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EFFECT OF RICE STRAW COMPOST AND VINASSE APPLICATIONS ON SOME SOIL PROPERTIES AND YIELD OF EGYPTIAN CLOVER

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ABSTRACT

Two field trials were conducted at El-Kasasen district, Ismailia Governorate during the successive winter seasons of 2009 / 2010 and 2010 / 2011, at the same farmer, in a sandy clay loam soil under sprinkler irrigation system in order to study the effect of the applications of rice straw compost at rates 5.0 and 7.5 ton fed.$^{-1}$, vinasse at rates 5.0 and 7.5 ton fed.$^{-1}$ and their combinations on some soil physical properties (bulk density and soil total porosity) and some soil chemical properties (ECe, ESP, pH, OM, CEC and available contents of NPK) as well as the productivity of Egyptian clover. The experiment design was a randomized complete block design with 9 treatments and 3 replicates per a treatment. All treatments were applied once time in each cultivation season to the experimental plots at 7 days before the sowing of clover seeds.

The obtained results indicated that, the application of 7.5 ton compost fed.$^{-1}$ decreased soil bulk density, EC, ESP values and increased soil total porosity, soil available contents of N and P, compared to other treatments. On the other hand, the application of 7.5 ton compost + 7.5 ton vinasse fed.$^{-1}$ decreased soil pH value and increased soil OM, CEC values and soil available K content, compared to other treatments. Moreover, the plots treated with 7.5 ton fed.$^{-1}$ compost alone and 7.5 ton compost + 5.0 ton vinasse fed.$^{-1}$ gave higher average values of clover yield parameters than those obtained with the other treatments. The average relative increments of plant height and clover dry yield of three cuts in two seasons were 57.41 and 55.34 %, respectively for the plots which was treated with the compost 7.5 ton fed.$^{-1}$, while they were 45.28 and 47.57 % for plots which was treated with compost 7.5 ton fed.$^{-1}$ + vinasse 5.0 ton fed.$^{-1}$, respectively, over the control.

On the contrary, the application of vinasse at high rate 7.5 ton fed.$^{-1}$ led to increase soil bulk density, EC, ESP, soil K available content values and decreased the soil total porosity, clover yield parameters compared to other treatments. The average relative decrease of plant height and clover dry yield of three cuts in two seasons were obtained in the plots treated with vinasse at rate 7.5 ton fed.$^{-1}$ and were 23.45 and 12.62 %, respectively, lower the control.

In general, these results suggest that the application of rice straw compost alone or in combination with vinasse, had a positive impact on some soil properties and so on the clover yield parameters and quality, while the application of vinasse alone at the high application rate, led to a negative effect on some soil properties and therefore on the Egyptian clover yield parameters.

INTRODUCTION

In many industrial and agricultural processes, some by-products are produced apart from the useful products. A few years ago, these by-products were considered as waste and were often disposed of, causing environmental problems. Recently, it was well recognized that by-products should be considered as useful material, and methods and technologies should be developed to reuse them. In many cases, agriculture can offer a potential solution to these problems by using these materials.

Vinasse is a by-product of the alcohol industry using molasses from the sugar cane and sugar beet industry. Vinasse disposal was a great problem threatening the company's economic viability. A suggested solution was to use vinasse in agriculture as a substitute for chemical fertilizers and for soil improvement of Egyptian soils.

Vinasse is a product of a great agricultural interest and can be a good organic fertilizer for agricultural crops such as forage crops and a factor for maintaining the balance of nutrients and organic matter level in the soil, because its high content of organic matter, macro- and micronutrients, *(Madejon et al., 2001 and Tejada et al., 2006).* However, the direct application of concentrated vinasse on agricultural lands may lead to economical and environmental problems due to its high salinity, *(Murillo et al., 1993 and Madejon et al., 2001).*

Concerning the influence of vinasse applications on soil chemical and physical properties, several studies reported that the application of vinasse to the soil, especially at high doses, negatively affect soil physical properties (structure and available water) as well as nutrient uptake, and crop yield and quality (*Tejada and Gonzalez, 2006). Tejada et al. (2006),* found that the application of vinasse had a detrimental impact on the soil's physical (structural stability, bulk density), chemical (exchangeable sodium percentage), and biological (microbial biomass, soil respiration, and enzymatic activities) properties and the wheat yield parameters, probably because that high quantities of monovalent cations, such as Na^+ and K^+ were introduced into the soil by the vinasse.

