The Possible Use of Diluted Vinasse as A Partial Replacement with Mineral Fertilizer Sources for Wheat Production and Improving Nutritional Status in Sandy Soil

Mona, A. Osman

Soils, Water and Environ. Res. Inst., Agric. Res. Center, Giza, Egypt

Abstract: A field experiment was carried out using wheat plants (*Triticum aestivum* L., CV. Giza 168) grown on sandy soil at Ismaillia Agric. Res. Station, Agric. Res. Center (ARC), to evaluate the use of vinasse as a partial replacement of mineral fertilizers. The following three rates from diluted vinasse (V1) 2.5, (V2) 5 and (V3) 10 % were sprayed on surface soil layer once a week, with or without enrichment by 2 % N, P and K nutrients, after wheat cultivation. Control treatment was received the full doses of the mineral fertilizers. On the other hand, the effect of applications, 0, 50 and 75 % from the recommended dose of mineral fertilizers were combined with the previous three levels of diluted vinasse with or without enriched with macronutrients on the sandy soil and wheat plants were also investigated. The obtained results indicate that applied, Zero, 50 or 75 % from the mineral fertilizers in combination with or without vinasse led to slightly decrease pH values by increasing the rate of vinasse alone (V) or enriched with macronutrients (Ve) at both tested seasons. However, EC values in soil were generally increased by increasing the rate of vinasse (V) or (Ve). Moreover, Enriched vinasse with macronutrients (Ve) led to significantly increase the EC and available N, P and K nutrients in the soil than the other tested treatments. Moreover, application of mineral fertilizers at 50 and 75 % from the recommended dose led to significant increases N, P and K uptake in straw and grains of wheat than vinasse without mineral fertilizers (MF) treatments. The highest N, P and K uptake values were 55.6, 22 and 96.8 Kg/ fed and 77.4 , 24.1 and 13.1 Kg/ fed in wheat straw and grains, respectively. These values were significantly higher than that recorded by treatment V2 +75 % MF unriched by N, P and K. However, N, P and K uptake were decreased significantly by increasing the rate of Ve application in case of Ve3+75%MF treatment. Concerning the yield of wheat, it was gradually increased by increasing the rate of vinasse amendment, especially for vinasse enriched with macronutrients combined with 50 % MF while the application of 75 % MF with V3 led to significant decrease but still over the control in both two seasons. However, the highest significant increases in yield components (straw and grains) were obtained with application of V2 enriched with macronutrients and 75 % MF at both tested seasons as compared to the control treatment.

[Mona, A. Osman. The Possible Use of Diluted Vinasse as A Partial Replacement with Mineral Fertilizers Source on Wheat Yield and Nutritional Status on Sandy Soil. Nature and Science 2010;8(11):245-251] (ISSN: 1545-0740).

Keywords: Vinasse; Mineral; Fertilizer; Wheat; Yield; Soil

1. Introduction:

One of the main factors affecting plant growth in sandy soils is the types and amounts of fertilizers. However, the cost of mineral fertilizers has been significantly going up and up. As a result, it has become necessary to seek alternatives that would supply the poor soil with more economic sources of fertilizers (Rodriguez, 2000). Vinasse improves almost factors involved in soil fertility, provides favoring conditions for nitrogen assimilation into the soil, protects nutrients against washing out in winter and maintains them as reserve nutrients as a slow release during the vegetative period. These are the most important affect, leading to increase yield and quality of crops. Concentrated vinasse can be regarded as industrial by-product containing valuable active substances, recyclable to plant cultivation, Debruck and Lewicki (1990). Murillo et al. (1992) found that vinasse application produced beneficial results for ryegrass seedlings in the three cultivated soils while sunflower and ryegrass had the smallest *in vitro* germination under both solutions of 0.15 and 0.50 % of pure vinasse. However, seedling emergence, plantlet growth and nutrient content of sunflower grown in plots, in three different soil types, were not negatively affected by the application of moderate dose of pure vinasse, roughly equivalent to 2-3 t ha^{-1}. The application of vinasse at sowing can partially avoid losses of N that can take place if the vinasse is applied too far in advance of sowing, Murillo et al. (1998). Moreover, Gemtos et al. (1999)

