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EFFECT OF SOME SOIL ORGANIC AMENDEMENTS ON THE PRODUCTIVITY OF SANDY SOIL

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ABSTRACT: A green house experiment was conducted at experimental farm (El- Khattara sand soil) , Faculty of Agriculture, Zagazig University to study the effect of some soil amendments (Farmyard manure, chicken manure, town refuse and sewage sludge) and its combination effects on some growth characters of wheat plant (Triticum vulgare, c.v. Sakha 93) as well as some physical and chemical soil properties. There were 19 treatments, which cover all the possible combination of the four used amendments. The maximum dose of each used amendments is chosen to be equal 300 LE per feddan The results were computed and blotted on tetrahedral shape, which demonstrates the outside, and inside data in a 249 intersections each has the same cost of the used amendements.

Results revealed that the optimal combinations of wheat grain yield can be obtained with treatment consist of (1.2:0.66: 1.5: 2.5) ton /fed Farmyard manure, chicken manure, town refuse and sewage sludge respectively.Whereas the optimal combinations of bulk denisity, organic matter contentand fine capillary pores are 1:1:3:3, 5:1:1:1, 4:0:4:0 (of the 8 points score) of FY, CH,TR and SS respectively.

Key words: Farmyard manures, chicken manures, town refuse, sewage sludge

INTRODUCTION

Land reclamation is a major policy targets in Egypt . Sandy soil should constitute a substantial part of the Egyptian cultivated land now and in the future. Sandy soil which mainly characterized by, light texture, week structure, very low organic matter, water retention and nutrient contents , However it could be as productive as any other soil if the right soil management practices were followed.

Intensive efforts were directed to use soil consigner to increased the productivity of such soil(Awadalla *et al.*1984, Chen and Avnimelech 1986, Tester 1990, Moussa, *et al.*1995 and El_Hady *et al.*1995) reported an improve in soil chemical and physical properties of sandy soil and enhanced yield production by using one or more of soil conditioner amendments There are thousands of papers, reports etc. which declare that a change in soil organic matter status is associated with an improvement or deterioration in the behavior of agricultural soils, *e.g.* in workability, aggregate stability or strength, soil water retention, nutrient supply *etc.*However soil amendments can include virtually any substance that improves the growth of plant in soil .Generally, it could separate fertilizers from soil amendments by their higher nutrient content, but the distinction is not always clear since soil amendments can improve both chemical and physical properties of a soil. The physical properties of soil that are improved by amendments include soil structure, porosity, and water holding capacity .

Organic soil amendments are currently the most common solution for improving physical characteristics of these sandy soil .In this respect it is worthy to mention that the beauty of organic soil amendments is that they will, on one hand , increase aeration and porosity in heavy clay soils ,while increasing water retention in sandy soil. However the Philosophy of mixing amendments tested previously by several works of El-Sersawy (1997) and Moussa *et al.* (1995).

The objective of the present work is to investigate the effect of farmyard manure, chicken manure, town refuse and Sewage sludge either alone or its all the possible combinations , our goal is to define the best combination of organic amendments for sandy soil.

MATERIALS AND METHODS

Tetra factorial computer model Moussa and Youssef (1992) was applied using Farmyard manures , chicken manure , town refuse and sewage sludge as soil amendments for sandy soil of El -Khattara experimental farm physical and chemical properties of the soil and the amendments used are shown in Table 1, the investigated materials farmyard manures, chicken manure, town refuse and sewage sludge were designated as X1 , X2 , X3 ,and X 4 respectively they were applied