However, some authors have suggested that the problems associated with fresh residues (such as vinasse) may be overcome by co-composting or/and mixing it with solid agricultural wastes to obtain an organic product suitable for use as fertilizer and easily handled with a higher P content and lower salinity *(Madejon et al., 2001).*

Compost has a positive effect on soil fertility as well as the productivity of the field crops. Addition of significant quantities of agricultural residues as compost in sandy soils improves their physical, chemical and biological properties. *Seddik and Laila (2004)* found that addition of rice straw compost to the sandy soil decreased bulk density and hydraulic conductivity and increased total porosity, field capacity and available water. Moreover, the use of compost as an amendment improving the soil chemical and biological properties and /or provided plants with essential nutrients, (*Awad, 1994).*

The objective of this study was to evaluate the effect of the application of rice straw compost, vinasse and their combinations at different application rates on some physical and some chemical soil properties as well as the yield and quality of Egyptian clover cultivated in sandy clay loam soil under sprinkler irrigation system.

MATERIALS AND METHODS

Two field trials were conducted at El-Kasasen district, Ismailia Governorate during the successive winter seasons of 2009 / 2010 and 2010 / 2011, at the same farmer, in a sandy clay loam soil under sprinkler irrigation systems in a order to study the effect of the application of vinasse (V), rice straw compost (C) and their combinations (C + V) on some soil physical properties (bulk density and soil total porosity) and some soil chemical properties (ECe, ESP, pH, OM, CEC and available contents of NPK) as well as the productivity of Egyptian clover.

Experimental Layout and Treatments

The experimental layout was a randomized complete block design with 9 treatments and 3 replicates per a treatment. The plot size was 5 X 4 m^2. The treatments were as follows:

1- Control,
2- Compost, (C_1): 5.0 ton $fed.^{-1}$,
3- Compost, (C_2): 7.5 ton $fed.^{-1}$,
4- Vinasse, (V_1): 5.0 ton $fed.^{-1}$,
5- Vinasse, (V_2): 7.5 ton / fed,
6- Compost 5.0 ton + Vinasse 5.0 ton $fed.^{-1}$, (C_1+V_1).
7- Compost 5.0 ton + Vinasse 7.5 ton $fed.^{-1}$, (C_1+V_2),
8- Compost 7.5 ton + Vinasse 5.0 ton $fed.^{-1}$, (C_2+V_1).
9- Compost 7.5 ton + Vinasse 7.5 ton $fed.^{-1}$, (C_2+V_2).

Vinasse was added after diluted 10 times with water to facilitate its handling in field. All treatments were applied once time in each cultivation season to the experimental plots at 7 days before the sowing of Egyptian clover seeds.

Clover seeds (cv. Hellaly), 20 kg seed $fed.^{-1}$ were sown on 4 November 2009/ 2010 and 2010 / 2011. In each season, the plots received 10 kg N fed^{-1} as the stimulatory dose after10 days from the planting. In addition,15 kg P_2O_5 and 24 kg K_2O $fed.^{-1}$were applied after each cut.

Sampling and soil analysis

Composite soil samples (0 – 30 cm) were taken before applying the treatments. Some physical and chemical properties of the soil are shown in Table (1). At the end of each cultivated season, composite soil samples (0 – 30 cm) were taken from each plot to determine some soil physical and chemical properties. Physical and chemical properties of soil samples were determined according to the methods described by Page et al. (1982).

Some chemical properties of the compost and vinasse used were analyzed after sulfuric acid and hydrogen peroxide digestion according to Cottenie et al. (1982) and listed in Table (2).

Clove yield parameters:

Three successive cuts were taken from the growing Egyptian Clover to determine the plant height (cm). Dry yield (ton $fed.^{-1}$) and total NPK content. The first cut was after 60 days from sowing, the second cut was 45 days after the first cut, while the third cut was after 45 from the second cut.

Total NPK Content:

Composite plant samples were taken from each cut, dried at 70 C°, ground and prepared for digestion using H_2SO_4 and H_2O_2 method for the determination of total content of N, P and K using the procedure described by Cottenie *et al.* (1982).

Data were subjected to statistical analysis *(Snedecor and Cocharn 1980)*. Treatment means were compared using the least significant difference (L.S.D) at 0.05 % level.

Table (1): Some physical and chemical properties of the experimental soil in both two seasons of study.

Property	Compost (C)		Fresh Vinasse (V)	
	1st season	2nd season	1st season	2nd season
pH	6.85*	6.72*	4.55	4.82
Organic matter (%)	34.25	35.75	40.25	39.95
C/N ratio	10.74	10.80	20.48	21.86
EC dSm^{-1}	3.45*	4.02*	20.20	19.50
Soluble Anions and Cations (meq L^{-1})				
CO_3^{--}	–		–	
HCO_3^-	5.45	6.25	15.45	17.50
Cl^-	16.50	20.48	150.4	155.25
SO_4^{--}	12.55	13.27	51.90	33.90
Ca^{++}	5.25	3.40	37.50	34.45
Mg^{++}	8.44	8.50	21.25	22.25
Na^+	15.55	21.65	93.50	90.50
K^+	5.26	6.45	65.50	59.45
Total content of NPK				
N (%)	1.85	1.92	1.14	1.06
P (%)	0.65	0.75	0.28	0.32
K (%)	0.55	0.45	4.26	3.95

*** SCL: Sandy Clay Loam**

**** ECe (in paste extract).**

Table (2): Chemical analyses of the compost and vinasse used.

