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Effect of Cement By-Pass Addition to the Sandy Desert Soils on Growth, Yield and Nutrient Contents of Alfalfa (*Medicago sativa*)

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Abstract :

Disposal of industrial wastes is a major problem in many industrial companies that causes environmental hazards. Cement By-pass is one of the major byproducts of Cement industry which it daily accumulates in huge amounts (about 150 ton/day in the Assiut Cement Company). A field experiment was conducted in Assiut Cement Company farm to study effects of adding Cement By-pass at 0, 2.5, 5, 7.5% to the sandy desert soils without and with applying farm yard manure (FYM) at 4 ton/fed. on the growth, yield and nutrient contents of alfalfa. The experiment was designed as a randomized complete block in split plots with three replications where the farm yard manure (without and with FYM) was assigned to the main plots and By-pass levels was in the sub-plots. The area of each soil plot was 2x2 m (4 m^2). Alfalfa seeds were sown on April 8, 2009 at 15 g /plot. Nitrogen, phosphorus and potassium fertilizers were added to the soil at the recommended levels as ammonium nitrate, superphosphate and potassium sulfate, respectively. All agriculture practices were done as usual. Four alfalfa cuts were taken until Nov. 24, 2009.

By-pass addition to the sandy desert soil resulted in significant decreases in soil pH before cultivation and significant increases in the available soil P, K, Fe and Cu before and after the soil was cultivated by alfalfa. The interaction effect of By-pass and FYM application gave significant increases in the total soil N as well as available soil K and Cu but insignificant increases in the available soil P, Fe, Mn and Zn. The application of FMY caused increases in about 44.8 and 26.6 % of the total green yield and total dry matter of alfalfa plants, respectively compared without FYM application. The addition of By-pass to the sandy desert soil at a level of 7.5%

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showed increases in the total green yield and total dry matter of alfalfa plants of about 121.4 and 106.2 %, respectively, compared to the control. The results showed that adding the cement By-pass at 7.5% was the best addition level to the sandy desert soil even with or without applying FYM to obtain good growth and yield of alfalfa. The highest total green yield and total dry matter (11.02 and 2.24 ton/fed., respectively) of alfalfa plants were obtained with adding FYM and By-pass at 7.5 %.

Introduction

Disposal of industrial wastes is a major problem in many industries which causes environmental hazards. Recycling of industrial wastes is one way of disposal mechanism and another way of resource management. Cement By-pass is a major byproduct of cement industry which accumulates daily in huge amounts (about 150 ton/day in Assiut Cement Company). If this byproduct is not wisely used or even disposed, it will become an environmental pollutant. This By-pass is a very fine powdered, dusty material and grayish in colour. The physical and chemical properties of this byproduct suggested it to be used directly to improve the properties of sandy desert soils (Hassanien et al., 2010). Cement kiln dust (CKD) contains alkali salts derived from the clay raw materials, which include potassium and sodium feldspars (Daous., 2002). The major existing application of these cement kiln dusts (CKDs) is as a soil stabilization (McCoy and Kriner., 1971; Baghdadi and Rahman., 1990). Daous (2002) found that the enriched levels of soluble potassium sulfate in alkali rich cement kiln dust (CKD) made such dust a promising raw material for the extraction of potash or its soluble salts. Many researchers suggested the direct use of CKD as a fertilizer material because of its high potassium concentrations and as an acid neutralizing material due to its high lime content (Baker et. al., 1975; Risser et. al., 1981; Preston, 1993). The alkalis in kiln dust are recovered by leaching at higher temperature with an aqueous solution of KCl. The leachate is cooled for crystallization of KCl and removed. The washed CKD is reclaimed for use as kiln feed (McCord, 1977).

Alfalfa is a main fodder crop in many countries and is a moderately salt-tolerant crop. It is susceptible to salt damage during its establishment (Lehman and Robinson, 1979; Stone *et al.*, 1979). Determining the amounts of nitrogen (N), sulfur (S), potassium (K) and phosphorus (P) that are needed is important to insure adequate alfalfa yield and quality. This recommendation is applied when soil N prior to planting is below critical levels (Koenig, 2002). Salinity-fertility relationships are important and have been the subject of many greenhouse and field studies (Kafkafi et al., 1982; Papadopoulos and Rending, 1983; Kafkafi, 1984). Alfalfa yield is influenced not only by salinity but also by the addition of phosphorus fertilizer as indicated by Alva (1985) who found that alfalfa yield increased linearly with the application of phosphorus up to 44 kg ha^{-1}. Micronutrients are those nutrients that are essential but needed in only small amounts. They include zinc, manganese, boron, copper, iron, chlorine, and molybdenum for plants.