Table 1. Some physical and chemical properties of El Khatara sandy soil

Characters	Sandy soil
Particle size distribution	
Sand %	88
Silt %	8
Clay %	4
Textural class	Sand
FC %	1.85
WP %	0.25
Am %	1.60
Chemical properties	
EC ds/m	0.50
PH	8.2
OM %	0.05
N_{ppm}	43.00
P_{ppm}	4.50
K_{ppm}	68.00
CaCo3 %	0.43
Soluble cations and anions in saturated extract meq/L	
Na^{+}	3.40
K^{+}	0.48
Ca^{++}	0.51
Mg^{++}	0.62
Cl^{-}	1.40
$HCO3^{-}$	1.20
$CO3^{=}$	nil
$SO4^{--}$	2.41

at a levels ranging from zero to a maximum. The maximum dose of each used amendments is chosen to be equal 300 LE per feddan so the maximum dose of farmyard manures ,chicken town refuse , sewage sludge were (9.6 ,1.07 ,12.0 and ,20.0 Ton feddan – 1 .There were 19 treatments of different FY ,Ch ,TR ,SS Table 2. The four amendments were allocated on the four head of the tetrahedron on which sites they were equal to the maximum 100% or 8- points graduated to be 0 % on the opposite base. However the treatments 1 to 4 and 6 to 11 lie on the surface of the tetrahedron while treatment 12 to 19 lie inside it. Treatment 3 lies

Table 2. Some chemical characteristics of applied manures

Characters	Farmyard manure	Chicken manure	Town refuse	Sewage Sludge
O.M%	43.4	44.07	38.40	42.94
C%	25.17	25.56	22.27	24.90
N%	1.23	2.30	1.00	1.67
P_{ppm}	16.3	18.5	18.30	18.15
K_{ppm}	110	149	116	142
PH	6.7	7.3	6.9	7.1

exactly on the tetrahedron center and consists of the four amendments 25% each or 2 units (The sum of any treatment is 100% or 8 units with equal cost 300 LE. / feddan .Treatments were prepared under greenhouse conditions at the Faculty of Agriculture Zagazig University in 25 cm plastic pot, four replicates each, pots were kept moisture 4 weeks before planted with wheat (Triticum vulgare, c.v. Sakha 93) of the rate of kg / feddan. The other normal cultural practices were adopted.

Some plant morphological characters wear recorded whereas after harvesting soil samples were taken for determination of organic matter content,avilable water,bulk denisity, and pore size distribution according to (De. Leenheer and De Boot, 1965. Each of these parameters was passed through the tetra factorial computer programme in which the result were printed either on the surface or inside the tetrahedron each value refers to specific combination according to its position on or inside the tetrahedron.

The total number as the output values are 249, the values located on the surface area of the principle tetrahedron amount to 130 corresponding to 4 single, 21 double and 105 triple factorial treatments. The other 119 values located in side the principal one and refers to tetra factorial combined treatments.

It is worthily to mention that any of the 249 intersections have the same cost of the amendments used, this is very important to compared correctly the effect and inter effect of the material under investigation. However, to facilitate interpreting the obtained results of any parameter, equivalent transparent diagrams may used showing the intersections points between X1, X2, X3 and X4 as defined by their equivalent real values of the actual

Table 3. Treatments scheme and doss of soil amendments used in organic experiment (farmyard manure, chicken manure, town refuse, and sewage sludge) ton feddan^{-1}

Treatment	X_1	X_2	X_3	X_4	X1=FY	X2=Ch	X3=TR	X4=SS
1	8/100	0	0	0	9.60	0.00	0.00	0.00
2	0	8/100	0	0	0.00	1.07	0.00	0.00
3	0	0	8/100	0	0.00	0.00	12.00	0.00
4	0	0	0	8/100	0.00	0.00	0.00	20.00
5	2/25	2/25	2/25	2/25	2.40	0.26	3.00	5.00
6	4/50	4/50	0	0	4.80	0.53	0.00	0.00
7	4/50	0	4/50	0	4.80	0.00	6.00	0.00
8	4/50	0	0	4/50	4.80	0.00	0.00	10.00
9	0	4/50	4/50	0	0.00	0.53	6.00	0.00
10	0	4/50	0	4/50	0.00	0.53	0.00	10.00
11	0	0	4/50	4/50	0.00	0.00	6.00	10.00
12	5/62.5	1/12.5	1/12.5	1/12.5	6.00	0.13	1.50	2.50
13	1/12.5	5/62.5	1/12.5	1/12.5	1.20	0.66	1.50	2.50
14	1/12.5	1/12.5	5/62.5	1/12.5	1.20	0.13	7.50	2.50
15	1/12.5	1/12.5	1/12.5	5/62.5	1.20	0.13	1.50	12.50
16	2.5/31.25	2.5/31.25	2.5/31.25	0.5/6.25	3.00	0.33	3.75	1.25
17	2.5/31.25	2.5/31.25	0.5/6.25	2.5/31.25	3.00	0.33	0.75	6.25
18	2.5/31.25	0.5/6.25	2.5/31.25	2.5/31.25	3.00	0.06	3.75	6.25
19	0.5/6.25	2.5/31.25	2.5/31.25	2.5/31.25	0.60	0.33	3.75	6.25