Some soil physio-chemical properties:

Property / No. of seasons	Sand %	Clay %	silt %	Texture Grad	Bulk density ($g\ cm^{-3}$)	Total porosity %	pH (1:2.5)	CaCO$_3$ %	OM %	CEC meq. 100 g^{-1} soil	ESP %
1st season	59.50	21.80	8.70	SCL*	1.420	40.60	8.14	1.95	0.62	11.27	8.64
2nd season	58.80	22.20	9.00	SCL*	1.45	41.00	8.16	2.25	0.68	12.00	8.72

Property / No. of seasons	EC** dSm^{-1}	Soluble Anions and Cations										
		Anions meq 100 g^{-1} soil				Cations meq 100 g^{-1} soil				*Available nutrients (ppm)*		
		CO_3^{--}	HCO_3^-	Cl^-	SO_4^{--}	Ca^{++}	Mg^{++}	Na^+	K^+	*N*	*P*	*K*
1st season	1.70	–	2.25	6.50	8.25	8.00	3.00	5.50	0.50	50.50	4.85	75.46
2nd season	1.82	–	2.75	6.25	9.20	7.50	4.10	6.20	0.40	51..25	5.02	78.50

*** pH (1 : 10) water suspension,**

*** EC (1 : 10) water extract,**

RESULTS AND DISCUSSION

Soil physical properties

Soil bulk density is considered as a good indicator for the improvement of the main physical properties. It is well known also that total soil porosity is related either directly or indirectly to soil bulk density.

Data presented in Table (3) show that, except vinasse treatments, the mean values of soil bulk density, significantly decreased with increasing the application rates of rice straw compost alone or / and in combination with vinasse compared with the control in both seasons. The applications of 7.5 ton fed.$^{-1}$compost and 7.5 ton compost + 5 ton vinasse fed.$^{-1}$ reduced soil bulk density from 1.50 for the control to 1.29 and 1.31 g cm^{-3}, respectively. On the other hand, the soil total porosity increased from 43.72 % for the control to 51.32 and 50.76 % in the plots treated with 7.5 ton fed.$^{-1}$compost and 7.5 ton compost + 5.0 ton vinasse fed^{-1}, respectively. These results are similar to those obtained by *Puget et al. (2000)*, who found that a good soil bulk density depended on the content and nature of the organic matter added, Table 2 shows the high content of organic matter in both compost and vinasse used. Increases soil organic matter lead to the dilution of the denser soil mineral fraction and soil aeration increases because of the increase in soil porosity. This increase was especially evident for the high rate of compost 7.5 ton fed.$^{-1}$ and its combination with 5.0 ton fed.$^{-1}$ vinasse and was similar to the obtained results by (*Tejada and Gonzalez, 2006*).

Concerning of vinasse treatments, (Table 3) the mean values of soil bulk density increased with increasing the application rate of vinasse, it was 1.74 g cm^{-3} for the plots treated with 7.5 ton fed.$^{-1}$ compared with the control (1.50 g cm^{-3}). While, the mean value of total porosity had decreased from 43.72 % for the control to 34.72 % for the vinasse at the rate of 7.5 ton fed^{-1} followed by the vinasse at rate 5.0 ton fed^{-1} (40.76%). The negative effect of vinasse on soil bulk density and total porosity could be due to the high concentration of Na^+ and its role on soil dispersion. These findings are in consistence with those obtained by (*Tejada and Conzalez, 2006*).

Table (3): Effect of compost and vinasse on soil bulk density and total porosity of soil samples (0 – 30 cm) taken after harvesting in both two seasons.

