# COMPARATIVE EFFECT OF SOME INDUSTRIAL WASTES AS SOIL CONDITIONERS ON SOME PHYISO-CHEMICAL, HYDRO PHYSICAL SOIL PROPERTIES AND MAIZE PRODUCTIVITY

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**ABSTRACT**: *A field experiment was conducted at EL-Arish Agricultural Research Station, North Sinai Governorate for two successive summer seasons 2009 and 2010 to study the effect of the application of by -pass, sugar lime, vinasse and the mixtures of them on some phyiso-chemical, hydro physical soil properties and Maize productivity.The obtained data showed an improvement on the phyiso-chemical, hydro physical soil properties and corn production , with all treatments, due to increasing total porosity, fine capillary pores, available water, and water use efficiency while, bulk density, hydraulic conductivity, quickly drainable pores ECe and pH values have been decreased indicating an improvement on soil structure.*

*Grain yield of maize was increased by using concerning amendments, particularly in the presence of the mixture (4) followed by the mixture (1) then the mixture (3)*

*The application of the mixture (1) gave the highest profit followed by the mixture (2). according to the economic evaluation*

*Using mixture (4) in the light soils saved 343 $m^3 fed^{-1}$ of water. Almost $2\times10^6$ fed. of the Egypt's land area is comprised of the light soils, consequently led to save about $686\times 10^6$ $m^3$ of water, at using mixture (4). This quantity can be used to cultivate about $69\times10^3$ fed.*

**Key words**: *industrial wastes as soil conditioners, phyiso-chemical, hydro physical soil properties*

## INTRODUCTION

Nowadays the extension of desert reclamation and cultivation in Egypt has Become urgent and essential due to the tremendous increase in population. Light soils are widely distributed in arid and semi-arid regions like Egypt. The soils of the North Sinai of Egypt are light soils and have been recently subjected of intensire investigation, aiming to improve their characteristics to satisfy the needs of the increasing human population. Some of the most important factors affecting the economic management of such soils are erosion hazarads, poor physical properties high water requirements and low soil fertility.

Cement kiln dust (CKD),is afine-grained material generated as a by-product of cement manufacturing .Raw materials are feed into a cement kiln and heated to temperatures ranging between (1400 and 1550c°). The main raw material which used to produce cement is limestone ($CaCO_3$), with approximately ten percent of the raw mix made up of a silica source (e.g., sand or clay), an alumina source and an iron source. Heating the raw materials to such high temperatures , a process called calcinations , alters the chemical make up of the materials to produce cement clinker (Kosmatka *et al.*, 2002) .CKD consists primarily of $CaCO_3$ and silicon dioxide which is similar to the cement kiln raw feed , but the amount of alkalis, chloride and sulfate is usually considerably higher in the dust CKD from three different types of operations: long–wet, long-dry, and alkali by-pass with precalciner were characterized for chemical and physical habits by Todres *et al* (1992). The particle size of (CKD) is dependent upon the type of kiln operation, Muller (1977) showed that the dusts collected from dry kilns were finer that those for wet and semi-wet / semi-dry kilns. In general, the chemical properties of cement kiln dust (by-pass) are: $CaCO_3$ = 53.9%, $Na_2SO_4$= 1.3%, $K_2SO_4$= 5.9%, $Al_2O_3$=3.07%, $Fe_2O_3$=2.0% $K_2O$=2.53%, $SO_3$=8.67%, MgO=1.3%, $P_2O_5$=0.1% and $SiO_2$=15.2% (Todres *et al*, 1992). Furthermore in Egypt many factories, there are tremendous amount of industrial by products from cement factories, which are increasing annually without utilization causing environmental pollution. Such by products are rich in calcium and potassium.