studied the vinasse rate, time of application and compaction effect on soil properties and durum wheat crop to evaluate the effect of sugar cane industry wastes on some chemical soil properties, macro and micronutrients (N, P and K), (Fe, Zn, Mn and Cu) availability to wheat plants. The applied treatments were mineral K fertilizer (K_2SO_4), vinasse, bagasse ash, organo-mineral fertilizer (Tacamolia) and control. The treatments were added on the K-equivalent basis (25, 50 and 100 mg K kg^{-1}). The obtained results indicated that, sugar cane wastes incorporated into the loamy sand soil affected the forms of soil K and K availability to wheat plants. Addition of vinasse wastes caused a significant decrease in soil pH and significant increases in soil available P, total N, and total organic C. Omar et al. (2000) found that, application of different concentrations (0.5, 1.0, and 1.5 ton/ fed) of vinasse as soil conditioner caused an increase in grain yield of faba bean with average values 33% over the control, irrespective of concentrated vinasse levels. Madejon et al. (2001) added that, direct application of concentrated vinasse on agricultural lands may lead to economical and environmental problems due to high salinity. Tejada and Gonzalez (2006) mentioned that, despite the nutrient supply by the vinasse, under dry land conditions, may be led to negatively affect soil structure, nutrient uptake and crop yield and quality because of its high concentration of monovalent cations, such as Na and fulvic acids were introduced into the soil by the vinasse, thus destabilizing its structure. Moreover, Parnaudeau et al. (2007) mentioned that, both diluted and concentrated vinasse can be spread on agricultural fields or used as organic fertilizer. Concentrated vinasse led to a slight increase in the abundance of phenolic compounds, acid – insoluble fraction and a slight decrease in the labile fraction of vinasses partially or totally derived from sugar beet.

The objectives of the present study, are based on the possible use of diluted vinasse to replace the fertilization of potassium and partially replace fertilization with Nitrogen and phosphorus due to its content of high levels of the organic matter, potassium, calcium and moderate amount of N and P . Also, the use of vinasse as a fertilizer source applied at different doses combined with different rates of mineral fertilizers on yield and nutritional status of wheat crops grown on sandy soil.

2. Materials and Methods:

A field experiment was carried out on wheat plants (*Triticum aestivum* L., CV. Giza 168) cultivated in sandy soil at Ismaillia Agric. Res. Station, ARC, to evaluate the use of vinasse as a fertilizer source and partially replacement to mineral fertilizers. Some physical and chemical characteristics of the tested soil sample are shown in Table (1), while vinasse composition is presented in Table (2).

Table (1): Some physical and chemical properties of the experimental soil

Soil characteristics	Values
Particle size distribution %	
Coarse Sand	**72.20**
Fine Sand	**17.60**
Silt	**3.04**
Clay	**7.16**
Texture class	**Sandy**
Chemical properties	
$CaCO_3$ %	**1.40**
pH(Suspension 1: 2.5)	**7.60**
EC dS/m (Saturated past extract)	**0.33**
Organic matter %	**0.52**
Soluble cations and anions (meq/l)	
Ca^{++}	**0.92**
Mg^{++}	**0.84**
Na^{+}	**1.56**
K^{+}	**0.46**
CO_3^{--}	**-**
HCO_3^{-}	**1.32**
Cl^{-}	**1.22**
SO_4^{--}	**1.24**
Available nutrients (mg Kg^{-1})	
N	**79**
P	**23**
K	**112**

Table (2): Composition of the concentrated vinasse used in the experiment

pH	Density Kgl^{-1}	O.M (gl^{-1})	O.C (gl^{-1})	Total sugar (%)	Available macronutrient			Total macronutrient (ppm)		
					N (gkg^{-1})	P (%)	K (%)	N	P	K
4.20	1.29	535	310	59.7	25	0.09	7.06	1575	390	6300

Source: Integrated industries and sugar Co., El-Hawamdia, Egypt.