Treatment	Bulk density gm. cm^{-3}			Total porosity %		
	1st Season	2 nd Season	Mean	1st Season	2 nd Season	Mean
Control	1.49	1.50	1.50	43.77	43.66	43.72
C_1	1.38	1.40	1.39	47.92	47.17	47.55
C_2	1.28	1.30	1.29	51.70	50.94	51.32
V_1	1.56	1.58	1.57	41.13	40.38	40.76
V_2	1.72	1.75	1.74	35.09	34.34	34.72
C_1+V_1	1.40	1.43	1.42	47.17	46.04	46.61
C_1+V_2	1.44	1.46	1.45	45.66	44.91	45.29
C_2+V_1	1.29	1.32	1.31	51.32	50.19	50.76
C_2+V_2	1.35	1.38	1.37	49.06	47.92	48.49
L.S.D*	**0.016**	**0.018**		**0.260**	**0.240**	

LSD at 0.05 between treatments

Soil chemical properties

Soil ECe, pH, OM, CEC and ESP

The effect of compost (C), vinasse (V), and their combinations on the mean values of soil EC, pH, OM, CEC and ESP are shown in Table (4).

Data indicate that, at both seasons, applied compost alone decrease the soil EC values by increasing the rate of application compared to other treatments and the control. In this respect, the lowest mean values (1.53 and 1.70 dSm^{-1}) were obtained for the plots treated with the compost at rates 7.5 and 5.0 ton $fed.^{-1}$, respectively and these values were even lower than control treatment. *El-Etr et al.(2004)* attributed the reduction of EC to the increase of salt leaching into the deepest layers of soil because of the formation of aggregates resulting from compost application.

However, the soil EC mean values were significantly increased with increasing the application rate of vinasse compared to the other treatments and control. Moreover, the highest mean value (3.17 dSm^{-1}) was obtained for the plots treated with 7.5 ton $fed.^{-1}$ vinasse. This could be because of the high salt content of vinasse, (Table 2). These results were in agreement with those obtained by *Madejon et al., (2001)*.

In general, it is observed that the EC values in all treatments were always lower than 4 dSm^{-1}, the traditional value above which soils consider as saline ones, *(Richards, 1973)*.

In regard to the soil pH, data in Table (4) indicate that, applying the compost alone or in combination with vinasse led to a slight decrease in the pH values by increasing the rate of application compared to the control in both seasons. Moreover, the lowest mean value of soil pH (7.36) was obtained for the plots treated with 7.5 ton compost + 7.5 ton vinasse fed^{-1} compared to other treatments and control. These results show that even the compost and vinasse contain relatively high contents of sodium ion but their acidic nature, pH values, as shown in Table (2), has a the positive impact on lowering pH values than the control and in all treatments. *Abdelhamid et al. (2004)*, reported that, the reduction of pH may be attributed to the production of organic acids resulted from the microbial activity.

One of the clearest effects of compost and vinasse applications was the increase in the soil organic matter content. Data in Table (4) showed that the mean values of organic matter contents (OM %), of the two seasons, were significantly positive responded to the applications in all treatments and increased with increasing the application rates compared to the control. The highest mean value of soil OM (1.48 %) was obtained for the plots treated with 7.5 ton compost + vinasse 7.5 ton fed^{-1}. Therefore, the use of these wastes improves and maintains soil organic matter. *Madejón et al. (2001)* found that the application of vinasse and co-composted vinasse to the soil increased the organic matter content by 1.7 times greater than the mean value in the control.

Table (4): Mean values of ECe , pH, OM , CEC and ESP of soil samples (0 – 30 cm) taken after harvesting in both two seasons.

Treatment	EC dSm^{-1}			pH (1 : 2.5 susp.)			OM %			CEC meq $100g^{-1}$ soil			ESP %		
	1st Season	2 nd Season	Mean	1st Season	2 nd Season	Mean	1st Season	2 nd Season	Mean	1st Season	2 nd Season	Mean	1st eason	2 nd eason	Mean
Control	1.78	1.91	1.85	8.15	8.18	8.17	0.65	0.73	0.69	11.50	11.95	11.73	8.55	8.74	8.65
C_1	1.67	1.72	1.70	7.92	7.90	7.91	0.93	0.96	0.95	14.55	15.87	14.21	8.95	9.44	9.20
C_2	1.49	1.56	1.53	7.84	7.86	7.85	1.09	1.15	1.12	17.23	18.15	17.69	10.48	10.04	10.26
V_1	2.59	2.55	2.57	7.85	7.88	7.87	0.89	0.82	0.86	24.50	24.90	24.70	18.35	18.25	18.30
V_2	3.11	3.23	3.17	7.73	7.76	7.75	0.92	0.94	0.93	26.62	26.05	26.34	20.00	20.41	20.21
C_1+V_1	2.15	2.22	2.19	7.62	7.65	7.64	1.10	1.20	1.15	27.95	26.83	27.39	13.01	13.14	13.13
C_1+V_2	2.28	2.41	2.35	7.51	7.48	7.50	1.21	1.31	1.26	28.65	28.98	28.82	13.52	13.31	13.42
C_2+V_1	2.01	2.08	2.05	7.41	7.40	7.41	1.39	1.45	1.42	30.80	30.13	30.47	11.04	11.52	11.28
C_2+V_2	2.11	2.17	2.14	7.37	7.35	7.36	1.45	1.51	1.48	31.87	31.13	31.50	12.41	12.72	12.57
L.S.D*	0.01	0.02		0.02	0.02		0.04	0.06		0.20	0.20		0.05	0.07	

* LSD at 0.05 between treatments.

