainly cereals which require improvement through industrial fertilizers to increase crop yields.

Bentonite is clay minerals, mainly smectites (Partay *et al*., 2006). The primary role of bentonite is to improve the water holding capacity and moisture content of soil, thus contributes to the stimulation of biological activity (Shimmel and Darley, 1985; Usman *et al*., 2005 and Lazanyi, 2005). Addition of bentonite to soil should increase the mineral nutrient and colloid content of soil which should decrease the leaching of different nutrients from soil (Noble *et al*., 2000).

In this perspective, introducing clay-rich bentonite can improve the physical and chemical characteristics of soils. This action should increase cation exchange capacity (Dejou, 1987), and improve soil structure leading to a good water and nutrients retention and a better soil ventilation. The approach for development of a culture system combining a legume and cereal in bentonite amended soil can be a model to improve fertility and increase crop production. The introduction of nitrogen fixing legumes in combination with a cereal, by means of the symbiotic association with nitrogen fixing bacteria, can replace at least partly the synthetic nitrogenous fertilizer and hence reduce land pollution. In spite of that, Houcine and Moulay (2007) mentioned that EC increased with application of bentonite mixture; pH tended to the alkalinity of soil; total $CaCO_3$ rises, when bentonite was added in the used mixtures, but active $CaCO_3$ decreased. The high bentonite amounts (10 and 15%) showed no effect on the total phosphorus. The mixture of bentonite at 15% reduces the organic carbon, whereas total nitrogen falls down. Na^{+} and Ca^{++} become higher when bentonite was increased amount; K^{+} however, was reduced in all treatments with responses for Mg^{++} only under high mixture bentonite (15%).

Concerning vinasse as an industrial waste was being a problem for getting disposed from sugar industries. The large amount of vinasse can harm the environment, causing salinization and river Nile pollution. Therefore it was thought useful to try overcoming the created problem using it in agriculture land. Arafat and Yassen, (2002) found that vinasse increased significantly the pea and maize yield as well as N, P, K, S and Ca uptake; however, the predominant effect was mainly to K and S. In addition, the (RSW) raw spent wash (vinasse) is highly acidic and contains easily oxidisable organic matter with very high BOD and COD (Patil *et al*., 1987). Also, such spent wash contains high organic nitrogen and other nutrients (Ramadurai and Gearard, 1994). By installing biomethenation plant in distilleries, reduces the oxygen demand of RSW, the resulting vinasse is called primary treated spent wash (PTSW); primary treatment to RSW increases the nitrogen (N), potassium (K), and phosphorous (P) contents but decreases calcium (Ca), magnesium (Mg), sodium (Na), chloride (Cl^{-}), and sulphate ($SO4^{2-}$) (Mohamod and Subash, 2004). Vinasse is rich in potassium (K), sulphur (S), nitrogen (N), phosphorous (P) as well as easily biodegradable organic matter thus its application to soil has been reported to increase yield of sugar cane (Zalawadia *et al*., 1997). The diluted vinasse irrigation was superior for physical and chemical properties of the soil and further rise soil micro flora (Kuntal *et al*., 2004). Diluted vinasse increases the shoot length, leaf number per plant, leaf area and chlorophyll content of peas (Rani and Vastava, 1990). Increased concentration of applied spent wash causes decreased seed germination, seedling growth and chlorophyll content in sunflowers *Helianthus annuus*; in fact, the spent wash could be safely used for irrigation purpose at relatively lower concentrations (Ramana *et* *al*., 2001). As previously mentioned, the spent wash containes an excess of various cations and anions, which are injurious to plant growth; these constituents should be reduced to beneficial level by dilution.

Finally, Skowronska (2010) pointed out that the high organic carbon (350-830 g kg^{-1}) and nutrient contents (30-53 g N kg^{-1}, 30-95 g K kg^{-1}) in the vinasse makes it potentially useful as a fertilizer, in spite of some constraints of its salinity, low C:N ratio and low phosphorus content. Addition of such soil amendment to agricultural soils is a very common practice due to the observed improvement of physical, chemical and biological properties of soils, as well as the reduction of disposal costs. The aim of this study was to evaluate the effect of different levels of both bentonite and vinasse in a combination on soil quality particularly regarding modified chemical properties of sandy soil.

MATERIALS AND METHODS

To study the effect of some soil conditioners, bentonite as mineral soil conditioner and vinasse as organic soil conditioner, on some chemical properties of sandy soil and crop productivity, a Field experiment was carried out on sandy soil at El- Ismailia Agriculture Research Station Farm in Ismailia Governorate, Egypt. The institute farm is located at 30° 35´41.9" N Latitude and 32° 16´ 45.8" E longitude. Physical and chemical properties of the studied soil are shown in Table (1).