*** 8/100 refers to 8 units, 100%**

FY= Farmyard manure **TR= Town refuse**

Ch= Chicken manures **SS= Sewage sludge**

used amendments. Moreover average value, general mean error, correlation coefficient, fisher criterion, adequacy test of the model through the treatments 16-19 and the optimum combination of the parameter under investigation are of the programmed output.

RESULTS AND DISCUSSION

Data presented in Table 4. Showed the actual results of some soil physical-chemical properties and yield characters in response to the original 19 treatments comprising some combination of

Table 4. Some soil properties as affected by different combination of farmyard manure, chicken manure, town refuse and sewage sludge

Treatment No	Organic matter %	Bulk density gm/ cm^3	Available moisture %	Pore size listribution 28 MM	Pore size distribution 9-28 MM	Pore size distribution >0.19 MM	Grain yield ardab / fed	Biological yield gm/ pot	Straw yield gm /pot
1	0.27	1.75	12.40	27.21	3.54	9.15	8.06	15.53	4.58
2	0.20	1.73	12.52	32.24	3.47	9.39	7.99	16.00	5.16
3	0.33	1.72	13.60	27.50	4.72	9.46	7.59	16.58	5.61
4	0.40	1.73	11.39	29.35	3.25	8.66	8.19	14.77	4.65
5	0.40	1.71	11.01	30.46	3.03	8.23	8.27	13.42	4.29
6	0.23	1.68	12.60	29.64	4.34	8.69	7.56	15.04	4.71
7	0.31	1.67	13.26	23.38	3.05	14.59	8.09	15.03	4.05
8	0.35	1.72	12.64	27.53	3.95	9.30	6.01	11.41	3.00
9	0.24	1.74	14.14	26.64	5.20	10.91	7.35	15.65	5.16
10	0.16	1.71	12.52	35.23	2.50	10.62	6.06	12.62	3.89
11	0.18	1.66	10.86	30.49	3.97	8.09	5.68	12.13	2.34
12	0.68	1.70	11.97	31.35	2.12	11.80	8.11	14.33	3.93
13	0.38	1.65	12.67	28.97	3.95	9.20	10.16	12.96	2.41
14	0.10	1.64	11.80	25.06	3.45	8.69	6.07	10.60	2.46
15	0.10	1.63	10.75	32.80	2.04	8.43	6.74	12.40	3.26
16	0.08	1.66	11.46	32.22	2.29	7.56	6.87	12.31	3.74
17	0.11	1.64	12.69	27.18	5.06	8.28	9.40	15.49	3.98
18	0.13	1.63	13.05	27.21	4.77	8.83	7.01	10.85	2.13
19	0.07	1.59	10.19	31.23	2.10	8.57	10.20	13.39	3.45
20							6.49	9.99	3.50

farmyard manure, chicken manure, town refuse and sewage sludge. However the response was not always the same.