The objective of this study is to evaluate the interactive effects of farm yard manure and cement By-pass on the growth, yield and nutrient contents of alfalfa plants as well as on some properties and nutrient contents of the sandy soil.

Materials and Methods

A field experiment was carried out in Assiut Cement Company farm at Assiut to study the effects of cement By-pass (0, 2.5, 5, and 7.5%) without and with adding farm yard manure (FYM) on the growth, yield and nutrient contents of alfalfa. The effect of these treatments on some properties and nutrient contents of the sandy desert soil was also studied. The experiment was designed as randomized complete block in split plots with three replications where the farm yard manure (without and with FYM) was assigned to the main plots and By-pass levels was in the subplots. The area of each soil plot was 2x2 m (4 m^2). Some soil properties of the experimental farm are given in Table 1. . The By-pass characteristics used in this experiment was presented in Tables 2 and 3. The particle-size distribution of the soil was measured using the pipette method according to Richards (1954) and Jackson (1969). The saturation percentage (SP) of the soil and By-pass was determined as it was described by Hesse (1998). Organic matter (OM) in the soil was determined using the Walkley-Black method and the pH of both soil and By-pass was determined in 1:1 suspension of a soil or By-pass to deionized water by a glass electrode (Jackson, 1973). Calcium Carbonate ($CaCO_3$) in the soil was estimated using a volumetric calcium carbonate calcimeter (Nelson, 1982), whereas the electrical conductivity of the saturated soil or By-pass paste extract (EC_e) was measured using an electrical conductivity meter (Hesse, 1998). Available phosphorus (Olsen-P) in the soil and By-pass was extracted by 0.5 M $NaHCO_3$ at pH 8.5 according to Olsen et al. (1954), and calorimetrically determined using the chlorostanous phosphomolybdic acid method according to Jackson (1973). Soil available potassium was extracted using 1 M CH_3COONH_4 at pH=7, and determined using the flame photometery method (Jackson, 1973). Available Fe, Mn, Zn and Cu in the soil and By-pass were extracted using 0.005 M DTPA (diethlene triamine penta-acetic acid) at pH 7.3 (Lindsay and Norvell, 1978) and determined by GBC atomic absorption sepctrophotometer (GBC). Total N in the soil was determined by micro-kjeldahl method (Jackson, 1973).

In this experiment the cement By-pass was added to the soil plots and mixed with the surface layer of each plot and these plots were leached for three weeks (one leach every other day) to get rid of By-pass salts. The FYM was added to the experiment at a level of (4 ton/fed.) after cultivated. Superphosphate was applied to the plots at a level of (100 kg/fed.) while potassium sulfate was applied at the recommended level (300 kg/fed.) in two equal doses after cultivation. Nitrogen was added to booster as ammonium nitrate a level of 50 kg/fed. Alfalfa (*Medicago sativa*) was sown at 15 g/plot on April 8, 2009. Four alfalfa cuts were taken from each plot on July 5, Sept. 17, Oct. 29 and Nov. 24, 2009 and then total green yield (ton/fed.) and total dry matter (ton/fed.) were estimated. At the end of this experiment Nov. 24, 2009, plant samples were taken and subjected to chemical analysis using the wet digestion of H_2SO_4-H_2O_2 mixture as described by Parkinson and Allen (1975). Phosphorous concentration in the digests was determined colorimetrically using the stannous chloride phosphomolibdic-sulfuric acid system as described by Jackson (1973). Nitrogen in the digests was determined by micro-kjeldahl method (Jackson, 1973). Potassium in the digests was determined using the flame photometery (Hesse, 1998). Iron, manganese, zinc and copper in the digests were estimated by a GBC atomic absorption sepctrophotometer.

The statistical analysis of data was done according to the described by Gomez and Gomez (1984).

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

Property	**Value**
Particle size Distribution (%)	
Clay	2.00
Silt	1.20
Sand	96.80
Texture	**Sand**
Saturation percentage (%)	17.25
Organic matter (%)	0.054
ECe (dS/m)	4.72
$CaCO_3$ (%)	6.73
pH (1: 1)	8.50
Soluble cations (mmol/ kg)	
Ca^{+2}	3.41
Mg^{+2}	0.53
Na^{+}	2.25
K^{+}	0.15
Soluble anions (mmol/ kg)	
HCO_3^{-}	0.41
Cl^{-}	3.97
SO_4^{-2}	2.63
Extractable nutrients	
Olsen-P (mg/kg)	0.35
Available K (mg/kg)	18.12
DTPA-Fe (mg/kg)	1.466
DTPA-Mn (mg/kg)	0.721
DTPA-Zn (mg/kg)	1.596
DTPA-Cu (mg/kg)	0.317
CEC (cmol+/kg)	18.93

Table (2): Chemical constituents of cement By-pass (Assiut Cement Company).