Table 1. Analysis of soil sample representing the studied site

Soil characteristics	Values	Soil characteristics	Values
Particle size distribution %		Soluble cations and anions (meq L^{-1})	
Coarse sand	52.0	Ca^{+2}	0.90
Fine sand	38.1	Mg^{+2}	0.79
Silt	3.50	Na^{+}	1.49
Clay	6.40	K^{+}	0.32
Texture class	Sandy	CO_3^{-2}	-
		HCO_3^{-}	1.30
		Cl^{-}	1.72
		SO_4^{-2}	0.48
Chemical properties		Available nutrients (mg kg^{-1})	
$CaCO_3$ %	1.41	N	66.0
pH	7.88	P	12.0
EC dSm^{-1}	0.35	K	45.6
Organic matter %	0.55		

The experiment was laid out during two successive winter seasons cultivated with Pea (*Pisum sativum.* L.Variety Master B), in a split plot design with three replications for each treatment. The main plots were devoted for bentonite mineral soil conditioner at rates of 2, 4 and 6 ton $fed.^{-1}$. The sub-main plots represented treatments for vinasse as organic soil conditioner with five rates of 0, 0.25, 0.50, 0.75 and 1.0 ton fed^{-1} (V0, V1, V2, V3, and V4) respectively, Some analysis of both bentonite and vinasse are presented in Table (2).

Bentonite and vinasse were added by thoroughly mixing with the surface soil layer before pea cultivation. All treatments received mineral fertilizers at the recommended dose from superphosphate (15 % P_2O_5) at a rate of 200 Kg $fed.^{-1}$ basically before sowing after that potassium was added as form potassium sulfate (48 % K_2O) at 50 kg $fed.^{-1}$, four split equal doses being used after 2, 4, 6 and 8 weeks from sowing into two equal doses. Nitrogen was applied in the form ammonium sulfate (20 % N) rates of 350 Kg $fed.^{-1}$. The first doses were added at sowing and the second after 35 day from sowing.

Table 2.Some analysis of both bentonite and vinasse

Parameters	Bentonite	Vinasse
pH(1:2.5)	8.01	4.50
EC dSm^{-1}	3.77	21.1
OC %	0 .79	15.1
OM %	1.36	25.9
CEC Cmol kg^{-1}	64	-
N %	350 mg kg^{-1}	1.42
P_2O_5 %	19.2 mg kg^{-1}	0.30
K_2O %	939 mg kg^{-1}	4.22%

At harvest, surface soil samples were collected to analyses soil chemical properties evaluated according to Cottenie *et al*. (1982).The studied parameters included soil pH determined in 1:2.5 soil water suspensions, electrical conductivity (EC) in saturation extract, organic matter (%) along with available N, P and K . Samples of both straw and pods for the tested crop were collected from each plot, weighed to determine the yield components (straw, pods and seeds yield), oven dried at 70°C for 48 h. until to a constant dry weight then ground and prepared for digestion as determination as by Page *et al*. (1982). Determination the macronutrients in digests according to procedures described by Cottenie *et al*. (1982).Obtained results were subjected to statistical analysis according to Snedecor and Cochran (1980) and the treatments were compared by using L.S.D. at 0.05 level of probability.

RESULTS AND DISCUSSION

Effect of bentonite and vinasse on soil chemical properties:-

Data in Tables (3 and 4) reveal the effect of different rates of both bentonite and vinasse, in combination, on pH, EC and organic matter content (OM) along with available elements of N, P and K values in two successive seasons after pea crop harvesting in both two seasons.

Soil reaction (pH)

Concerning pH values, data generally, indicated decreases in pH values as affected by bentonite application particularly with low rate compared to control treatment. Although, Satje and Nelson (2009) found that Soil pH increased through bentonite addition, ability of bentonite treatments to effectively raise the pH of low pH soils was observed. But in our study data show the inversely, this may be due to the grater effectiveness of vinasse on pH values. Whereas, data showed that, the effect of applied vinasse on pH values decreases gradually with increasing the rates of vinasse. Similar results were obtained by Carmen and Pmp (2006), who showed that vinasse is considerable acidic liquid whereas pH ranged between 4 and 5.