Concentrated vinasse is provided by Integrated industries and sugar Co., El-Hawamdia,Egypt. The following three rates from diluted vinasse 2.5, 5 and 10 % (V1, V2, V3), respectively, were sprayed on surface soil layer once a week with or without enriched by 2 % N , P and K nutrients. Mineral fertilizers were applied at a full dose for control treatment from the ammonium sulphate (20.5 %) Superphosphate (15 % P_2O_5) and Potassium sulphate (48 % K_2O) at rates of 100, 200 and 50 kg fed $^{-1}$ of N, P_2O_5 and K_2O respectively. Mineral fertilizers treatments were added with three ratios Zero, 50 and 75 % from the recommended dose as combined with the three level from the diluted vinasse with or without enrichment with macronutrients as the following:

i. Zero, 50 and 75 % from the recommended dose.
ii. Zero, 50 and 75 % from the recommended dose + three levels from the diluted vinasse without enrichment with macronutrients.
lll. Zero, 50 and 75 % from the recommended dose + three levels from the diluted vinasse enrichment with macronutrients .

The diluted vinasse sprayed weekly on the surface soil layer after wheat cultivation. The experiment was designed in split – split plot design with three replications. The main plots were applied with the mineral fertilizers, the sub-main plots were applied with the vinasse amendments, and the sub-sub main plots were applied with the enriched vinasse with NPK fertilizers, which added both P and K before planting while ammonium sulphate was added in four equal split doses after 2 , 4 , 6 and 8 weeks from sowing. Plants were harvested at maturity from each plot, and the yield components (straw and grains) were weighted, and subjected to oven dried at 70°C, up to a constant dry weight, ground and prepared for digestion using H_2SO_4 and H_2O_2 methods as described by Page et al. (1982). Furthermore, chemical properties of soil samples were determined according to Cottenie et al. (1982). Obtained results were subjected to statistical analysis according to Snedecor and Cochran (1982), and the treatments were compared by using the least significant difference (L.S.D) at 0.05 level of probability.

3. Results and Discussion:

1-Influence of applied diluted vinasse as a fertilizer source partially replacing with mineral fertilizers on soil chemical characteristics.

Chemical properties:

1. 1 Soil reaction (pH)

Data presented in Table (3) show, the effect of different rates of vinasse that partially substitute of N, P and K mineral fertilizers on some chemical properties of the tested soil at two seasons, data indicate that, applied diluted vinasse with or without the following mineral fertilizer's rates: Zero, 50 or 75 % from the recommended dose led to slightly decrease the pH values gradually by increasing the rate of application either for vinasse alone (V) or vinasse enriched with macronutrients (Ve) as compared to the control at both tested seasons. This may be due to the increase of the vinasse rate, which led to slightly increase the insoluble acid fraction (Parnaudeau et al., 2007 and Paz et al.,2009) because vinasse is an acidic liquid with pH between 4 and 5 (Carmen and Pmp, 2006). On the other hand, the values of pH were increased gradually by increasing the mineral fertilization rate either with both vinasse amendment treatments (V) or (Ve) in both tested seasons.

1. 2. Electric conductivity (EC)

Results show that, the values of EC in soil at both seasons, generally, were increased by increasing the rate of vinasse (V) or (Ve). This may be led to increase the concentration of dissolved salts in the vinasse and especially the monovalent cations, (Tejada and Gonzalez, 2005). Moreover, enriched vinasse with macronutrients caused a significant increase in EC values as compared to the control or the other tested treatments.

1.3 Availability of macronutrients

Macronutrients availability in the tested soil, at the two seasons, were affected by combined vinasse amendment with different rates of mineral fertilizers (MF). Values of macronutrients N, P and K were increased due to increasing the rate of both two vinasse amendment types, i.e., (V) and (Ve). Moreover, data presented indicated significant increases in available N, P and K in a case of (Ve) as compared to (V) treatment. This may be due to its high organic matter content, nitrogen and potassium concentration (Madejon et al., 2001). However, the addition of mineral fertilization led to significant increase in available N, P and K with increasing the mineral fertilizer's rates in comparison to vinasse alone treatments (Paz et al., 2009).