Con-stituent	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Na_2O	K_2O	Cl
Conc. (%)	11.88	2.97	2.60	47.81	0.68	12.13	2.28	4.38	4.81

Table (3): Some physical and chemical properties of cement By-pass material used in the experiment.

Property	**Value**
Saturation percentage (%)	65.82
pH (1: 1 suspension)	12.41
ECe (dS/m)	24.6
Soluble cations (mmol/kg)	
Ca^{+2}	76.27
Mg^{+2}	1.92
Na^{+}	457.88
K^{+}	1080.56
Soluble anions (mmol/kg)	
Cl^{-}	1629.40
SO_4^{-2}	28.06
Extractable nutrients	
Olsen-P (mg/kg)	63.75
DTPA-Fe (mg/kg)	102.89
DTPA-Mn (mg/kg)	0.035
DTPA-Zn (mg/kg)	0.411
DTPA-Cu (mg/kg)	9.000
CEC (cmol+/kg soil)	21.74

Results and Discussion

I- Effect of By-pass addition on some properties and nutrient contents of the sandy desert soil before cultivation

Table 4 shows the addition effects of By-pass on some properties and nutrient contents of the sandy desert soil before cultivation. Soil pH significantly decreased ($\rho \leq 0.05$) but the soluble salts (EC_e) and soluble sulfate insignificantly increased with increasing the By-pass level. Increasing NaCl concentration results in a decrease in the soil pH (Maji *et al.*, 1993). Moreover, By-pass additions caused significant increases in the available soil P, K, Fe and Cu (Table 4). This indicates that By-pass is able to improve the available soil nutritional status of phosphorus, potassium and some micronutrient in the sandy soils because the By-pass contains available levels of these nutrients. It is obvious that the best addition level of By-pass to these sandy desert soils is 7.5 % (35.63 kg/plot). Cement kiln dust (CKD) contains alkali salts derived from the clay raw materials, which include potassium and sodium feldspars. The enriched level of soluble potassium sulfates in alkali rich cement kiln dust (CKD) makes such dust a promising raw material for the extraction of potash or its soluble salts (Daous., 2002). Hassanien et al. (2010) reported that the addition of By-pass to the sandy soil increased the soil available micronutrients such as Fe, Mn, Zn and Cu.

Table (4): Effect of By-pass addition on some properties and nutrient contents of the studied soil before cultivation

Treatment of cement By-pass	pH (1:1)	EC_e (dS/m)	Soluble SO_4 (mmol/L)	Total N (mg/kg)	Available P (mg/kg)	Available K (mg/kg)	DTPA-extractable (mg/kg)			
							Fe	Mn	Zn	Cu
Control	8.522	0.815	1.968	87.325	4.297	22.745	6.375	1.413	1.290	0.478
2.5 %	8.510	0.752	4.927	95.818	6.490	34.227	10.060	1.495	1.195	0.477
5 %	8.352	1.178	7.453	103.543	7.273	47.383	13.348	1.543	1.223	0.513
7.5 %	8.237	1.818	10.720	98.775	7.633	62.513	16.973	1.765	1.310	0.588
$LSD_{0.05}$	0.19	n.s	n.s	n.s	0.90	10.97	3.27	n.s	n.s	0.06

Control= 0 By-pass, 2.5 % = 23.81 kg By-pass/plot,
5 % = 47.62 kg By-pass /plot and 7.5 % = 71.43 kg By-pass /plot

II- Effects of By-pass addition with farm yard manure (FYM) on some properties and nutrient contents of the sandy desert soil after cultivation.

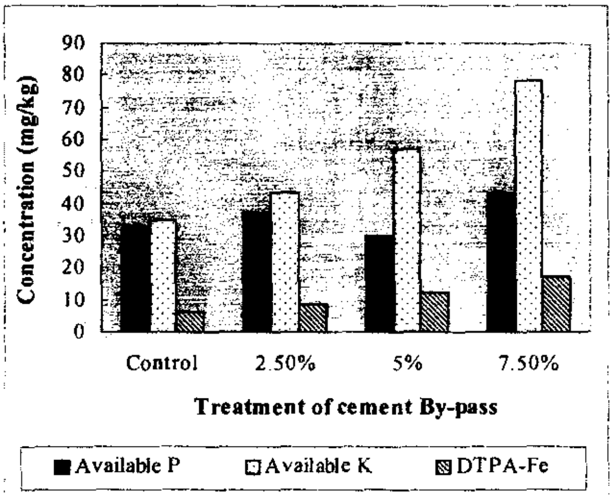
1. By-pass effects

The addition of By-pass to the sandy desert soil showed no effects on the soil pH, a significantly decrease in the soluble $SO_4^=$ and a significant increase in the EC_e (Table 5). Adding By-pass at 7.5% level is considered the best addition level to the sandy desert soils.