Data present in Table 4 and Fig 1 show soil organic matter percentages as affected by all the possible combination of the used amendments, results revealed that soil organic matter percentage ranged between 0.07-0.68. However single treatment of FY, CH, TR and SS reveled that sewage sludge single treatment was more effective on soil organic matter content 0.403% compared with town refused 0.330%, farmyard manure 0.270% and chicken manure 0.203%. The order is sewage sludge > tow refused > farmyard manure> chicken manure respectively. Scanning the different values of Fig 1b shows the number 0.683% as the maximum one this maximum corresponding to an interpolated four combined treatments consisting of 5: 1: 1: 1 (of the 8 points score) i.e. (6, 0.13, 1.5 and 2.5 ton/fed) of FY,CH,TR and SS respectively. Moreover Fig 1c revel that the central point of the tetrahedron has an organic matter percentage equal 0.403 % corresponding to treatment of 2 :2: 2: 2 i.e. equivalent mixture of the four used amendments. These results strongly confirmed by Magdy (1999), and Aal *et al.* (2003) they reported that application of organic materials increased organic matter content. Shaban (2005) mentions that high soil organic matter is correlated with the occurrence of active organic acids. These organic acids provided a substantial modification of soil physical properties, especially soil structure as will as soil aggregation and drainable pores.

Regarding to soil bulk density data in Table 4 and Fig 2 show the values of soil bulk density as affected by all the possible combination of the used amendments. The results reveal that the single treatment of FY, CH, TR and SS were 1.75, 1.73, 1.72 and 1.73 gm/cm^3 respectively, these results suggested that TR gave the promotion effect comparing with the other used organic amendments, the order where TR> CH>SS>FY. Scanning the different values of Fig 2a could recognized a zone of bulk density equal to 1.66 gm/cm^3 these zone are a combination between X4, X3 and X1 i.e. a mixture of SS, TR and FY manures. Furthermore scanning the different values of Fig 2b will indicates the number of 1.62 gm/cm^3 as a minimum one. This minimum corresponding to a combination of 1:1:3:3 or 1:1:2:4 (of 8 point score) of FY, CH, TR and SS respectively. This results

Fig. (1)

Computer output of organic matter as affected by farmyard manure, chicken manure, town refuse and sewage sludge.

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FOUR COMBINATION EXPERIMENTAL RESULTS (FACULTY OF AGR. ENGINEERING SHIV.)
-------------------------------------------------------------------------
NUMBER OF TREATMENTS  = 19; NUMBER OF REPLICATES= 3

EXPERIMENTAL DATA AND (MEAN)
----------------------------
 1.     0.27    0.26    0.28    0.27  (  0.27 )
 2.     0.22    0.20    0.18    0.21  (  0.20 )
 3.     0.32    0.33    0.34    0.33  (  0.33 )
 4.     0.42    0.40    0.33    0.46  (  0.40 )
 5.     0.40    0.34    0.51    0.36  (  0.40 )
 6.     0.20    0.29    0.20    0.23  (  0.23 )
 7.     0.31    0.30    0.20    0.33  (  0.31 )
 8.     0.34    0.36    0.33    0.35  (  0.35 )
 9.     0.24    0.33    0.30    0.20  (  0.26 )
10.     0.15    0.17    0.16    0.15  (  0.16 )
11.     0.18    0.15    0.21    0.17  (  0.18 )
12.     0.55    0.69    0.81    0.68  (  0.68 )
13.     0.38    0.32    0.45    0.35  (  0.38 )
14.     0.09    0.12    0.10    0.07  (  0.10 )
15.     0.09    0.10    0.12    0.07  (  0.10 )
16.     0.07    0.08    0.09    0.08  (  0.08 )
17.     0.11    0.10    0.12    0.11  (  0.11 )
18.     0.11    0.13    0.13    0.13  (  0.13 )
19.     0.06    0.07    0.08    0.07  (  0.07 )

GENERAL MEAN  = .2475
MEAN ERROR    = 1.7103118-02
CORRELATION COEFFICIENT= .9750255
ERRSTRIN FISHER  F( 18 57 )= 61.03292