Tables 3. Effect of combination of different rates of bentonite and vinasse on soil chemical properties (first and second season)

Treatments		pH (1:2suspension)	EC(dSm^{-1}) (sat.extract)	OM%	Available macronutrients ($mg\ kg^{-1}$) N	P	K
Control		8.20	0.8	0.44	150	21	91
Bentonite	Vinasse						
	V0	7.74	1.50	0.46	205	44	100
	V1	7.40	1.62	0.47	229	45	105
2 Ton	V2	7.36	1.71	0.57	235	50	110
	V3	7.34	2.11	0.59	238	50	117
	V4	7.24	2.59	0.67	247	64	190
Mean		7.14	1.91	0.55	231	51	124
	V0	7.77	1.53	0.46	201	45	125
	V1	7.43	2.00	0.48	224	49	131
4 Ton	V2	7.36	2.08	0.50	232	54	136
	V3	7.39	2.19	0.57	245	61	138
	V4	7.20	2.65	0.61	255	79	185
Mean		7.43	2.09	0.52	231	57	143
	V0	7.87	2.85	0.41	205	66	131
	V1	7.40	3.01	0.46	226	71	152
6 Ton	V2	7.55	3.05	0.50	235	90	152
	V3	7.38	3.29	0.55	248	93	185
	V4	7.36	3.67	0.68	256	94	278
Mean		7.51	3.17	0.52	234	82	179
L.S.D. at 5%							
Bentonite (A)		0.157	0.99	0.09	17.2	15.9	64.8
Vinasse (B)		0.147	0.66	0.05	25.8	18.8	68.6
A*B		0.255	1.15	0.09	44.8	32.7	119

Tables 4. Effect of combination of different rates of bentonite and vinasse on soil chemical properties (first and second season)

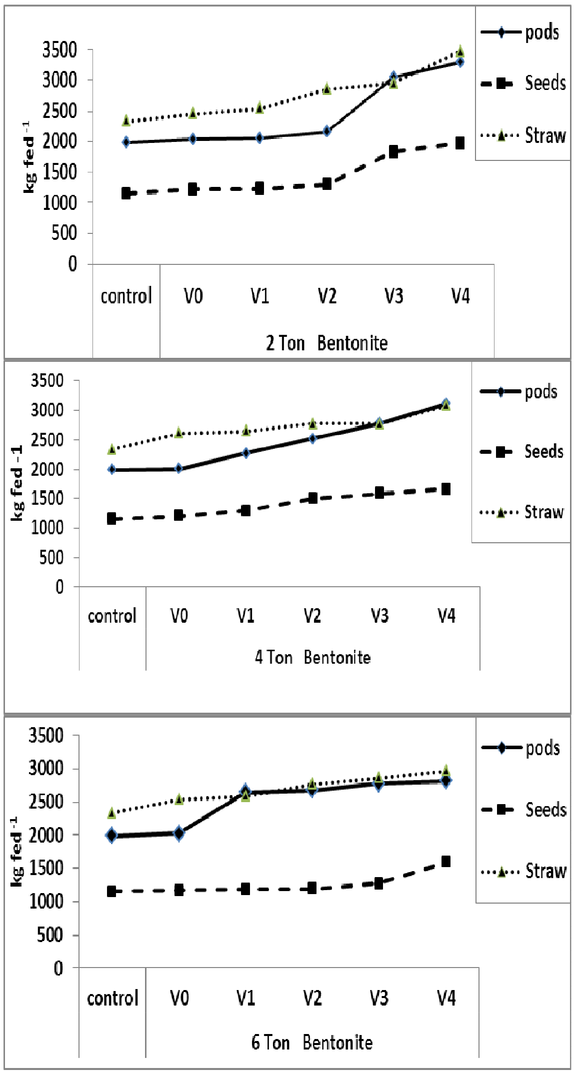
Treatments		pH (1:2 suspension)	EC(dSm^{-1}) (sat.extract)	OM%	Available macronutrients $mg\ kg^{-1}$ N	P	K
Control		8.6	1.2	0.64	157	28	98
Bentonite	Vinasse						
	V0	8.14	1.93	0.66	212	51	107
	V1	7.80	2.4	0.67	236	52	112
2 Ton	V2	7.76	2.48	0.77	242	57	117
	V3	7.74	2.59	0.79	245	57	124
	V4	7.64	3.05	0.87	254	71	197
Mean		7.54	2.49	0.75	238	58	131
	V0	8.17	1.90	0.66	208	52	132
	V1	7.83	2.02	0.68	231	56	138
4 Ton	V2	7.76	2.11	0.70	239	61	143
	V3	7.79	2.51	0.77	252	68	145
	V4	7.60	2.99	0.81	262	86	192
Mean		7.83	2.31	0.72	238	65	150
	V0	8.27	3.25	0.41	212	73	138
	V1	7.80	3.41	0.46	233	78	159
6 Ton	V2	7.95	3.45	0.5	242	97	159
	V3	7.78	3.69	0.55	255	100	192
	V4	7.76	4.07	0.68	263	101	285
L.S.D. at 5%							
Bentonite (A)		0.266	1.523	0.101	20.2	17.9	68.8
Vinasse (B)		0.163	1.664	0.067	30.8	21.8	72.6
A*B		0.820	1.151	0.119	49.8	35.7	125