Table (3) Effect of applied different rates of Vinasse as partially replace to mineral fertilizers on some chemical properties of the tested soil for both seasons

Treatments			First Season					Second Season				
Mineral fertilizers (MF)	Vinasse rates	Vinasse enriched with nutrients	pH	E C ds/m	Available of NPK nutrients (ppm)			pH	EC ds/m	Available of NPK nutrients (ppm)		
					N	P	K			N	P	K
Control			8.20	0.80	100.	24.7	87.0	8.30	0.90	102	26.2	99.0
Zero %	V1	Without	7.80	1.10	82.0	8.2	82.0	7.80	1.10	99.4	10.8	98.0
	V2		7.60	1.10	90.0	14.5	136	7.60	1.10	101	16.0	148
	V3		7.50	1.10	95.0	19.3	198	7.40	1.10	102	20.7	206
Mean			**7.60**	**1.10**	**89.0**	**14.0**	**138**	**7.60**	**1.10**	**101**	**15.8**	**151**
50%	V1		8.00	1.10	99.0	28.0	132	8.00	1.10	102	30.0	136
	V2		7.90	1.20	100.	30.7	145	7.80	1.10	102	32.0	165
	V3		7.60	1.20	102.	40.4	289	7.50	1.20	103	50.0	280
Mean			**7.80**	**1.20**	**100.**	**33.0**	**188**	**7.80**	**1.10**	**102**	**37.3**	**194**
75%	V1		8.00	1.10	103.	24.2	280	8.00	1.10	105	26.5	288
	V2		7.90	1.10	105.	29.0	350	7.90	1.10	106	30.8	366
	V3		7.80	1.20	106.	32.0	369	7.60	1.20	107	34.0	389
Mean			**7.90**	**1.10**	**104**	**28.4**	**333**	**7.80**	**1.20**	**106**	**30.4**	**348**
Mean			**7.80**	**1.10**	**98.1**	**25.1**	**220**	**7.70**	**1.10**	**103**	**27.9**	**231**
Zero %	V1	With	8.10	1.10	98.0	17.0	115	8.20	1.10	102	19.5	117
	V2		7.60	1.20	117.0	22.7	145	7.60	1.10	120	24.3	150
	V3		7.60	1.20	120.0	24.0	287	7.60	1.20	122	25.6	292
Mean			**7.70**	**1.20**	**111.7**	**21.2**	**182**	**7.80**	**1.10**	**114**	**23.1**	**186**
50%	V1		8.40	1.20	100.0	22.0	137	8.20	1.20	105	23.1	148
	V2		7.90	1.20	120.0	28.0	270	7.90	1.20	126	29.1	286
	V3		7.80	1.50	127.5	43.0	298	7.70	1.30	129	48.6	294
Mean			**8.00**	**1.30**	**115.8**	**31.0**	**235**	**7.90**	**1.20**	**120**	**33.6**	**242**
75%	V1		8.40	1.10	100.8	37.6	289	8.60	1.10	112	39.9	290
	V2		7.90	1.20	127.4	43.5	370	8.00	1.20	129	49.3	383
	V3		7.80	1.60	97.2	17.8	74.5	7.70	1.30	102	20.0	85.9
Mean			**8.10**	**1.30**	**108.5**	**33.0**	**244**	**8.10**	**1.20**	**114**	**36.4**	**253**
Mean			**7.90**	**1.20**	**112.0**	**28.4**	**220**	**7.90**	**1.20**	**116**	**31.0**	**227**
LSD (0.05) for												
Vinasse enrichment (A)			**0.05**	**0.007**	**1.38**	**0.94**	**1.47**	**0.27**	**0.024**	**1.40**	**0.98**	**1.52**
Mineral fertilizer (B)			**0.02**	**0.008**	**0.82**	**0.91**	**1.35**	**0.14**	**0.019**	**0.90**	**0.80**	**1.26**
Vinasse (C)			**0.03**	**0.010**	**0.64**	**0.61**	**2.41**	**0.11**	**0.018**	**0.80**	**0.75**	**2.72**
A*B			**0.02**	**0.006**	**1.43**	**1.59**	**2.34**	**0.24**	**0.033**	**1.30**	**1.40**	**2.00**
A*C			**0.03**	**0.009**	**1.10**	**0.61**	**2.41**	**0.19**	**0.030**	**1.00**	**0.82**	**2.31**
B*C			**0.03**	**0.009**	**1.10**	**0.61**	**2.41**	**0.19**	**0.030**	**1.00**	**0.50**	**2.60**
A*B*C			**0.05**	**0.017**	**1.91**	**1.05**	**4.17**	**0.34**	**0.052**	**1.60**	**1.00**	**4.00**