REALITY ADEQUATE TEST OF THE MODEL THROUGH THE LAST FOUR TREATMENTS
------------------------------------------------------------------
EXPERIMENTAL TREATMENT - TABULAR =DIFFERENCE  RES.STUDENT
  16       0.08 -   0.33 =  -0.25       -12.27
  17       0.11 -   0.31 =  -0.20        -9.95
  18       0.13 -   0.25 =  -0.12        -5.82
  19       0.07 -   0.12 =  -0.05        -2.36

THE SIGNIFICANT ADEQUATE SECTOR OF THE SQUARE TEST FOR THE CALCULATED VALUE
, MULTIPLY BY  1000
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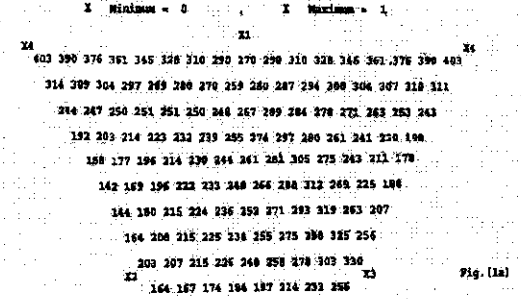

Fig. (1a)

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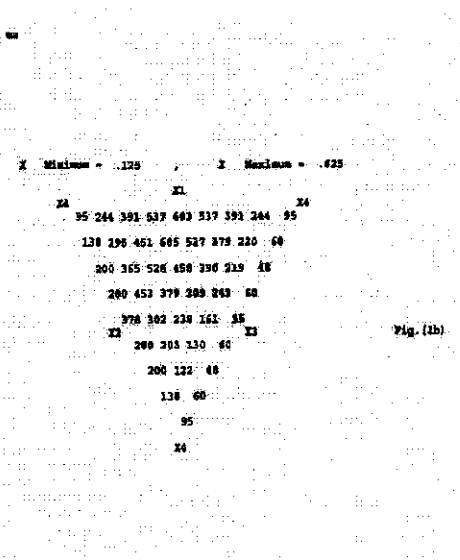

Fig. (1b)

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MAXIMUM VALUE          YR =   0.683

OPTIMUM COMBINATION;  ( 5.0 , 1.0 , 1.0 , 1.0 )
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FIG.(2):
Computer output of milk density as affected by farmyard manure, chicken waste, town refuse and sewage sludge.

BOX CONFERION EXPERIMENTAL RESULTS (FACULTY OF AGR. ZAGAZIG UNIV.)

NUMBER OF TREATMENTS= 19; NUMBER OF REPLICATES= 4

EXPERIMENTAL DATA AND (MEAN)

1.	1.78	1.67	1.75	1.79	(1.75)
2.	1.65	1.70	1.77	1.79	(1.73)
3.	1.78	1.69	1.71	1.75	(1.73)
4.	1.69	1.77	1.69	1.76	(1.73)
5.	1.72	1.78	1.64	1.78	(1.71)
6.	1.74	1.68	1.63	1.65	(1.68)
7.	1.63	1.63	1.67	1.68	(1.67)
8.	1.79	1.79	1.72	1.73	(1.72)
9.	1.91	1.77	1.74	1.73	(1.74)
10.	1.71	1.69	1.73	1.73	(1.71)
11.	1.67	1.68	1.63	1.63	(1.66)
12.	1.71	1.69	1.67	1.71	(1.70)
13.	1.65	1.65	1.63	1.66	(1.65)
14.	1.62	1.68	1.65	1.62	(1.64)
15.	1.60	1.65	1.62	1.66	(1.63)
16.	1.64	1.69	1.64	1.63	(1.66)
17.	1.62	1.64	1.69	1.61	(1.64)
18.	1.67	1.61	1.63	1.60	(1.63)
19.	1.69	1.54	1.61	1.58	(1.59)