Concerning of soil CEC, as shown in Table (4), the results indicated that the soil CEC significantly increased with increasing the application rates of all treatments compared with control in both seasons. The highest mean value of CEC (31.50 meq $100g^{-1}$ soil) was obtained from the plots treated with 7.5 ton compost + 7.5 ton vinasse fed^{-1}compared with other treatments and control. These results are due to relatively high contents of organic matter and its effect on soil chemical and biochemical properties. Similar results were obtained by *Tejada et al., (2006)* when they applied beet vinasse to soil. This increase in exchangeable cations is of great importance because they increase the soil nutritious reserves, *Tejada, et al. (2007).*

In regard to the exchangeable sodium percentage ESP, data in Table (4) showed that, the soil ESP significantly increased with increasing of application rates of vinasse alone compared with other treatments and control. The highest mean values of ESP (20.21 and 18.30 %) were obtained in the plots treated with the vinasse alone at rate 7.5 ton fed^{-1} and 5 ton $fed.^{-1}$, respectively compared to other treatments. These results may be due to that vinasse contains a high concentrations of sodium. These values are higher than the sodicity level 15 of ESP, *(Richards, 1973).* While the plots treated with the compost alone or added with vinasse gave lower values of soil ESP than the sodicity level, but it was slightly higher than control compared with vinasse treatments, these results are in agreement with those reported by *Tejada et al., (2006).*

Soil available content of NPK

Regarding the availability of NPK in soil in both seasons, data in Table (5) indicated that the application of all treatments significantly increased the soil available contents of N, P and K after the two growing seasons compared with control and reached their maximum values in the plots treated with the compost alone and its combination with vinasse at high application rates.

The highest mean value of available N (137.84 ppm) was obtained in the plots treated with the compost at rate 7.5 ton fed^{-1} followed by the plots treated with 7.5 ton compost + 5.0 ton vinasse fed.$^{-1}$ (132.41 ppm) compared to other treatments and the control. While, the lowest mean values (61.89 and 74.26 ppm) were obtained from the plots treated with viansse alone at the rate of 5.0 and 7.5 ton fed^{-1}, respectively, compared with control. These results may be due to the suitable C/N ratio in the compost, (Table 2) which has great effect on the soil available nitrogen, *Abdel-Wahab et al.,(2005).*

In regard to soil available P content, data in Table (5), show that the highest mean values of available P (25.49 and 22.32 ppm) were obtained from the plots treated with 7.5 ton fed.$^{-1}$ compost and 7.5 ton compost + 5.0 ton vinasse fed.$^{-1}$, respectively. The availability of P is affected by a complexity of factors including the pH of the soil. In this respect, the application of compost alone and in combination with vinasse had positive impact on lowering pH values than the control, (as shown in Table 3) and thereby increase the concentration of available phosphorus in soil, *Lalljee (2005).*

Concerning the soil available K content, data in Table (5) indicated that the application of all treatments significantly increased the mean values of available K and reached their maximum values (181.8 and 17.05 ppm) in the plots treated with 7.5 ton compost + 7.5 ton vinasse fed.$^{-1}$ and 7.5 ton compost + 5.0 ton vinasse fed.$^{-1}$, respectively.

Table (5): Mean values of available contents of NPK in soil samples (0 – 30 cm) taken after harvesting in both two seasons.

Treatment	N - KCl (ppm)			P - Olson (ppm)			K - DTPA (ppm)		
	1st Season	2nd Season	Mean	1st Season	2nd Season	Mean	1st Season	2nd Season	Mean
Control	55.25	54.15	54.70	5.24	6.05	5.65	72.15	88.25	80.20
C_1	113.45	112.60	113.03	16.32	15.65	15.99	95.45	101.26	98.36
C_2	138.23	137.45	137.84	26.72	24.25	25.49	111.65	110.54	111.10
V_1	61.54	62.24	61.89	6.95	7.54	7.25	140.50	139.45	139.98
V_2	73.70	74.85	74.28	8.65	8.02	8.34	147.23	150.25	148.74
C_1+V_1	84.87	82.56	83.72	10.25	10.87	10.56	155.50	154.86	155.18
C_1+V_2	98.23	95.50	96.87	13.45	14.27	13.86	162.74	168.90	165.82
C_2+V_1	131.56	133.25	132.41	23.45	21.18	22.32	172.65	171.45	172.05
C_2+V_2	118.28	119.46	118.87	17.98	16.23	17.11	181.54	182.05	181.80
L.S.D*	4.66	4.46		2.54	2.76		0.12	0.13	