2- Influence of applied diluted vinasse as a fertilizer source partially replacing with mineral fertilizers on macronutrients uptake in straw and grains of wheat plants.

Regarding the effect of vinasse amendment alone (V) or (Ve) and the rate of mineral fertilizers on nutrient uptake by both straw and grains of wheat plants grown in sandy soil, data in Table (4) indicated that vinasse amendment as (V) or (Ve) applied with mineral fertilizers at 50 and 75 % from the recommended dose caused a significant increase in N, P and K uptake in both wheat straw and grains than vinasse without mineral fertilizers (MF). Generally low level of vinasse (V1) combined with either 50 or 75 % (MF) had secured a higher N, P and K uptake for straw than the control treatments or zero (MF) . However, (Ve) amendment caused a higher N, P and K uptake than vinasse alone or control treatments with different rate zero, 50 or 75 % of (MF). The highest N, P and K uptake (55.6, 22 and 96.8) and (77.4, 24.1 and 13.1) kg/ fed in straw and grain, respectively was recorded in case of treatment (Ve2 +75 % MF). These values were significantly higher than that recorded by the treatment of V2 +75 % MF without enriched by N, P and K due to a general increase of the root system area in case of Ve2 +75 % MF and not to any specific enhancement of the normal ion uptake mechanism (Murty and Ladha, 1988). Results also, mentioned that N, P and K uptake decreased significantly by increasing the rate of (Ve) in case of treatment Ve3+75%MF.

Table (4) Uptake of macronutrients (kgfed^{-1})on wheat plants as affected by applied different rates of mineral fertilizers as a partially replacing by Vinasse