it is fine powder of light gray colour, and could have an economical value as a soil conditioner .Vinasse is a by product of the sugar industrial either sugar cane or sugar beet. Vinasse comes either from sugar cane is called cane-vinasse or from sugar beet is called beet-vinasse. Vinasse produces after the removal of the fermentation products from molasses. Vinasse is brown colour and viscosity. Its chemical composition is variable depending among other factors, on water availability sugar-cane characteristics and the fermentation as distillation processes emplyed (Ferraz *et al*, 1986) In general, vinasses presents high turbidity, low pH, high levels of organic matter (mainly glycerol, a soluble carbon source) potassium and calcium (Gomez and Rodriguez, 2000). Arafat and Yassen (2002) concluded that application of vinasse increased crop because it is a good source of many of nutrients which plants needed to grow. Also, they found that the residual available N, P and K and organic matter in soil after wheat harvesting, increased with increasing the rates of vinasse applied. Adel and Mohsen (2008) found that application of vinasse to a newly reclaimed loamy sand soil caused a significant decrease in soil $_{P}$H.Habib *et al.* (2009) found that beet vinasse had a positive effect on soils physical i.e., structural stability increased and bulk density decreased with respect to control. Awaad *et al*, (2010) found that the application of vinasse to the soil increased soil microbial biomass mineralized organic matter, and consequently increased $N$-$NO_3$ content. Monika (2010) found that the application of beet vinasse to the light soils had a positive effect on CEC, exchangeable-cations and available P and K content. Sugar Lime is waste product of the sugar refinery (resulting from sugar beet factories). It is an aggregated powder of light brown color. Mansour (2002) showed that adding sugar lime in saline sodic soil increased total porosity, water holding pores, total aggregates, available water hydraulic conductivity, quickly drainable pores and the grain yield of both wheat and maize plants. On the other hand ,soil bulk density and fine capillary pores were decreased with increasing the application rate. Reda *et al*, (2006) found that the best treatment in reference to improve certain soil structure microbiological properties as well as increasing wheat grains and straw yields and their nutrient contents was the combined treatment of (4.6 ton/fed sugar lime +1.0 ton/fed elemental sulphur) accompanied by inoculation with a mixture of $N_2$-fixers, particularly in the presence of 50% of recommended dose of inorganic N-fertilizer. .Sharma *et al* (1996) found that sulfuric acid lowers the soil pH, reacts with soluble carbonates and replaces the exchangeable sodium with calcium. Hussein *et al* (2003) found that sulfuric acid more effective in decreased ECe, bulk density and sodium adsorption ratio (SAR) and increased total porosity and hydraulic conductivity of saline sodic soils.Sadiq, et al. (2003) found that the application of sulfuric acid at 20%G.R.for amelioration of moderately saline-sodic and medium textured soil proved effective and ensured significantly higher yields. Mansour (2007) found that the addition of diluted sulfuric acid reduced soil reaction, soil bulk density penetration resistance, total $CaCO_3$ and active $CaCO_3$. While, total porosity, quickly drainable pores, available water and hydraulic conductivity were increased.. Mariano *et. al,*. (2009) stated that the addition of acid or acidic forming materials such as sulfur and Vinasse often reduced soil reaction (pH) and enhance microbial densities and activities.

Therefore, the aim of this work was to find out the potential use of these materials and its effects on physical and chemical properties, which affect the soil structure and subsequently improve soil productivity.

## MATERIALS AND METHODS

Two summer field experiments designed at EL-Arish Agricultural Research station, North-Sinai Governorate 2009 and 2010 seasons to study a possible amelioration for some properties of light soils and its productivity using the natural industrial wastes i.e., By -pass, Sugar lime, and Vinasse separately and their mixtures Particle size distribution of the studied soil is recorded in Table (1) and chemical analysis of well water is shown in Table (2).