***L.S.D at 0.05 between treatments**

Clover yield parameters:-

Data presented in Tables (6 and 7) indicated that, except vinasse treatments, the mean values of plant height and dry yield in the three successive cuts, of the two seasons, significantly increased with increasing the application rates of the compost and their combination with vinasse compared to control. It is clear from Table (8) that the plots treated with 7.5 ton compost alone and 7.5 ton compost + 5.0 ton vinasse fed^{-1} gave higher average values of plant height and dry yield than those obtained with the other treatments. The average relative increments of plant height and clover dry yield of three cuts in two seasons were 57.41 and 55.34 % for the plots treated with the compost 7.5 ton fed.$^{-1}$ and were 45.28 and 47.57 % for plots treated with compost 7.5 ton fed.$^{-1}$ + vinasse 5.0 ton fed.$^{-1}$ respectively, over the control.

Table (6): Effect of compost, vinasse and their combinations on plant height, dry yield and total content of (N, P and K %) in three successive cuts of Egyptian clover (season 1).

Treatments	Plant Height (cm)			Dry Yield (ton / fed.)			N %			P %			K %		
Cut No.	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Control	36.0	38.5	40.8	0.95	0.97	1.04	2.64	2.80	2.96	0.32	0.34	0.38	2.33	2.55	2.66
C_1	42.5	49.2	49.5	1.12	1.14	1.15	3.04	3.41	3.50	0.41	0.45	0.49	2.66	3.14	3.33
C_2	54.0	56.0	63.5	1.18	1.29	1.75	3.57	3.78	4.08	0.52	0.56	0.61	3.39	3.58	3.86
V_1	29.2	31.7	33.8	0.91	0.87	0.98	2.46	2.69	2.60	0.24	0.25	0.27	2.15	2.23	2.44
V_2	24.5	27.6	31.8	0.75	0.78	0.92	2.18	2.48	2.70	0.20	0.22	0.26	2.14	2.21	2.37
$C_1 + V_1$	37.5	42.6	47.0	1.05	1.06	1.38	2.98	3.02	3.28	0.38	0.41	0.43	2.98	3.11	3.38
$C_1 + V_2$	36.5	40.0	43.5	1.02	1.05	1.29	2.80	2.91	3.14	0.31	0.35	0.40	3.09	3.25	3.45
$C_2 + V_1$	48.0	51.0	62.0	1.16	1.21	1.67	3.44	3.68	3.94	0.44	0.49	0.55	3.38	3.75	4.00
$C_2 + V_2$	43.5	48.7	52.5	1.14	1.19	1.56	3.12	3.60	3.65	0.42	0.47	0.53	3.54	4.02	4.43
*L.S.D	3.004	4.328	2.800	0.037	0.063	0.093	0.164	0.211	0.249	0.080	0.015	0.024	0.013	0.009	0.031

*L.S.D at 0.05 % between treatments

Table (7): Effect of compost, vinasse and their combinations on plant height, dry yield and total content of (N, P and K %) in three successive cuts of Egyptian clover (season 2).

Treatments	Plant Height (cm)			Dry Yield (ton / fed.)			N %			P %			K %		
Cut No.	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Control	34.0	36.0	37.5	0.90	0.98	1.16	2.75	2.94	3.00	0.27	0.28	0.32	2.42	2.59	2.81
C_1	40.5	46.0	47.5	1.06	1.15	1.53	3.04	3.24	3.42	0.39	0.41	0.47	2.80	3.26	3.52
C_2	52.0	59.0	66.0	1.21	1.38	1.73	3.40	3.54	3.70	0.51	0.53	0.59	3.28	3.54	3.82
V_1	27.0	32.0	34.0	0.81	0.88	1.05	2.60	2.80	2.96	0.25	0.27	0.29	2.25	2.40	2.58
V_2	25.0	29.0	32.0	0.78	0.86	0.95	2.48	2.67	2.83	0.21	0.25	0.28	2.17	2.34	2.43
$C_1 + V_1$	39.0	44.0.	46.0	1.02	1.08	1.40	2.96	3.21	3.26	0.34	0.37	0.43	3.15	3.31	3.55
$C_1 + V_2$	36.0	40.0	41.0	0.99	1.04	1.28	2.88	3.11	3.17	0.30	0.32	0.41	3.23	3.41	3.60
$C_2 + V_1$	47.0	54.0	61.0	1.15	1.30	1.65	3.24	3.45	3.62	0.45	0.47	0.57	3.31	3.62	3.87
$C_2 + V_2$	42.0	49.0	51.0	1.10	1.25	1.60	3.17	3.37	3.49	0.41	0.43	0.51	3.46	3.80	4.54
*L.S.D	2.572	2.720	3.881	0.046	0.0413	0.0416	0.023	0.022	0.025	0.026	0.026	0.029	0.016	0.016	0.046

*L.S.D at 0.05 % between treatments

Table(8): Average values of three cuts of plant height and dry yield of Egyptian clover (two seasons).