Treatments			Uptake (kgfed^{-1})											
Mineral fertilizers (MF)	Vinasse Rates	Vinasse enriched with nutrients	First Season						Second Season					
			Straw			Grain			Straw			Grain		
			N	P	K	N	P	K	N	P	K	N	P	K
Control			**22.4**	**8.50**	**35.1**	**57.0**	**17.5**	**11.3**	**23.0**	**7.40**	**35.0**	**58.0**	**18.2**	**11.5**
Zero %	**V1**	**Without**	7.3	2.10	14.6	25.9	7.7	5.00	10.0	2.20	13.2	25.5	8.20	6.00
	V2		12.0	4.40	25.5	39.2	12.4	7.00	13.0	4.30	26.3	39.9	13.7	7.40
	V3		17.8	7.10	36.4	41.9	14.2	7.80	16.9	7.00	37.2	43.4	14.6	7.90
Mean			**12.4**	**4.53**	**25.5**	**35.7**	**11.4**	**6.60**	**13.3**	**4.50**	**25.6**	**36.3**	**12.2**	**7.10**
50%	**V1**		24.6	9.20	50.9	37.4	11.6	7.70	23.7	8.40	46.0	38.2	11.0	6.80
	V2		24.9	9.20	52.9	47.7	14.5	9.50	24.0	9.30	54.0	46.9	15.2	9.40
	V3		28.3	12.6	78.5	66.7	20.4	13.4	29.3	11.2	79..6	56.9	18.7	14.0
Mean			**25.9**	**10.3**	**60.8**	**50.6**	**15.5**	**10.2**	**25.7**	**9.63**	**59.9**	**47.3**	**14.9**	**10.1**
75%	**V1**		27.4	10.5	56.7	53.7	17.9	11.9	27.3	9.40	59.5	50.7	19.2	12.0
	V2		28.2	11.0	60.8	55.7	15.9	10.9	29.4	10.0	62.5	56.2	20.0	13.2
	V3		31.9	16.5	89.7	75.4	22.1	17.3	30.2	17.2	88.2	77.2	22.2	16.9
Mean			**29.2**	**12.7**	**69.1**	**61.6**	**18.6**	**13.4**	**28.9**	**12.2**	**70.1**	**61.4**	**20.5**	**14.0**
Mean			**22.5**	**9.18**	**51.8**	**49.3**	**15.2**	**10.1**	**22.6**	**8.78**	**51.9**	**48.3**	**15.9**	**10.4**
Zero %	**V1**	**With**	17.6	5.50	33.9	32.2	9.50	6.30	18.4	6.40	32.2	30.4	9.70	7.40
	V2		19.0	6.00	39.4	42.2	14.6	9.10	18.6	6.50	39.7	44.2	15.2	10.0
	V3		20.5	6.70	41.8	47.5	15.4	9.90	20.7	7.00	42.7	45.9	16.7	11.0
Mean			**19.0**	**6.07**	**38.4**	**40.6**	**13.2**	**8.43**	**19.2**	**6.63**	**38.2**	**40.2**	**13.9**	**9.47**
50%	**V1**		31.0	8.80	48.8	52.0	14.6	9.90	33.0	8.90	50.0	53.0	14.9	9.00
	V2		42.8	15.5	72.5	71.6	21.4	11.6	39.5	14.6	62.7	73.0	21.0	12.0
	V3		43.1	15.5	74.3	75.4	23.9	13.1	40.7	16.0	75.8	74.0	24.6	14.0
Mean			**38.9**	**13.3**	**65.2**	**66.3**	**19.9**	**11.5**	**37.7**	**13.2**	**62.8**	**66.7**	**20.2**	**11.7**
75%	**V1**		35.9	16.1	58.0	69.0	18.9	13.1	36.6	17.0	60.2	70.0	19.0	13.2
	V2		55.6	22.0	96.8	77.4	24.1	13.1	57.2	24.0	82.5	77.2	25.0	14.7
	V3		25.3	6.60	49.3	53.7	16.9	6.50	24.7	7.00	50.4	63.2	19.2	6.50
Mean			**38.9**	**14.9**	**68.0**	**66.7**	**19.9**	**10.9**	**39.5**	**16.0**	**64.4**	**70.1**	**21.1**	**11.5**
Mean			**32.3**	**11.4**	**57.2**	**57.9**	**17.7**	**10.3**	**32.1**	**11.9**	**55.1**	**59.0**	**18.4**	**10.8**
LSD(0.05) for														
Vinasse enrichment (A)			**0.35**	**0.22**	**0.75**	**4.53**	**0.67**	**0.32**	**1.48**	**0.63**	**4.09**	**1.76**	**3.13**	**0.87**
Mineral fertilizer (B)			**0.31**	**0.14**	**0.66**	**3.61**	**0.12**	**0.19**	**0.57**	**0.31**	**0.54**	**0.32**	**0.61**	**0.61**
Vinasse ©			**0.22**	**0.10**	**0.45**	**3.31**	**0.14**	**0.20**	**0.53**	**0.33**	**0.87**	**0.52**	**0.79**	**0.72**
A*B			**0.31**	**0.25**	**1.15**	**6.25**	**0.20**	**0.33**	**0.99**	**0.57**	**0.93**	**0.52**	**0.85**	**0.68**
A*C			**0.39**	**0.18**	**0.77**	**5.73**	**0.24**	**0.35**	**0.92**	**0.57**	**0.87**	**0.93**	**0.79**	**0.72**
B*C			**0.39**	**0.18**	**0.77**	**5.73**	**0.24**	**0.35**	**0.92**	**0.57**	**0.89**	**0.93**	**0.79**	**0.72**
A*B*C			**0.67**	**0.31**	**1.34**	**9.93**	**0.42**	**0.60**	**1.59**	**0.98**	**1.53**	**1.61**	**1.37**	**1.25**