The application of By-pass to the sandy desert soil resulted in significant increases in the available soil P, K, Fe and Cu (Table 5 and Figures 1 and 2). However, By-pass addition showed no significant effects on the total soil N as well as available soil Mn and Zn.

Table (5): Effect of By-pass addition on some properties and nutrient contents of the sandy desert soil after cultivation

Treatment of cement By-pass	pH (1:1)	EC_e (dS/m)	Soluble SO_4 (mmol/L)	Total N (mg/kg)	Available P (mg/kg)	Available K (mg/kg)	DTPA-extractable (mg/kg)			
							Fe	Mn	Zn	Cu
Control	8.395	0.270	0.803	202.488	33.002	34.938	5.992	2.328	1.667	0.522
2.5 %	8.327	0.272	0.542	226.695	37.612	43.462	8.385	2.345	1.520	0.470
5 %	8.393	0.307	0.697	171.112	30.230	56.777	12.338	2.328	1.467	0.522
7.5 %	8.390	0.352	0.717	191.462	43.702	78.362	16.925	2.733	1.670	0.663
LSD 0.05	**n.s**	**0.051**	**0.163**	**n.s**	**8.089**	**13.638**	**1.8406**	**n.s**	**n.s**	**0.061**



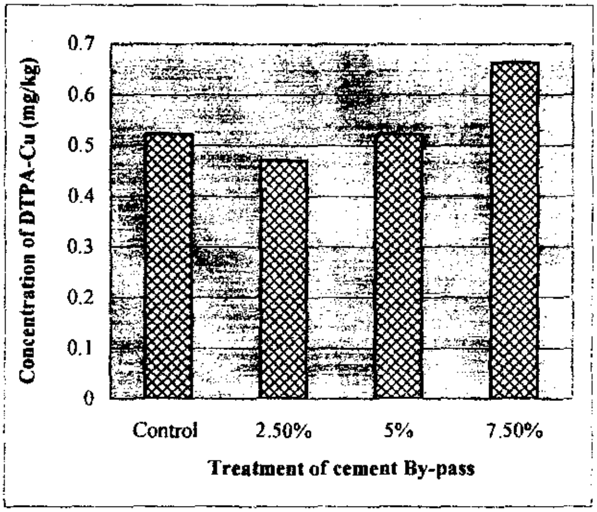


Fig. (1): Effect of By-pass on the available soil P, K

Fig. (2): Effect of By-pass on the available soil Cu and Fe

2. FYM effects

The addition of FYM to the sandy soil caused highly significant and significant increases in the EC_e and soluble $SO_4^=$, respectively, as well as a significant decrease in the soil pH (Table 6). Ali (2008) found that the application of different organic materials to sandy calcareous soils significantly decreased the soil pH but FYM additions resulted in a significant increase in the EC_e.

Total N and available P, Mn and Zn in the soil highly significantly increased as well as available K and Cu in the soil significantly increased but available Fe in the soil insignificantly increased with FYM addition (Table 6). The addition of manure decreases both P adsorption and phosphate potential while it increases both available P (Bahl and Toor, 2002) and native P mobilization (Toor and Bahl., 1997). Amin (2008) reported that the correlation coefficients of both DTPA-Mn and Zn-DTPA with the organic matter content of some Assiut soils were positively significant. Moreover, organic matter addition to the soil increases the solubility of Zn due to the formation of soluble organo-metallic complexes (Almas *et al.*, 2000).

Table (6): Effect of FYM addition on some properties and nutrients of the sandy desert soil after cultivation

Treatment	pH (1:1)	EC_e (dS/m)	Soluble SO_4 (mmol/L)	Total N (mg/kg)	Available P (mg/kg)	Available K (mg/kg)	DTPA-extractable (mg/kg)			
							Fe	Mn	Zn	Cu
Without FYM	8.586	0.273	0.509	81.063	9.317	39.460	10.401	1.483	1.176	0.444
With FYM	8.167	0.327	0.870	314.815	62.956	67.309	11.419	3.384	1.986	0.644
F_{value}	**	**	*	**	**	*	n.s	**	**	*

3. Interaction effects of By-pass and FYM

The interaction effect of By-pass and FYM application on the soil pH was negatively significant (Table 7). Adding By-pass at a level of 7.5 % significantly decreased the pH of the sandy desert soil from 8.65 to 8.13 with farm yard manure addition at a level of 4 ton/feddan. The combined application of By-pass and FYM caused insignificant increases in the EC_e (Table 7). Moreover, the interaction effect of By-pass and FYM application on soluble SO_4 showed significant increases (Table 7), because organic matter contains sulfur.