Electrical conductivity (EC)

EC values, as shown in Tables (3 and 4), were significantly increased by increasing rates of application as compared to control treatments particularly with high rates for them in both seasons. This is due to the possibility of high salt dissolved from vinasse to the soil solution (Tejada and Gonzalez, 2006). Also, they mentioned that, an increasing in electrical conductivity caused by high vinasse application rate. Results agree with those of Yssad and Belkhodja (2007) who found that, application of bentonite to soil increased EC values.

Organic matter (OM)

With regard to organic matter results, in general, showed that, it's content content was increased with bentonite rates application as compared to control treatments. Vinasse application showed increases of OM content with gradual increase rates. Soil conditioner as a combination of bentonite + vinasse was beneficial to increases of OM content of soil. This may be to that vinasse, like other organic fertilizers has high organic matter content (Hazbavi and Sadeghi, 2016).Besides, Madejon *et al*., (2001) showed that vinasse is a dense liquid with high organic matter and salt contents which leads to the availability of some nutrients through the association of groups carboxylic and phenols. As well as the activation of microorganisms that produce organic acids that facilitate the elements, which is reflected on increasing soil fertility.

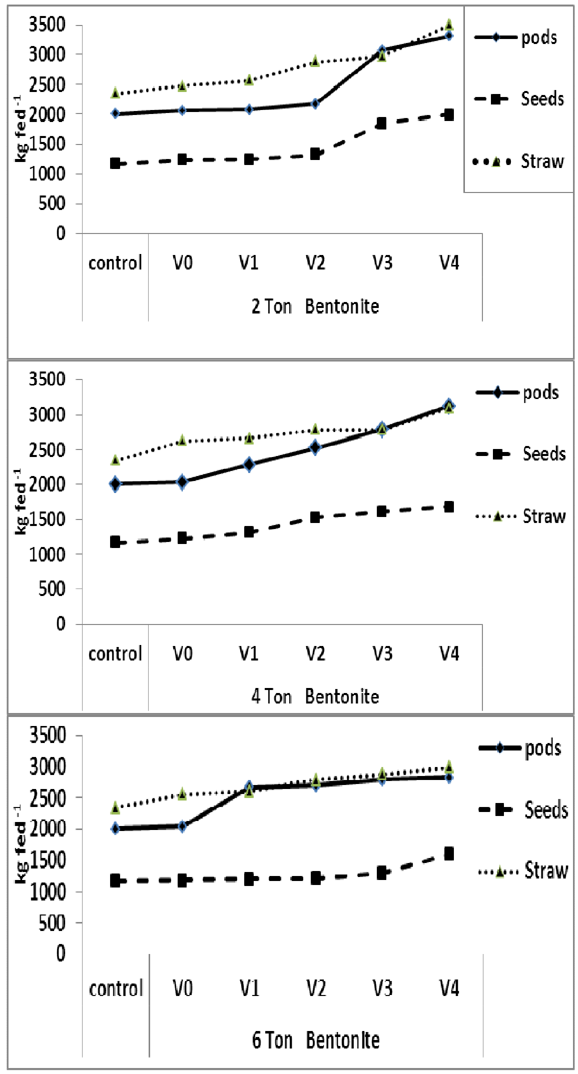


L.S.D. at 5%	Bentonite (A)	Vinasse (B)	A*B
Pods	168	583	1011
Seeds	211	365	633
Straw	430	547	947

Fig. 1. Effect of combination of different rates of bentonite and vinasse on the yield of pods, straw and seeds in pea crop (first season)

Availability of N, P and K in soil

Results revealed significant responses of N, P and K availability in soil under influences of bentonite application compared to control treatments but no significance among the studied rates. Similar responses were obtained with vinasse especially with high rates. As expected, the effect of bentonite and vinasse as a combination represents a good soil conditioner especially when using high in vinasse which promotes nutrient recycling in ecosystems (Madejon *et al*., 2001). Besides, Noble *et al*., (2000) observed that, when adding bentonite to soil, the mineral and colloid contenst were increased. Skowronska, (2010) added that the application of vinasse and bentonite to the light soil had a positive effect on CEC along with available P and K contents.