3- Influence of applied diluted vinasse as partially replacing of mineral fertilizers on yield components of wheat plants

Data illustrated in Table (5) revealed that, wheat yield (grains and straw) shows the highly significant effect of vinasse amendment with mineral fertilizers, especially V2, V3 with 50 % (MF) and V1, V2, V3 with 75 % (MF) at both tested seasons as compared to the control treatment. Generally, yield components increased gradually by increasing the rate of vinasse amendment, especially for vinasse enriched with macronutrients combined with MF (50 %) but for 75 % with V3 values of yield components decreased significantly, but they were still over the control at both tested seasons, due to increasing the rate of vinasse enriched with macronutrients and MF (75 %), because of its high concentration of monovalent cations, which may negatively affect on soil structure, nutrient uptake and crop yield and quality (Tejada, and Gonzalez, 2006). However, the highest significant increases in yield components (straw and grains) were obtained with the case of V2 enriched with macronutrients combined with MF (75 %) at both tested seasons as compared to the control treatment. Obtained results are in agreement with Omar et al. (2000) who found that vinasse application plays as a soil conditioner, which improves the nutrient uptake and yield.

Thus, it could be concluded that application of vinasse to field crops is a viable method for its disposal. Furthermore, it has a direct effect as a good replacement for mineral fertilizers, and an indirect effect through improving the plant nutrients absorbance. Additionally, 25% of the mineral fertilizers required for wheat crop can be reduced by the partial use of vinasse when sprayed on the soil surface weekly at a rate of either 5 or 10 %. Also, when diluted vinasse was sprayed as 2.5 or 5% enrichment with 2% macronutrients, it led to reduce the mineral fertilizers by 50%. However, this work needs to be repeated for other crops rather than wheat to reach the level or recommendation.

Table (5): Influence of applied diluted vinasse as a fertilizer source partially replacing with mineral fertilizers on yield components of wheat plants

Treatments			Yield components (Ton fed^{-1})			
Mineral fertilizers (MF)	Vinasse rates	Vinasse enriched with nutrients	First Season		Second Season	
			Straw	Grain	Straw	Grain
Control			**2.40**	**2.00**	**2.80**	**2.00**
Zero %	**V1**	**Without**	1.00	1.20	1.40	1.00
	V2		1.50	1.80	2.60	5.00
	V3		2.10	1.90	3.00	2.00
Mean			**1.50**	**1.70**	**2.30**	**2.70**
50%	**V1**		2.90	1.60	2.80	1.80
	V2		2.90	2.10	2.90	2.00
	V3		3.10	2.80	3.10	2.70
Mean			**3.00**	**2.20**	**2.90**	**2.20**
75%	**V1**		3.00	2.30	2.90	2.00
	V2		3.00	2.40	3.80	2.20
	V3		3.40	3.00	3.10	2.90
Mean			**3.10**	**2.60**	**3.30**	**2.40**
Mean			**2.50**	**2.10**	**2.80**	**2.40**
Zero %	**V1**	**With**	2.00	1.40	2.60	1.60
	V2		2.00	2.30	3.00	2.00
	V3		2.10	2.40	3.20	2.50
Mean			**2.00**	**2.00**	**2.90**	**2.00**
50%	**V1**		2.90	2.00	2.90	2.00
	V2		3.70	3.10	3.70	3.20
	V3		3.50	3.30	4.30	3.50
Mean			**3.40**	**2.80**	**3.60**	**2.90**
75%	**V1**		3.00	2.50	3.10	2.50
	V2		4.50	3.30	3.90	3.50
	V3		3.20	2.40	3.80	3.10
Mean			**3.50**	**2.70**	**3.60**	**3.00**
Mean			**3.00**	**2.50**	**3.40**	**2.60**
LSD (0.05) for						
Vinasse enrichment (A)			0.219	0.133	0.162	0.165
Mineral fertilizer (B)			0.124	0.120	0.096	0.160
Vinasse (C)			0.110	0.102	0.092	0.134
A*B			0.215	0.208	0.166	0.278
A*C			0.19	0.176	0.160	0.232
B*C			0.191	0.176	0.160	0.232
A*B*C			0.331	0.305	0.277	0.402