Treatments	Plant Height (cm)			Dry Yield (ton / fed.)		
No. of Season	1st Season	2nd Season	Mean	1st Season	2nd Season	Mean
Control	35.80	38.40	37.10	1.01	1.04	1.03
C_1	44.80	47.10	45.90	1.25	1.15	1.20
C_2	59.00	57.80	58.40	1.44	1.75	1.60
V_1	31.00	31.60	32.30	0.91	0.98	0.95
V_2	28.70	28.00	28.40	0.87	0.92	0.90
$C_1 + V_1$	43.00	42.40	42.50	1.17	1.38	1.28
$C_1 + V_2$	40.70	40.00	40.40	1.10	1.29	1.20
$C_2 + V_1$	54.00	53.70	53.90	1.37	1.67	1.52
$C_2 + V_2$	47.30	48.20	47.80	1.32	1.56	1.44

These direct effects of these treatments in increasing clover yield parameters could be explained through its favorable role on soil water retention and maintenance of nutrients, which in turn enhanced translocation efficiency of the clover plants. These results support those obtained by *Bardran (2002); Badawi (2003) and Tejada et al., (2006).*

On the other hand, the vinasse addition alone gave lowest mean values of plant height and clover dry yield of the three successive cuts, in both seasons, compared with other treatments and control. The average values of Egyptian clover yield parameters were negatively affected in the plots treated with highest application rate of vinasse (7.5 ton fed.-1) and were lower than those obtained under the control treatment. The average relative decrease of plant height and clover dry yield of the three cuts in two seasons were obtained in the plots treated with vinasse at rate 7.5 ton fed.-1and were 23.45 and 12.62 % respectively, lower the control. It can be stated that, these results is due to the effect of either vinasse alone, compost alone and / or their combinations on the soil physical and chemical properties. Similar results were obtained by *Tejada and Gonzalez (2006); Alba (2001) and Tejada et al.,(2006).*

Total NPK content:

The mean values of total contents of N, P and K in the three cutting of Egyptian clover, in both seasons, are shown in (Table 6 and 7). The data show that, except vinasse treatments, the total contents of N, P and K in the shoots of clover plants significantly increased with increasing the application rates of the compost alone and its combination with vinasse compared with other treatments and control. In this respect, the plots treated with 7.5 ton compost and 7.5 ton compost fed.$^{-1}$ + 5.0 ton vinasse fed.$^{-1}$ give the highest mean values of total N (3.70 and 3.62 %) and P (0.59 and 0.57 %) content, in the third cut, compared to other treatments and the control. The highest mean value of total K (4.54 %) content was obtained from the plots treated with 7.5 ton compost + 5.0 ton vinasse fed.$^{-1}$ compared to other treatments and the control. These results were consistent with those obtained by *Mekail (1998)* who mentioned that composted materials were considered as the major source of both available macro and micronutrients in appropriate amounts.

On the other hand, Table (6 and 7) show that, total contents of N, P and K significantly decreased with increasing the application rates of vinasse. The lowest mean values were observed in the first cut through both seasons and are 2.44 % for N, 0.21 % for P and 2.17 % for K for the plots treated with the high rate of vinasse (7.5 ton fed.$^{-1}$) and they were lower than those obtained for control. Several studies reported that the application of vinasse to the soil, especially at high doses, negatively affect soil physical properties as well as nutrient uptake, and crop yield and quality, *Tejada and Gonzalez, (2006)* and *Tejada et al. (2006)*.

CONCLUSIONS

It could be concluded that the applications of rice straw compost alone at rate of 7.5 ton fed.$^{-1}$ to a sandy clay loam soil resulted for improvement in some soil physical and chemical properties as well as for the production and nutrient contents of Egyptian clover.

The application of vinasse at high application rate (7.5 ton fed.$^{-1}$) to the soil caused a negatively effect on soil physical properties and Egyptian clover yield parameters. This negative effect of vinasse may be due to its nature.

An opposite trend was observed when the application of vinasse with rice straw compost at application rate 7.5 ton of compost + 5.0 ton of vinasse fed.$^{-1}$.