L.S.D. at 5%	Bentonite (A)	Vinasse (B)	A*B
Pods	575	769	1333
Seeds	251	440	762
Straw	408	653	1131

Fig. 2. Effect of combination of different rates of bentonite and vinasse on the yield of pods, straw and seeds in pea crop (second season)

Yield components:

Data presented in Figs (1 and 2) reported values of yield for pods, seeds, and straw of pea crop at both studied two seasons. Generally, results showed significant by impact for either bentonite or vinasse especially with high rates compared to control treatments. This may be due to better growth plants as affected with a good state of physical and chemical properties of soil treated with such soil conditioners (bentonite+ vinasse) as combination. Similar results were observed with Prado *et al*., (2013) who suggested that, the use of vinasse in fertigation systems had advantages because of contributeing substantial amounts of water and mineral nutrients along with, support soil quality and crop productivity. Again, Reguieg *et al*. (2011) found that, bentonite could be a very promising material for improvement of the physical, chemical and biological properties of sandy soils in arid region which would contribute positively to improved production yields.

Total content of nitrogen, phosphors and potassium

Figs (3 - 4) showed total content of nitrogen, phosphors and potassium nutrients in straw and seeds under combined rates both of bentonite and vinasse treatments. Data again revealed positive responses particularly with high applied levels compared to control treatment. This may be due to good moving of elements from the soil to grown plant as well as its good metabolism which is reflected indirectly on the health state of the soil. This result agree with resultant of Reguieg *et al*. (2011) who suggested that addition of bentonite as soil amendment increased in total nutrients content of chickpea plant which should associat with good use of nutrients in soil solution by roots.

Also, Korndorfer and Anderson (1993) found the application of vinasses to soil increased significantly N, P, K, S and Ca uptake; however the predominant effect was mainly due to K and S. as well as, Gomez (1996) explained this phenomenon to be parallel to seeds and straw of pea plant; the total amount of inorganic N,P and K added with vinasse along the growing period is sufficient to meet the elements required for plant especially with high rates