The experimental layout was a randomized complete block design with 3 replicates. The nine soil conditioners treatments were control, By-pass, at rates of 1.0 and 3.0 ton/fed.(B1 and B2), Vinasse 2.0 ton fed$^{-1}$, Sugar lime 4.0 ton fed$^{-1}$. and 4 mixtures of them at rate of 4.0 ton fed$^{-1}$ .for each one. The treatments were thoroughly mixed with the top 20 cm.surface layer of each plot. The mixtures composition and their chemical properties are given in Table (3)

Maize grains (Zea Mays, single cross 10) were Soaked for 2.0 hours time with compost tea (C.T) and then planted under drip irrigation condition. All plot received the NPK fertilizers at recommended doses for maize crop before cultivation where P and K were applied at rates of 15 kgfed$^{-1}$ and 24 kgfed$^{-1}$ .as super phosphate (15% $P_2O_5$) and potassium sulphate (48% $K_2O$) respectively. Nitrogen was applied at a rate of 120 kgNfed$^{-1}$. as ammonium nitrate (33.5%N) at three equal doses (15, 45 and 60 day after sowing)..At the end of each season, soil samples (0-20cm.) were collected from each plot and analyzed for the following properties which recerded in Table (4).

**Table (1): Particle size distribution (%) of the studied area.**

| Particle size distribution (%) | | | | Soil texture class | $CaCO_3$ (%) |
|---|---|---|---|---|---|
| Coarse sand | Fine sand | Silt | Clay | | |
| 60.3 | 7.2 | 21.1 | 11.4 | sandy loam | 16.9 |

**Table (2): Chemical analysis of well water.**

| EC (dSm$^{-1}$) | Cations (meq.L$^{-1}$) | | | | Anion (meq.L$^{-1}$) | | | PH | RSC (meq.L$^{-1}$) | Adj. SAR. |
|---|---|---|---|---|---|---|---|---|---|---|
| | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $HCO_3^-$ | $CL^-$ | $SO_4^{2-}$ | | | |
| 6.74 | 15.45 | 19.45 | 32.9 | 0.37 | 2.59 | 43.7 | 21.88 | 7.63 | - | 22.4 |

**Table (3): chemical composition of the sugar lime, By-pass and vinasse.**

| Composition and characteristics | Sugar lime | Vinasse | By-pass |
|---|---|---|---|
| Density (g cm$^{-3}$) | 0.74 | 1.14 | 0.63 |
| pH (1:2.5) | 8.3 | 4.5 | 12.0 |
| EC (dSm$^{-1}$) | 35.3 | 40.0 | 37.5 |
| SP | 70.0 | ---- | 209.0 |
| $CaCO_3$ (%) | 51.3 | 0.09 | 40.9 |
| Total nitrogen (%) | 0.24 | 0.2 | 0.02 |
| Total Potassium (%) | 0.06 | 0.71 | 1.36 |
| Total Calcium (%) | 28.5 | 0.65 | 4.51 |
| Total Phosphorous (%) | 0.28 | 0.21 | 0.09 |
| Organic matter (%) | 3.42 | 0.6 | 0.35 |
| Total Manganese (%) | 0.007 | 0.0006 | 0.011 |
| Total Iron (%) | 0.21 | 0.0073 | 2.02 |
| Total Copper (%) | 0.002 | 0.004 | 0.001 |
| Total Zinc (%) | 0.003 | 0.0024 | 0.003 |

**Table (3):Cont. Mixtures composition used and their chemicals properties.**

| Mixture number | Raw materials (%) | | | | | *Chemicals properties* | | |
|---|---|---|---|---|---|---|---|---|
| | Vinasse (V) | Sugar lime (S.L) | By-pass (B.P) | Sulfuric acid (S.A) | $H_2O$ | PH | EC (dSm-1) | *$CaCO_3$ (%)* |
| Mix.1 | 1 | 3 | 2 | 1 | 2 | 6.9 | 14.3 | 4.1 |
| Mix. 2 | 1 | -- | 5 | 1 | 5 | 7.9 | 14.7 | 4.5 |
| Mix.3 | 1 | -- | 4 | 2 | -- | 5.7 | 17.3 | 2.1 |
| Mix.4 | 1 | 4 | 2 | 2 | -- | 6.8 | 15.2 | 12.0 |