The interaction effect of By-pass and FYM application gave significant increases in the total soil N as well as available soil K and Cu but insignificant increases in the available soil P, Fe, Mn and Zn (Table 7).

Table (7): Interaction effects of By-pass and FYM on some properties and nutrient contents of the sandy desert soil after cultivation

FYM	By-pass	pH (1:1)	EC_e (dS/m)	Soluble SO_4 (mmol/L)	Total N (mg/kg)	Available P (mg/kg)	Available K (mg/kg)	DTPA-extractable (mg/kg)			
								Fe	Mn	Zn	Cu
Without FYM	Control	8.633	0.240	0.443	62.673	7.047	2.680	5.480	1.393	1.207	0.477
	2.5 %	8.403	0.270	0.590	83.107	7.703	2.820	7.697	1.400	1.133	0.357
	5 %	8.660	0.280	0.490	91.280	9.570	2.743	12.793	1.557	1.143	0.433
	7.5 %	8.647	0.300	0.513	87.193	12.947	2.913	15.633	1.583	1.220	0.510
Mean		**8.586**	**0.273**	**0.509**	**81.063**	**9.317**	**2.789**	**10.401**	**1.483**	**1.176**	**0.444**
With FYM	Control	8.157	0.300	1.163	342.303	58.957	2.750	6.503	3.263	2.127	0.567
	2.5 %	8.250	0.273	0.493	370.283	67.520	2.933	9.073	3.290	1.907	0.583
	5 %	8.127	0.333	0.903	250.943	50.890	3.037	11.883	3.100	1.790	0.610
	7.5 %	8.133	0.403	0.920	295.730	74.457	3.373	18.217	3.883	2.120	0.817
Mean		**8.167**	**0.327**	**0.870**	**314.815**	**62.956**	**3.023**	**11.419**	**3.384**	**1.986**	**0.644**
$LSD_{0.05}$		**0.153**	**n.s**	**0.231**	**64.701**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**0.087**

III. Effects of By-pass addition with FYM on yield and nutrient contents of alfalfa plants.

1.By-pass effects

The results obtained in this experiment showed significant increases in the total green yield and total dry matter of alfalfa plants with By-pass addition (Table 8 and Figures 3 and 4). The application of By-pass at 7.5 % level to the sandy soils caused increases about of 121.4 and 106.2 % in the total green yield and total dry matter, respectively, of alfalfa plants compared to the control. The increases in the green yield and total dry matter of alfalfa plants could be because the By-pass is rich in P, K, Fe and Cu. The addition of By-pass to the sandy soil also increased the available soil micronutrients such as Fe, Mn, Zn and Cu (Hassanien et al. 2010).

The contents of N, P, Fe and Zn of alfalfa plants did not have significant effects with By-pass addition, while plant K, Mn and Cu showed significant increases with By-pass addition levels (Table 8). It is important to apply nitrogen (N), sulfur (S), potassium (K) and phosphorus (P) to insure adequate alfalfa yield and quality (Koenig, 2002).

Table (8): Effect of By-pass addition on the total green yield, total dry matter and nutrient contents of alfalfa plants.

Treatment of cement By-pass	**Total green yield (ton/fed.)**	**Total dry yield (ton/fed.)**	**Nutrient contents in alfalfa plant**						
			N (%)	**P (%)**	**k %)**	**Fe (mg/kg)**	**Mn (mg/kg)**	**Zn (mg/kg)**	**Cu (mg/kg)**
Control	3.852	0.898	3.287	0.258	2.715	214.212	37.440	27.190	9.252
2.5 %	5.672	1.272	3.140	0.262	2.877	211.690	39.358	29.732	8.773
5 %	5.468	1.267	3.157	0.268	2.890	206.147	31.440	26.313	10.482
7.5 %	8.530	1.852	3.200	0.300	3.143	234.210	38.752	28.585	13.958
LSD $_{0.05}$	**0.535**	**0.126**	**n.s**	**n.s**	**0.177**	**n.s**	**5.255**	**n.s**	**3.433**