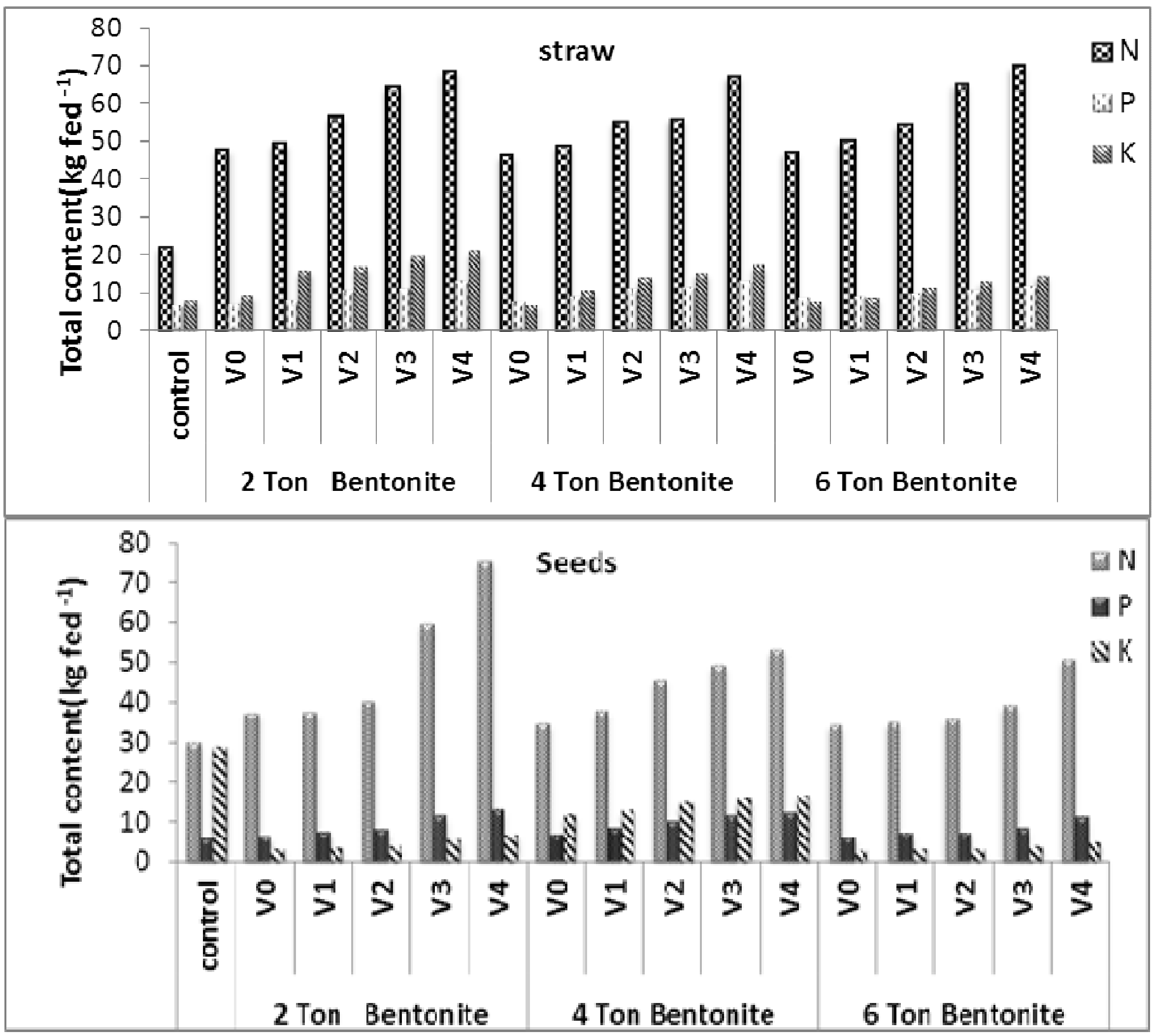


Fig. 3. Effect of combination of different rates of bentonite and vinasse on total content of N, P and K in plant (first season)