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تأثير إضافة كمبوست قش الأرز والفيناس على خواص التربة وإنتاجية محـــصول البرسيم المصري

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أجريت تجربتان حقليتان متتابعتان في أحد المزارع بمركز القـصاصين بمحافظـة الإسـماعيلية خلال الموسمي الشتوي عام ٢٠٠٩/٢٠١٠ و ٢٠١٠/ ٢٠١١ في أرض ذات قوام طميي رملي تحت نظـام الري الرش، ، وذلك بغرض دراسة تأثير إضافة الكمبوست عند معدل إضافة ٥ و ٧,٥ طن فدان⁻¹ والفيناس عند معدل إضافة ٥ و ٧,٥ طن فدان⁻¹ والإضافة معا في التربة، على بعض الخـواص الطبيعيـة للتربـة (الكثافة الظاهرية ونسبة المسام الكلية) وبعض الخواص الكيمائية للتربة (درجة الحموضة والقلوية، النـسبة المئوية للمادة العضوية، الأملاح الكلية الذائبة، النسبة المئوية للصوديوم المتبادل، والسعة التبادلية الكاتيونية) وبالمثل بعض الصفات المحصولية وإنتاجية محصول البرسيم المصري. وقد صممت التجربة في قطاعـات كاملة العشوائية في تسعة معاملات في ثلاث مكررات للمعاملة. وقد أضيفت كل المعاملات مرة واحدة فـي كلا موسمين الزراعة قبل أسبوع من زراعة تقاوي البرسيم المصرى.

وقد أوضحت النتائج المتحصل عليها، فيما عدا معاملات الفيناس ، أن إضافة كمبوست قش الأرز بمعدل ٧,٥ طن فدان⁻¹ أدت الى تناقص في متوسط قيم الكثافة الظاهرية، والتوصيل الكهربي والنسبة المئوية للصوديوم المتبادل بينما حدث زيادة في قيم المسام الكلية والمحتوى الميسر للنتروجين والفسفور في التربـة تحت الدراسة بالمقارنة بالمعاملات الأخرى. ومن جهة أخرى وجد أن إضافة ٧,٥ طن كمبوست + ٧,٥ طن فيناس فدان⁻¹ أدت الى تناقص في قيم درجة الحموضة والقلوية وزيادة في قيم المـادة العـضوية والـسعة التبادلية الكاتيونية ومحتوى التربة من البوتاسيوم الميسر بالمقارنة بالمعاملات الأخرى. علاوة على ذلك فإن الوحدات التجريبية التى عوملت مع ٧,٥ طن كمبوست + ٥ طن فيناس فدان⁻¹ قد أعطت قيم عالية للصفات المحصولية للبرسيم المصري فى الحشات الثلاثة بالمقارنة بالمعاملات الأخـرى والكنتـرول. وأن الزيـادة النسبية فى طول النبات والإنتاج الجاف للبرسيم المصري للثلاث حشات فى موسمي الزراعة، بينمـا كانـت ٥٥,٣٤ و ٥٧,٤١ % للوحدات التجريبية التي عوملت بمعدل ٧,٥ طن كمبوست فدان⁻¹ وكانـت ٤٥,٢٨ و ٤٧,٥٧ % للوحدات التجريبية التي عوملت مع٧,٥ طن كمبوست + ٥ طن فيناس فـدان⁻¹ علـى التـوالي وكانت اعلي من قيم الكنترول .

وعلى العكس من ذلك، فإن إضافة الفيناس بمعدل إضافة ٧,٥ طن فدان⁻¹ أدى إلى زيـادة فـي متوسط قيم الكثافة الظاهرية ،التوصيل الكهربى والنسبة المئوية للصوديوم المتبادل وتناقص فى قيم المـسام الكلية للتربة وبالمثل تناقص فى إنتاجية محصول البرسيم المصري. علاوة على ذلك فإن التناقص النسبي فى طول النبات والإنتاج الجاف للبرسيم المصري للثلاث حشات فـي موسـمى الزراعـة, كانـت ٢٣,٤٥ و ١٢,٦٢% للوحدات التجريبية التي عوملت بمعدل ٧,٥ طن فيناس فدان⁻¹ على التوالي وأقل من الكنترول.

وبصفة عامة، فقد أشارت هذه النتائج الى أن إضافة كمبوست قش الأرز فى صورة منفردة أوفى صورة خلط مع الفيناس كان له أثر إيجابي على بعض خواص التربة وإنتاجية محصول البرسيم المـصري، في حين أن إضافة الفيناس فى صورة منفردة عند معدل إضافة عالي كان له أثر سلبي على بعض خـواص التربة وإنتاجية محصول البرسيم المصري.

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