Table(4) . List of published methos used in the determined properties.

| Soil properties | Publishers |
|---|---|
| *Particle size distribution (%) | Gee and Bauder (1986) |
| *Bulk density ($Mgm^{-3}$). | Vomocil (1965) |
| *Pore size distribution<br>*Stability index = 1/instability index<br>*Instability index= (mean weight diameter of air dry soil before wet sieving) – (mean weight diameter of same soil after wet sieving) | De Leenheer and De Boodt (1965) |
| *Saturated hydraulic conductivity | Klute and Dirksen(1986) |
| *Soil reaction (pH) and EC(dS/m) | Page *et al* (1982) |
| *water use efficiency(kg $m^{-3}$)=Grain yield(kg $fed^{-1}$)/ seasonal consumptive($m^3$ $fed^{-1}$) | Jensen (1983) |
| Wet sieving | Kamper and Rosenau(1986) |
| *Dry sieving and Aggregation%<br>Aggregation(%)=(weight of aggregates>2m.m)/(total weight of soil)×100<br>*Percent stable aggregates. (P.S.A) =aggregates. %x stability index<br>Classification is used for the P.S.A:<br>P.S.A soil structure<br>40 acceptable<br>60 good<br>80 excellent | Sharma D.K. and De Boodt (1982) |

## RESULTS AND DISCUSSION

### Soil bulk density and total porosity.

It is well known that soil bulk density and total porosity are mostly affected by soil structure. Total porosity provides also valuable information about soil structure and is inversely correlated with bulk density. Mean values of soil bulk density ($Mgm^{-3}$) and total porosity (%) after maize harvesting are presented in Table (5). Data revealed that increasing the applied rate of By-pass, or any other amendments treatments (*mixture1,2,3 and 4,sugar lime*) to the light soil led to reduce the values of soil bulk density, and consequently caused an increase in total porosity compared with control (untreated soil). The efficiency of the studied amendments on reducing the values of bulk density could be arranged in the following ascending order: Mix4>Mix1>Mix3>Mix2>B2>V>B1>S.L>Con. These results may be attributed to the addition of any amendments treatments which enhanced the formation of large soil aggregates. This could be due to the dominance of soluble $Ca^{+2}$ on the exchange complex. These results are in agreement with Mansour *et.al.* (2011).

### Pore size distribution:

Pore size distribution is responsible for the limitation of water retention and movement in the soil and it is strongly affected by soil texture and structure .Mean values of pore size distribution of soil after maize harvesting, as affected by the different applied amendments treatments (*Mixtures 1, 2, 3, 4, sugar lime, by-pass* and vinasse) are shown in Table (5). Data indicated that the quickly drainable pores in the control represented the greatest percent of total pores by volume in the soil. On the other hand, the fine capillary pores are progressively increased with applied any of previous treatments. Generally, the data showed that applying any amendments led to increasing the total porosity and decreasing of quickly drainable pores. The treatments could be arranged the following ascending order:
M4>M1>M3>M2>B2>V>B1>S.L>Cont.
This result may be attributed to increase the solubility of $Ca^{2+}$ that enhanced soil aggregation and the percentage of stable aggregates (P.S.A). These results are in agreement with obtained by Miyamoto and Stroehlein (1986) and Mansour (2007).

**Table (5): Bulk density (B.D), hydraulic conductivity (K), total porosity (T.P) and Pore size distribution(%) as affected by different amendments treatments after harvesting two seasons (combined analysis)..**