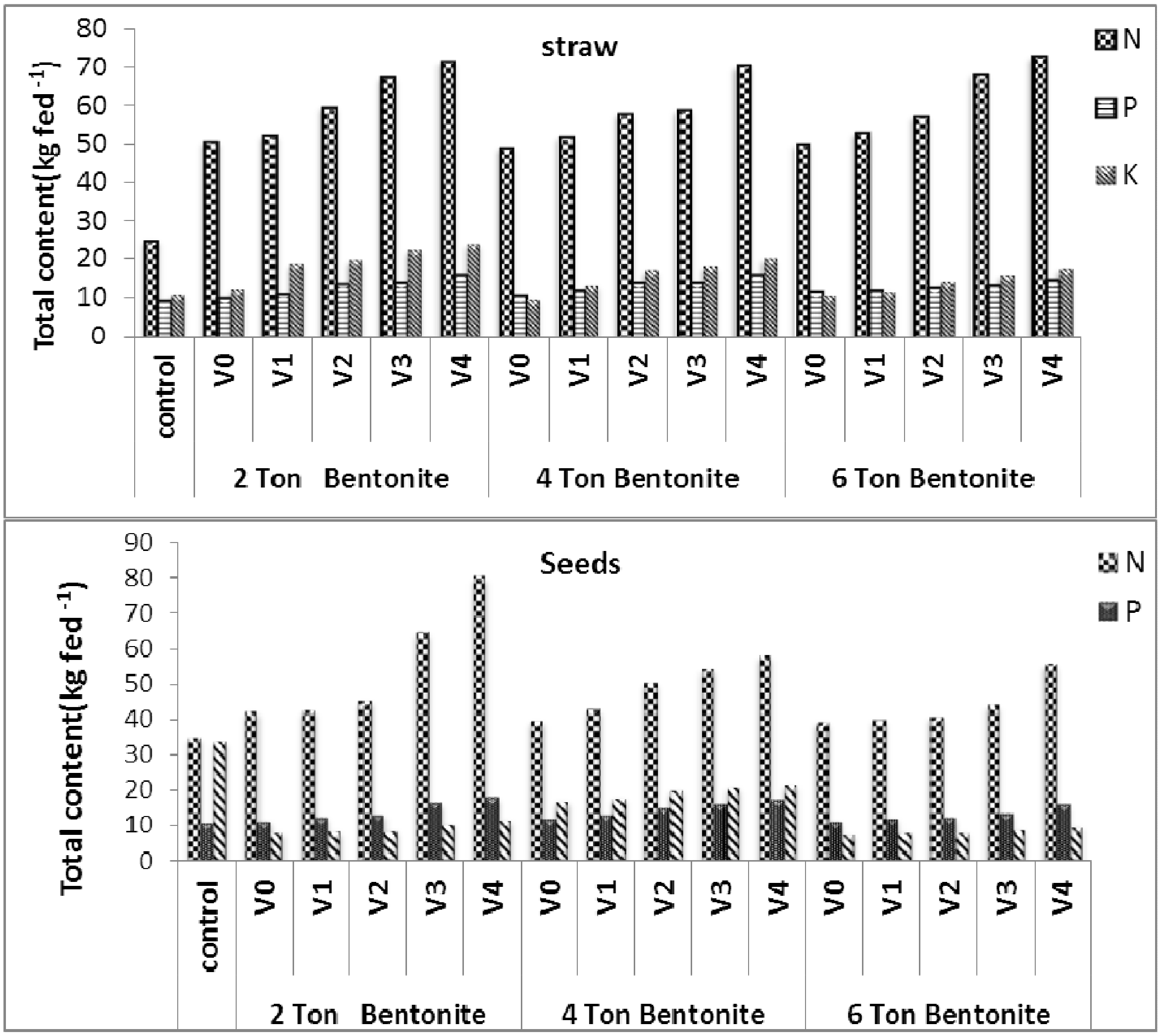


Fig. 4. Effect of combination of different rates of bentonite and vinasse on total content of N, P and K in plant (second season)

CONCLUSION

The application of different rates of both bentonite and vinasse as mineral and organic soil conditioners, in combinations, can improve soil chemical properties of sandy soil. Besides, using of vinasse to soil is a viable method for its elimination. Also it had direct effect as a source of elements and indirect effect consisting of an improvement of utilization of absorbed nutrients especially when combination with bentonite which should be reflected on pea productivity.

REFERENCES

Arafat, S. and A. E. Yassen (2002). Agronomic evalution of fertilizing efficiency of vinasse.Wcss, Thailand, 14: 1- 6.

Carmen, B.S. and P. E.Pmp (2006). Anaerobic digestion of vinasse for the production of methane in the sugar can distillery. "Conference on Sugar Processing" Loxahatchee, Florida, USA.

Cottenie,A., M. Verloo, L. Kiek, G. Velghe and R. Camerlynek, (1982)." Chemical Analysis of Plants and Soils" Lab. Anal. and Agroch. State Univ., Ghent, Belgium

Dejou, J.(1987). The specific surface of clay, its measurement, relationship with the CEC and its agronomic importance, in: Proc. Symp. AFES, 72-83.

Gomez, J.M. (1996). Effect of vinasse application on yield and quality of sugarcane. Can.de. Azucar 14:15-34.

Hazbavi, Z. and S. H. R. Sadeghi, (2016). Potential effects of vinasse as a soil amendment to control runoff and soil loss. SOIL, j. net. 2: 71–78.

Houcine, R. Y. and B. Moulay, (2007).The effect of bentonite on the physic-chemical characteristics of sandy soils in Algernia. J. App. Sci. 18: 2641-2645.

Korndorfer, G. H. and D. L. Anderson. (1993). Use and impact of sugar-alcohol residues vinasse and filter on sugarcane production in Brazil. In Proc. Inter. Am. Sem. 12:164-170

Kuntal, M.H., K. Ashis, Biswas, B. Kalikinkar, and K. Misra (2004).Effect of post-methanation effluent on soil physical properties under a soybean-wheat system in a Vertisol .J. Plant Nutri. Soil Sci., 167: 584-590.

Lazányi, J. (2005). Effects of bentonite on the water budget of sandy soil. In: Technologii de Culture Pentru Grau Si Porumb Sympozion International, 7–8 iulie Oradea-Romania. 10: 293–300.

Madejon, E., Lopez, R. Murillo, j. M. and F. Cabrera (2001). Agricultural use of three(sugar- beet) vinasse composts. Effect of crop sand chemical properties of a cambisol soil in the Guadalquivir river vally (SW Spain) Agric.Ecosyst. Environ. 84: 53-65.

Mohamed, H. AR. and C.B. M. Subash (2004). Use of distillery spentwash for alkali soil reclamation, treated distillery effluent for fertile irrigation of Crops. Indian Farm, March,48-51.

Noble, A. D., G. P.Gillmann, and S. Ruaysoongnern (2000).A cation exchange index for assessing degradation of acid soil by further acidification under permanent agriculture in the tropics. Europ. J. Soil Sci. 51.233–243.

Page,A.L., R.H. Miller and D.R. Keeney (1982)."Methods of soil analysis" Amer. Soc. Agron., Madison, Wisconsin, U.S.A.

Pártay, G., K. Rajkainé and V. A. Lukács (2006).Potassium migration in root medium treated with potassium feldspar. (In Hungarian) AgrokémiaésTalajtan.55: 395–414.

Patil, J. D., S.V. Arabatti, and D.G.Hapse (1987).A review of some aspects of distillery spent wash (vinase) utilization in sugar cane, Bhartiya Sugar. May, 9-15.

Prado, R. M., G. Caione and C. N. S. Campos (2013). Filter cake and vinasse as fertilizers contributing to conservation agriculture. Appl. and Environ. Soil Sci. 10: 1- 8.