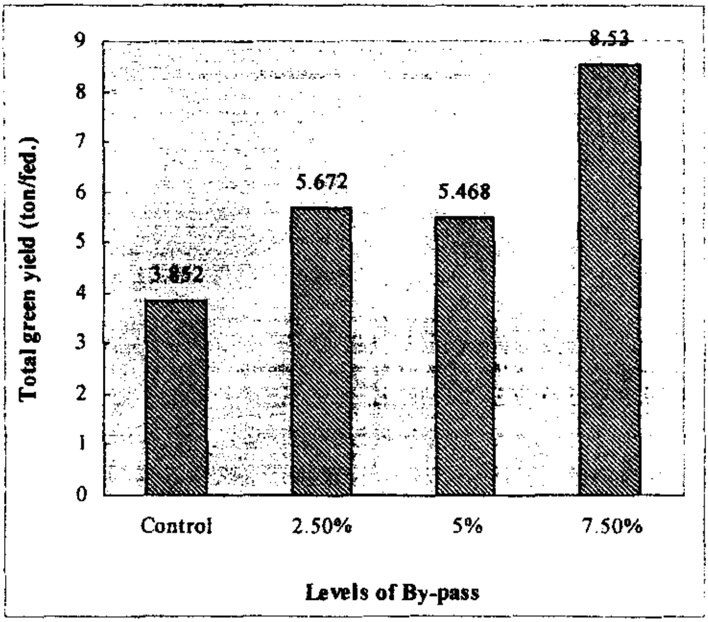


Fig. (3): Effect of By-pass on th e total green yield

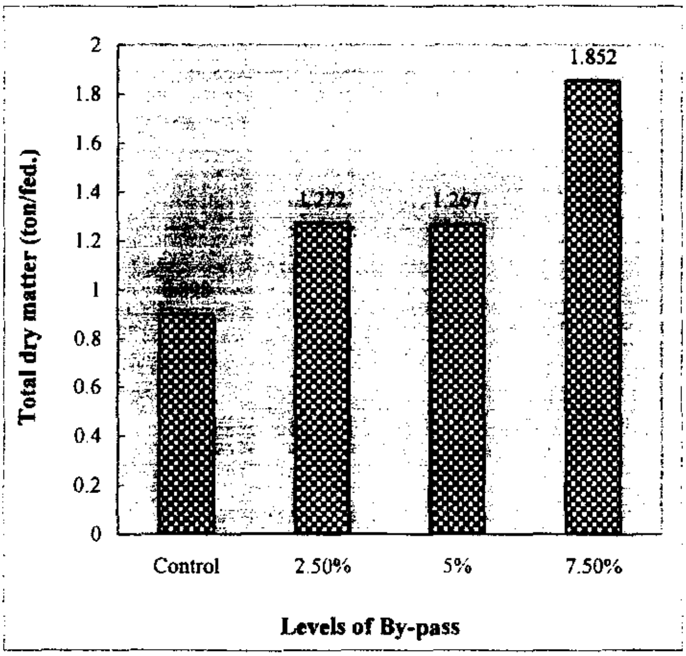


Fig. (4): Effect of By-pass on the total dry matter of alfalfa plants of alfalfa plants

2. FYM effects

Total green yield and total dry matter of alfalfa plants significantly increased with FYM addition (Table 9 and Figure.5). The addition of FYM caused the total green yield and total dry matter to increase about 44.8 and 26.6 %, respectively, compared without FYM addition. Organic matter contributes to plant growth through its effects on the physical, chemical and biological properties of the soil. It has a nutritional function in that it serves as a source of N, P, S and other nutrients for plant growth, a biological function when it profoundly affects the activities of microflora and microfaunal organisms, and a physical function in that it promotes good soil structure, thereby improving tillage, aeration, and retention of moisture (Bohn et al., 2001; Stevenson, 1982).

Content of N, P and Mn in alfalfa plants significantly increased but contents of K, Fe, Zn and Cu in alfalfa plants insignificantly increased with FYM addition (Table 9). The addition of FYM to sandy calcareous soils caused significantly increases the uptake of N and P in wheat plants (Ali, 2008). Ottman *et al.* (2000) reported that the total plant P was not affected by the applied P fertilizer form or method to alfalfa plants.

Table (9): Effect of FYM addition on the total green yield, total dry matter and nutrient contents of alfalfa plants.