| Amendments. | Application rate ($Mgfed^{-1}$.) | B.D ($Mg\ m^{-3}$) | K ($cmh^{-1}$) | T.P (%) | Pore size distribution (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Q.D.P >28.8µ | S.D.P 28.8 -8.6µ | W.H.P 8.6-0.19µ | F.C.P <0.19µ |
| **Control** | -- | 1.56 | 33.7 | 37.5 | 75.7 | 8.8 | 9.6 | 5.9 |
| By-pass (B1) | 1 | 1.52 | 26.2 | 45.8 | 46.4 | 43.6 | 19.4 | 20.6 |
| Vinasse (V) | 2 | 1.50 | 25.4 | 43.9 | 45.6 | 21.4 | 20.5 | 12.5 |
| By-pass (B2) | 3 | 1.49 | 23.1 | 50.3 | 45.5 | 16.3 | 18.5 | 19.7 |
| **Sugar lime** (S.L) | 4 | 1.53 | 26.3 | 49.0 | 44.6 | 11.9 | 18.9 | 19.6 |
| Mixture 1 | 4 | 1.45 | 21.0 | 56.1 | 36.4 | 22.1 | 18.4 | 23.1 |
| Mixture 2 | 4 | 1.47 | 218 | 52.1 | 39.4 | 200 | 19.0 | 21.7 |
| Mixture 3 | 4 | 1.46 | 21.4 | 53.3 | 38.6 | 20.3 | 19.7 | 21.4 |
| Mixture 4 | 4 | 1.42 | 20.6 | 58.6 | 35.5 | 19.1 | 18.3 | 27.1 |

Q.D.P=quickly drainable pores S.D.P=slowly drainable pores, W.H.P=water holding pores F.C.P= fine capillary pores

## Hydraulic conductivity (HC).

Data in Table (5) revealed that the values of soil hydraulic conductivity decreased with the previous amendments treatments (*Mixtures 1, 2, 3, 4, sugar lime, by-pass* and vinasse) as compared with the control. The hydraulic conductivity were decreased from 33.7 cm $h^{-1}$ in the untreated soil to 20.6 cm $h^{-1}$ in a mixture(4),The treatments could be arranged in the following ascending order :
M4<M1<M3<M2<B2<V<B1<S.L<Cont this could be attributed to the effect of any treatments increasing the micro pores and decreasing the macro pores. Similar results were obtained by Mansour (2007) and Mariano *et al.*, (2009)

## Available water (A.W) and water use efficiency (WUE).

The values of available water under different application of any amendments treatments (*Mixtures 1, 2, 3, 4, sugar lime, by-pass* and vinasse) are presented in Table (6).

These values indicated an increase in available water, with all soil conditioners treatments. The highest increase was observed under a mixture (4) which gave an average increase of 40.8%, while the least increase (6.58%) was under sugar lime The rate of increase in A.W % compared to untreated soil were 40.8, 38.2, 30.3, 22.4, 18.4, 11.8,9.2 and 6.58 % or 342.7, 320.9, 254.5, 188.2, 154.6, 99.1, 77.4 and 55.3$m^3$ $fed^{-1}$ for M4, M1, M3, M2, B2, V, B1 and S.L respectively. This result may be due to improve the aggregation process consequently increase fine capillary pores on the expense of quickly drainable pores (Mansour, 2002). As shown in Table (6) water use efficiency with adding previous amendments had the same trends. This finding could be explained on the basis of the effect of the mixture (4) on increasing the fine capillary pores, it could be concluded that, using mixture (4) in the light soils (about $2\times10^6$ fed.) led to saved about ($2\times10^6\times$ 26 $m^3$ = 52 $\times$ $10^6$ $m^3$ of water .This water quantity can using to cultivate about 5.2 $\times10^3$ fed. as well as increased of soil ability to keep nutrient elements, and increased of soil resistance to wind erosion.