Ramadurai, R. and E.J.Gearard, (1994).Distillery effluent and downstream products, SISSTA, Sugar J. 20: 129-131.

Ramana, S., A.K.Bisvas, S. Kundu, J.K. Saha, and R.B.R.Yadava (2001).Physiological response of soybean (Glycine max L.) to foliar application of distillery effluent. Ann. Plant Soil Res., 2: 1-6.

Rani, R. and M.M. Sri Vastava (1990). Eco-physiological response of Pisum sativumand Citrus maxima to distillery effluents.Inter. J. Eco. Environ. Sci. 7: 16-23.

Reguieg, H.Y., M. Belkhodja and A. Chibani (2011). Effect of bentonite on the sandy soils of arid regions: study of behavior of an association of wheat and chickpea. J. Environ. Sci. 5:1668-1677.

Satje, A. and P. Nelson. (2009). Bentonite treatments can improve the nutrient and water holding capacity of sugarcane soils in the wet tropics Proc Aust Soc Sugar Cane Technol 31: 166-176.

Shimmel, S. M. and W. M. Darley (1985). Productivity and density of soil algae in an agricultural system.Ecology.66. 1439–1447.

Skowronska, M. (2010). Beet vinasse effects on selected soil properties. Europ. Bioreme. Confer. 15:20-950.

Snedecor,G.W. and W.G. Cochran (1980)."Statistical Methods".7th Edition. Iowa State Univ. Press., Ames., IA., U.S.A.

Tejada, M. and J. L. Gonzalez (2006). Effect of two beet vinasse forms on soil physical properties and soil loss. Catena. 68:41-50.

Usman, A., Y.Kuzyakov and K. Stahr (2005).Effect of clay minerals on immobilization of heavy metals and microbial activity in a sewage sludge-contaminated soil. J. Soils and Sediments.5: 245–252.

Yssad, H.R. and M. Belkhodja (2007).The effect of bentonite on the physic chemical characteristics of sandy soils in Algeria. J. Appl. Sci., 7: 2641-2645.

Zalawadia, N.M., S. Raman, and R. G. Patil (1997). Diluted spent wash of sugar industries application on yield and nutrient uptake by sugarcane and changes in soil properties .J. Indian Soc. Soil Sci.,45: 767-769.

دراسة بعض صفات الاراضي الرملية المعاملة بمخلوط البنتونيت والفيناس وانعكاس ذلك علي محصول البسلة

وفاء محمد طه العتر و وجيدة زكريا حسن
مركز البحوث الزراعية الجيزة - مصر – معهد بحوث الأراضى والمياه والبيئة

أختبرت هذة الدراسة معدلات مختلفة لكل من البنتونيت والفيناس كمحسن معدنى وعضوى فى صورة مخلوط ، وذلك لتحسين الخواص الكيميائية للتربة وبالتالي إنعكاسها علي انتاجية نبات البسلة وذلك خلال موسمي شتوي ٢٠١٤ - ٢٠١٥ على التربة الرملية تحت نظام الرى بالتنقيط بمحطة بحوث الإسماعيلية – مركز البحوث الزراعية خط العرض،°٣٠ و ٣٥ ' ٩٠١.٤١ شمال و الطول°٣٢ و١٦ ٨٣٤,٤٥ شرق .معاملات البنتونيت المضاف كانت بمعدلات ٢ ،٤ و ٦ طن للفدان بينما معاملات الفيناس بمعدلات ٠ ،٠.٢٥ ،٠.٥ ،٠.٧٥ و١.٠ طن للفدان. أظهرت النتائج نقص فى قيم ال pH المتأثرة بإضافة كل المعاملات خصوصا مع زيادة التركيز في الفيناس مقارنة بمعاملة الكنترول. على العكس من ذلك تزايد قيم كل من ال EC والمادة العضوية بزيادة التركيزات المضافة. علاوة على ذلك اوضحت النتائج زيادة قيم كل من النيتروجين و الفوسفور و البوتاسيوم الميسر فى التربة مع الزيادة فى المعدلات المرتفعة من خليط (البنتونيت والفيناس) مقارنة بمعاملة الكنترول، وكذلك زادت قيم كل من محصول القرون , البذور والقش للبسلة . أيضا نفس الاتجاه وجد فى المحتوى الكلى للعناصر المغذية N,P ,K لكل من البذور والقش .أخيرا, فإن إضافة البنتونيت + الفيناس يعملان معا كمحسن معدنى وعضوى للتربة لتحسين الخواص الكميائية والتي تنعكس علي جودة التربة الرملية وانتاجية نبات البسلة .