Corresponding author:
Mona, A. Osman
Soils, Water and Environ. Res. Inst., Agric. Res. Center, Giza, Egypt

4. References:

1- Carmen, B.S. and Pmp, P. E. (2006). Anaerobic digestion of vinasse for the production of methane in the sugar can distillery. "Conference on Sugar Processing" Loxahatchee, Florida, USA
2- Cottenie, A., Verloo, M.,Kiekns, L.,Velghe,G. and Camerlynek,R.(1982). "Chemical Analysis of Plant and Soils" Lab. Analy. And Agroch. St. State Univ., Ghent, Belgium.
3- Debruck, J. and Lewcki, W. (1990). Sugar beet vinasse as organic nutrient solution. Ernanrungsdienst. 29 (C.F Proceedings of The Tenth Microbiology Conference , Cairo , Egypt. pp.100-109)
4- Gemtose, T.A., Chouliaras, N. and Marakis,S. (1999). Vinasse rate,time of application and compaction effect on soil properties and drum wheat crop. Journal Agric. Engineering research. 73,3: 283-296.
5- Madejon, E., Lopez, R. Murillo, j. M. and Cabrera, F. (2001). Agricultural use of three (sugar- beet) vinasse composts. Effect of crops and chemical properties of a cambisol soil in the Guadalquivir river vally (SW Spain) Agric. Ecosyst. Environ.,84: 53-65.
6- Murillo, j. M., Cabrera, F. and Lopez, R. (1992). Effect of beet vinasse on germination and seedling performance of ryegrass (*Lolium multiflorum* Lam Cv. Barwoltra). J. Sci. Food Agric., 61: 155-160.
7- Murillo, j. M., Cabrera, F. and Lopez, R., and Olmedo, P.M.(1998). Sunflower response to the application of a concentrated beet vinasse. Soil Sci. and Plant Analysis. 29: 643-655.
8- Murty , M.G. and Ladha, J.K. (1988). Influence of Azospirillum inoculation on the mineral uptake and growth of rice under hydroponic condition. Plant and Soil. 108: 281-285.
9- Omar, M.N.A., Mostafa, A.T. and Ahmed, A. S.(2000). Concentrated vinasse as a novel diazotrophs growth medium (biovinasse inoculant) and soil conditioner to improve faba bean yield under dripping irrigation system. Proceedings of The Tenth Microbiology Conference, Cairo , Egypt pp.100-109.
10- Page, A. L., Meller, R. H. and Keeneyeds, D. R. (1982). "Methods of soil Analysis", Parts. Chemical and Microbiological Properties. Agronomy Monograph No., (2 nd Ed), pp 539-624.
11- Parnaudeau, V., Condom, N., Oliver, R., Cazevieille, P. and Recous, S. (2007). Vinasse organic matterquality and mineralization potential, as influenced by raw material, fermentation and concentration processes. (C.F Science direct-Bioresource Technology. Copyright©2007 Elsevier Ltd All rights reserved).
12- Paz, C.B. Rub, J. A.M. Ginenez, R. G. and Ballesta R.J. (2009). Impacts caused by the addition of wine vinasse on some chemical and mineralogical properties of a Luvisol and Vertisol in La Mancha. Journal of Soils and Sediments. 121-128
13- Rodriguez, j. G.(2000). Effect of vinasse on sugarcane (*Saccharum officinarum*) productivity . Rev. Fac. Agron., 17:318-326.
14- Snedecor, G.W. and Cochran, W.G. (1982). "Statistical Methods". 7 th Edition. Lowa State Univ. Press. Amer. 1. A, USA.
15- Tejada, M. and Gonzalez, J. L.(2005). Beet vinasse applied to wheat under dryland conditions affects soil properties and yield . Eur. J. Agron., 23: 336-347.
16- Tejada, M. and Gonzalez, J. L. (2006). Effect of two beet vinasse form on soil physical properties and soil loss. Catena. 68:41-50.

9/10/2010