**Table (6): Available water (%), Relative increase ($m^3$/fed) and water use efficiency (WUE) as affected by different amendments treatments after harvesting, two seasons (combined analysis).**

| Amendments | Application rate | Available water % | Relative increase (%) | Rate of increase ($m^3$ fed) | WUE ($Kgm^{-3}$) |
|---|---|---|---|---|---|
| Control | 0 | 7.6 | - | - | 0.63 |
| By -pass (B1) | 1 | 8.3 | 9.21 | 5.88 | 0.74 |
| Vinass (V) | 2 | 8.5 | 11.8 | 7.56 | 0.70 |
| By – pass (B2) | 3 | 9.0 | 18.4 | 11.76 | 0.79 |
| Sugar lime (S.L) | 4 | 8.1 | 6.58 | 4.20 | 0.75 |
| Mixt. (1) | 4 | 10.50 | 38.2 | 24.36 | 1.01 |
| Mixt .(2) | 4 | 9.3 | 22.4 | 14.28 | 0.94 |
| Mixt .(3) | 4 | 9.9 | 30.3 | 16.80 | 0.99 |
| Mixt .(4) | 4 | 10.7 | 40.8 | 26.04 | 1.01 |

*water consumptive use for maize (2600$M^3$ $fedan^{-1}$)

## Stability Index (SI), Aggregation (%) and the percentage of stable aggregates (P.S.A):

Data in Table (7) revealed that the amendments treatments (*Mixtures 1,2,3,4, sugar lime, by-pass* and vinasse) resulted in an increase for stability index (SI), that can be arranged discerningly as follow: M4>M1>M3> B2> M2>B1>S.L> Cont>V., Regardless the SI the aggregation % was ranged from 29.6 to 49.6% with an order: S.L>V>M4>B1>M1>M3>M2>B2>con.. On the other hand, the percentage of the stable aggregates was not high enough to be appreciated to have an acceptable or good soil structure, except the mixture (4) whereas soil structure classification was good, while the other mixtures were acceptable.

In conclusion, it can be noticed that the application of the studied amendments increased the percentage of stable aggregates, (Mohamed, *et al.*2011).

## Soil salinity (ECe) and pH.

The movement of soluble salts in the soil depends mainly on its texture, structure, total porosity and permeability. Data in Table (8) showed the values of ECe and PH of the studied soil in flounced by the amendments (mixtures 1, 2, 3, 4, by-pass, vinass, and sugar lime) application under irrigation with saline water. Data indicated that the mean values of soil ECe after harvesting for two seasons decreased with the application treatments as compared with control. This may be attributed to the improvement of soil physical properties and enhance the leaching process of salts. as well as to the high adsorption of ions by the growing plant (EL-Saadany 1994). Concerning the effect of the amendments treatments on pH values, data showed the similar trend with ECe.

## Maize yield (grain&stalks).

Data presented in Table (9) showed that the application of any amendment treatments (mixture 1, 2, 3, 4, by-pass, venass, and sugar lime ) increased the grain and stalks yield The relative increase were 61, 59, 56, 49, 25, 18, 17 and 10% for M4, M1, M3, M2, B2, V, B1 and S.L. respectively as related to the control. This may be due to increase the A.W% and decrease the water loss by percolation through soil profile as a result improvement of soil properties.

Moreover, crop index decreased with the increasing of crop yield, (grain and stalks). Therefore ‹crop index was decreased with the application of the investigated amendments

**Table (7): The percentage of Stable aggregates (PSA) as affected by different amendments treatments after harvesting, two seasons (combined analysis).).**

| Amendments | Rate per fed. | M.W.D* | | Stability index (%) | Aggregation (%) | (PSA) % | Soil structure classification |
|---|---|---|---|---|---|---|---|
| | | Dry sieving | Wet sieving | | | | |
| Control | — | 2.34 | 0.93 | 0.71 | 29.6 | 21.6 | ---- |
| By –pass (B1) | 1 | 3.12 | 1.82 | 0.77 | 40.1 | 30.8 | ----- |
| Vinass (V) | 2 | 2.89 | 1.11 | 0.56 | 48.6 | 27.2 | ----- |
| By – pass (B2) | 3 | 1.96 | 1.15 | 1.23 | 30.2 | 37.1 | ------- |
| Sugar lime (S.L) | 4 | 2.12 | 0.74 | 0.72 | 49.6 | 35.7 | ------ |
| Mixt. (1) | 4 | 2.82 | 2.15 | 1.49 | 39.5 | 58.9 | Acceptable |
| Mixt ,(2) | 4 | 1.73 | 0.84 | 1.12 | 36.9 | 41.3 | Acceptable |
| Mixt .(3) | 4 | 1.25 | 0.46 | 1.27 | 38.2 | 48.5 | Acceptable |
| Mixt .(4) | 4 | 2.61 | 1.96 | 1.53 | 43.8 | 67.0 | Good |