Treatment	Total green yield (ton/fed.)	Total dry yield (ton/fed.)	Nutrient contents in alfalfa plant						
			N (%)	P (%)	k (%)	Fe (mg/kg)	Mn (mg/kg)	Zn (mg/kg)	Cu (mg/kg)
Without FYM	4.804	1.167	3.123	0.232	2.789	215.325	29.472	30.804	9.918
With FYM	6.957	1.478	3.269	0.313	3.023	217.804	44.023	25.106	11.315
F_{value}	*	*	*	*	n.s	n.s	*	n.s	n.s

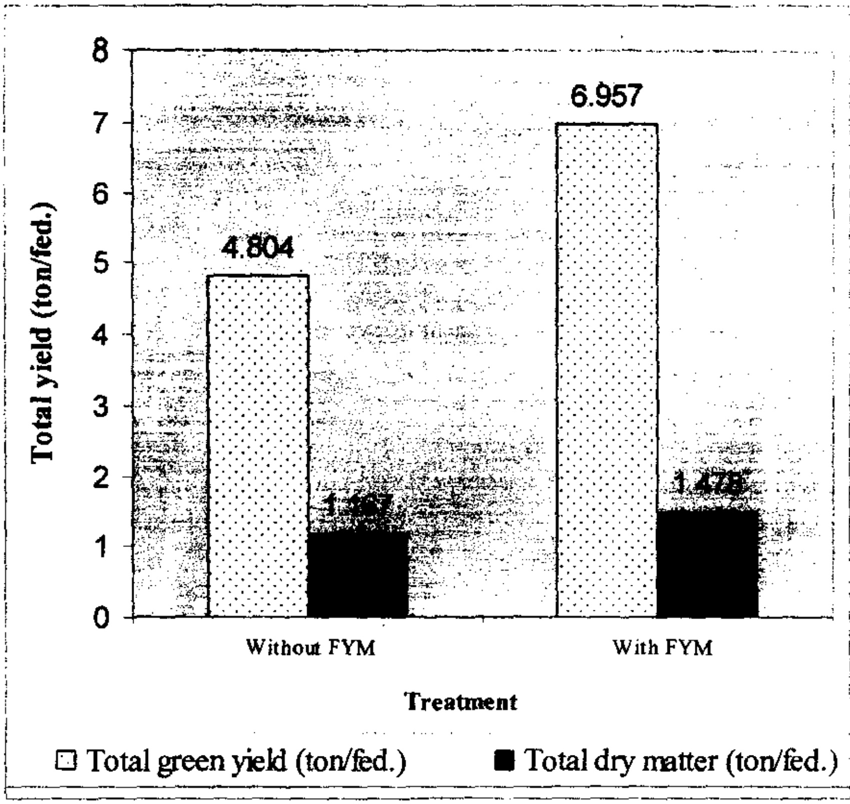


Fig. (5): Effect of FYM on total green yield and total dry matter of alfalfa plants

3. Interaction effects of By-pass and FYM

The interaction effect of By-pass and FYM resulted in significant increases of 44.8 and 26.6 % in the total green yield and total dry matter of alfalfa plants, respectively, compared with treatments of By-pass without FYM. The best application level of By-pass to the sandy desert soil was 7.5 % with applying FYM. The highest total green yield and total dry matter of alfalfa (11.02 and 2.24 ton/fed., respectively) were obtained with applying FYM and By-pass at 7.5 % level. By-pass and FYM materials contain some nutrients for growing alfalfa plants (Table 10 and Figure 6). Hassanien et al. (2010) found that the addition of By-pass with organic manure was more effective in enhancing sorghum growth.

High yields of hay require good fertility. The interaction effect of By-pass and FYM application was significant for alfalfa Fe. Adding By-pass at 2.5 % level increased alfalfa Fe from 185.1 to 238.3 mg/kg with applying FYM at 4 ton/fed. Other nutrients insignificantly increased in the soil due to the interaction effects of By-pass and FYM (Table 10).

Table (10): Interaction effects of By-pass and FYM on the total green yield, total dry matter and nutrient contents of alfalfa plants.

FYM	By-pass	Total green yield (ton/fed.)	Total dry yield (ton/fed.)	Nutrient contents in alfalfa plant						
				N (%)	P (%)	K (%)	Fe (mg/kg)	Mn (mg/kg)	Zn (mg/kg)	Cu (mg/kg)
Without FYM	Control	4.787	1.163	3.210	0.227	2.680	213.753	28.170	29.670	9.210
	2.5 %	5.007	1.223	3.053	0.207	2.820	185.087	30.420	31.670	9.003
	5 %	3.380	0.813	3.173	0.240	2.743	212.543	28.087	29.583	9.837
	7.5 %	6.043	1.467	3.053	0.253	2.913	249.917	31.210	32.293	11.620
Mean		**4.804**	**1.167**	**3.123**	**0.232**	**2.789**	**215.325**	**29.472**	**30.804**	**9.918**
With FYM	Control	2.917	0.633	3.363	0.290	2.750	214.670	46.710	24.710	9.293
	2.5 %	6.337	1.320	3.227	0.317	2.933	238.293	48.297	27.793	8.543
	5 %	7.557	1.720	3.140	0.297	3.037	199.750	34.793	23.043	11.127
	7.5 %	11.017	2.237	3.347	0.347	3.373	218.503	46.293	24.877	16.297
Mean		**6.957**	**1.478**	**3.269**	**0.313**	**3.023**	**234.210**	**44.023**	**25.106**	**11.315**
LSD 0.05		**0.756218**	**0.178731**	**n.s**	**n.s**	**n.s**	**34.065**	**n.s**	**n.s**	**n.s**