- MWD= Mean weight diameter

**Table (8): Soil pH and Electrical conductivity (EC) as affected by different analysis) amendments treatments after harvesting, two seasons (combined**

| Amendments | Rate per fed. | pH (1-2.5) | EC( dSm-1) |
|---|---|---|---|
| Control | - | 8.04 | 6.96 |
| By –pass (B1) | 1 | 7.9 | 6.86 |
| Vinass (V) | 2 | 7.87 | 6.86 |
| By – pass (B2) | 3 | 7.85 | 6.85 |
| Sugar lime (S.L) | 4 | 7.96 | 6.88 |
| Mixt. (1) | 4 | 7.75 | 6.78 |
| Mixt ,(2) | 4 | 7.83 | 6.82 |
| Mixt .(3) | 4 | 7.80 | 6.80 |
| Mixt .(4) | 4 | 7.70 | 6.75 |

**Table (9): Grain yield treatments and some components of maize plant as affected by different amendments (combined analysis 2009 and 2010 growing seasons).**

| Amendments | Application rate ($Mgfed^{-1}$) | Grain yield ($Mgfed.^{-1}$) | Stalks yield ($Mgfed.^{-1}$) | Crop index* | Relative increase (%) |
|---|---|---|---|---|---|
| Control | - | 1.65 | 051 | 3.24 | -- |
| By –pass (B1) | 1 | 1.93 | 0.87 | 2.22 | 17.0 |
| Vinass (V) | 2 | 1.82 | 0.60 | 3.03 | 10.3 |
| By – pass (B2) | 3 | 2.06 | 0.89 | 2.31 | 24.8 |
| Sugar lime (S.L) | 4 | 1.95 | 0.89 | 2.19 | 18.2 |
| Mixt. (1) | 4 | 2.62 | 0.94 | 2.79 | 58.8 |
| Mixt ,(2) | 4 | 2.45 | 0.88 | 2.78 | 48.5 |
| Mixt .(3) | 4 | 2.58 | 0.92 | 2.80 | 56.4 |
| Mixt .(4) | 4 | 2.66 | 0.98 | 2.71 | 61.2 |

*crop index=total grain yield/total stalks yield

## Economic evaluation.

The final profit of the mean yield and the economic classes (orders) are shown in Table (10).The data show that application mixture (1) gave the highest profit followed by mixture (2).The absolute profit took the following order:

mixture(1)> mix.(2)> mix.(4)> vinass> mix. (3)> S.l.> by-pass(2)> by-pass (1)> cont .during the two seasons.

Table (10): Total income (L.E.) and profit (L.E.) as affected by different amendments (Combined analysis 2009and 2010 growing seasons).

| Amendments | Application rate ($Mgf^{-1}$) | Total cost for amendments | Cost for one season | Price for Mg (L.E.) | Total yield ($Mg\ fed^{-1}$) | Total income (L.E.) | Profit (L.E.) | Order |
|---|---|---|---|---|---|---|---|---|
| Control | - | - | -- | 1500 | 1.65 | 2475 | 1475 | 7 |
| By -pass (B1) | 1 | 400 * | 100 | | 1.93 | 2895 | 1595 | 6 |
| Vinass (V) | 2 | 500 | 125 | | 1.82 | 2730 | 1355 | 8 |
| By - pass (B2) | 3 | 400 * | 100 | | 2.06 | 3090 | 1790 | 3 |
| Sugar lime (S.L) | 4 | 400 * | 100 | | 1.95 | 2925 | 1625 | 5 |
| Mixt. (1) | 4 | 888 | 222 | | 2.62 | 3930 | 2264 | 1 |
| Mixt.(2) | 4 | 672 | 168 | | 2.45 | 3675 | 2171 | 2 |
| Mixt .(3) | 4 | 2144 | 536 | | 2.58 | 3870 | 1262 | 9 |
| Mixt .(4) | 4 | 1664 | 416 | | 2.66 | 3990 | 1742 | 4 |

*Transport cost

The total net farm income resulted from mixture (1) treatment was approximately= 2264 L.E. season/fed. In contrast the loss in the net farm income under without treatment (control) was found to be=1475L.E. season/fed. Therefore relative increase equal 789 L.E.season/fed. Total cultivated maize crop area in Egypt from light soils about 50 thousand feddan, S0, the resulting increasing in the total national income is about 39 millions L.E. yearly.

In conclusion, the mixture (1) amendment is recommended to apply for the light soils to improve soil physical properties which are strongly requested to provide good sustainability for profitable cultivation.

## CONCLUSION

Based on the aforementioned discussion, it could be conclude that the application of the amendments :( mixtures 1, 2, 3 and 4) improved soil properties i.e. increased total porosity, fine capillary pores, available water, water use efficiency and grain yield .On the contrary, bulk density, hydraulic conductivity, quickly drainable pores, ECe and pH values were decreased.Furthermore,soil structure was improvement. The application of a mixture (1) gave the highest profit followed by a mixture (2), according to the economic evaluation. While using mixture (4) in the light soils saved 26 $m^3 fed^{-1}$. Almost $2\times10^6$ fed. of the Egypt's land area is comprised of the light soils, consequently led to save about $52\times10^6$ $m^3$ of water, at using mixture (4). These quantities can use to cultivate about $5.2\times10^3$ fed.

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# مقارنة تأثير بعض مخلفات المصانع كمحسنات تربه على بعض الخواص الفيزوكيميائيه والهيدروفيزيائية وإنتاجية الذرة

صبحي فهمي منصور

معهد بحوث الاراضى والمياه والبيئة (جيزة – مصر )

**الملخص العربي**

أقيمت تجربه حقليه بمحطة بحوث العريش بمحافظة شمال سيناء خلال موسمى (٢٠٠٩، ٢٠١٠) بهدف دراسة تاثير اضافة الباى باس، جير السكر، الفيناس ومخاليط منهم على بعض خواص التربة الفيزوكميائية والهيدرولوجية وزيادة انتاجيتها من الذرة وقد اشارت النتائج المتحصل عليها على :.

١) اضافة اى من المصلحات السابقة ادى الى تحسن فى بعض الخواص الفيزوكميائية والهيدرولوجية فى الاراضى الخفيفة فقد ذادت المسام الكلية والمسام الدقيقة والماء الميسرو كفاءه استخدام المياه و انخفضت قيم كلا من الكثافة الظاهرية، المسام السريعة الصرف و التوصيل الهيدرولكى ، ملوحة وقلوية التربة بالاضافة الى تحسن فى البناء الارضى

٢) زيادة محصول الحبوب باستخدام المصلحات السابقة خاصة عند استخدام مخلوط ٤ يلية مخلوط ١ ثم مخلوط ٣

٣) تفوق مخلوط ١ من الناحيه الاقتصاديه عند الاضافة حيث اعطى اكبر عائد اقتصادى يلية مخلوط ٢

٤) استخدام مخلوط ٤ فى الاراضى الخفيفة ادى الى توفير حوالى ٢٦متر مكعب ماء لكل فدان ونظرا لوجود ما يقرب من٢ مليون فدان بمصرتدخل ضمن الاراضى الخفيفه فان استخدام هذا المخلوط يوفرما يقرب من ٥٢ مليون متر مكعب ماء يمكن استخدامه فى زراعةحوالي ٥٠٠٠ فدان