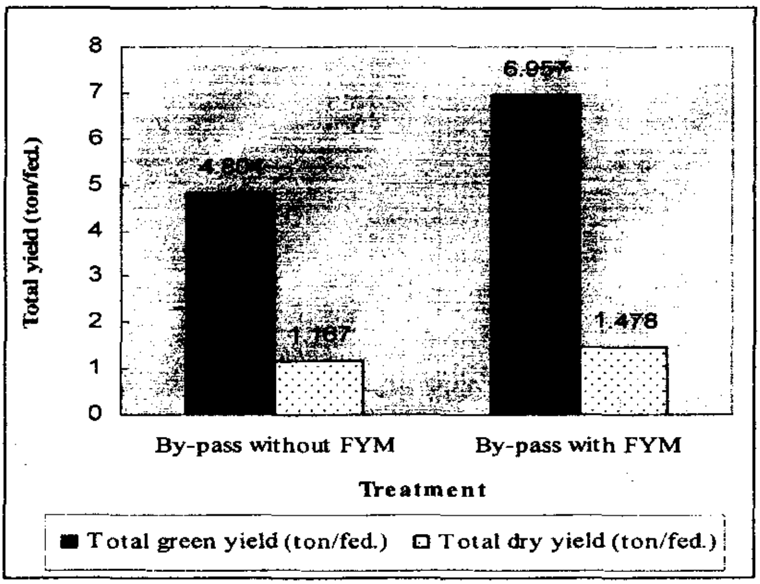


Figure (6): Interaction effects of By-pass and FYM on the total green yield and total dry matter

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تأثير إضافة مخلف صناعة الاسمنت للاراضى الصحراوية الرملية على النمو والمحصول والمحتوى العنصرى للبرسيم الحجازى

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يمثل إلقاء المخلفات الصناعية مشكله كبيره فى العديد من الصناعات وهذا يشكل ضررا كبيرا بالنسبة للبيئة. ويعتبر By-pass واحدا من المخلفات الناتجة من مصانع الاسمنت التى تسبب ضررا كبيرا للبيئه حيث ينتج مصنع أسمنت أسيوط حوالى 150طن/يوم من هذه الماده. ولذلك فقد اجريت تجربة حقلية فى الاراضى الرملية لمزرعة شركة اسمنت اسيوط. تم فيها دراسة تاثير اضافة By-pas عند مستويات صفر، 2.5، 5 و 7.5% مع اضافة وعدم اضافة السماد البلدى (4طن/فدان) على المحصول الاخضر، المحصول الجاف والمحتوى العنصرى للبرسيم الحجازى المزروع وتاثير ذلك على بعض صفات التربه الكميائيه والكميات الميسره لبعض العناصر الغذائيه اللازمة. و قد تم تصميم التجربه فى قطع منشقه ذو ثلاث مكررات فى أحواض مساحة الحوض2x2 م (4م^2). تم زراعة البرسيم الحجازى بمعدل 15جم بذور/حوض يوم 8 ابريل 2009.

أدت اضافة By-pass للاراضى الرملية الى زياده مستويات العناصر الميسره من الفوسفور والبوتاسيوم والحديد والنحاس قبل وبعد الزراعه وكما ادى التاثير المتداخل لهذا المخلف والسماد البلدى الى زياده معنويه فى محتوى التربه من النيتروجين الكلى والبوتاسيوم الميسر والنحاس الميسر و زياده غير معنويه فى الكميات الميسره من الفوسفور، الحديد، المنجنيز والزنك. كما أدى اضافة السماد البلدى الى زياده فى المحصول الاخضر والماده الجافه بمقدار 44.8 و 26.6 % على الترتيب مقارنة بالمعاملات التى لم يضاف اليها السماد البلدى. كما أن المخلف عند مستوى 7.5 % ادى الى زيادة فى المحصول الاخضر والمادة الجافة للبرسيم الحجازى بمقدار 121.4و 106.2 % على الترتيب مقارنه بالكنترول وأن اضافة المخلف عند مستوى 7.5% مع السماد البلدى قد اعطى اعلى كمية من المحصول الاخضر والمادة الجافة (11.02 و 2.24 طن/الفدان، على التوالى).