GENERAL MEAN = 1.680658
MEAN ERROR = 1.679797E-02
CORRELATION COEFFICIENT= .8085702
REGRESSION FISHER F(18 57)= 5.979686

QUALITY ADEQUATE TEST OF THE MODEL THROUGH THE LAST FOUR TREATMENTS

EXPERIMENTAL TREATMENT	- TABULAR	=DIFFERENCE	REM.RESIDUAL
16	1.66 - 1.65	= 0.00	0.20
17	1.64 - 1.66	= -0.02	-1.27
18	1.62 - 1.64	= -0.01	-0.76
19	1.59 - 1.63	= -0.05	-3.04

THE SIGNIFICANT ADEQUATE SECTOR OF THE SQUARE TEST FOR THE CALCULATED VALUE , MULTIPLY BY 100

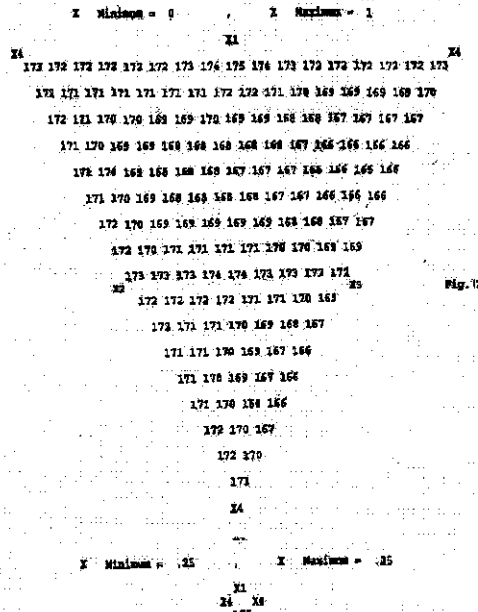

Fig.(2a)

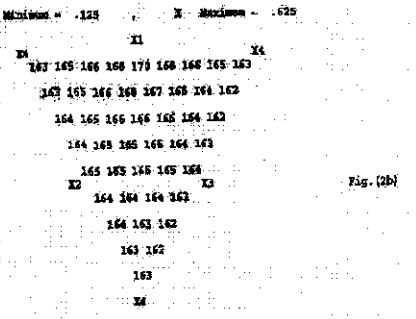

Fig.(2b)

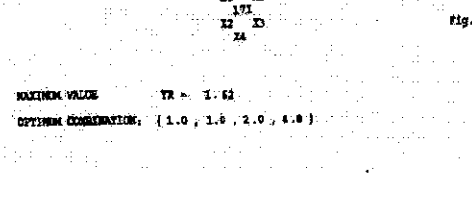

Fig.(2c)

MAXIMUM VALUE YR = 1.62

OPTIMUM COMBINATION: (1.0 , 1.0 , 2.0 , 4.0)

refer to the significant combination effect of FY: CH: TR and SS and not singly. However Fig 2c revel that the central point of tetrahedron has an bulk density equal 1.71 gm/cm^3 corresponding to treatment of 2:2:2:2 i.e. equivalent mixture of the four used amendments. The obtained result pointed to not only the important of mixture application but also the used ratio of the different amendments must take into consideration. These results agree with those of Habib *et .al.*, (1987) and Lalia *et. al*, (1993).

Available moisture is an important parameter, which indicates how much water could be released to plant roots without high tensions. It is mainly corresponding to the major variation in physical constituents of soil. Concerning the light soils, increasing of available moisture mean that an improvement of soil physical properties had been achieved. Data in Table 4 Fig 3 show soil Available moisture as affected by all the possible combination of the used amendments, results revealed that available moisture is ranged between 10.19 - 14.14%. However the located value of the four single treatments where 12.40, 12.52, 13.60 and 11.39 % FY, CH, TR and SS respectively. These results suggested that TR gave the promotion effect comparing with the other used organic amendments, the order where TR > CH > FY > SS. Scanning the different values of Fig 3a shows the number 14.2 % as the maximum one, this maximum corresponding to an interpolated four combined treatments consisting of 0:3:5:0 (of the 8 points score) of FY, CH, TR and SS respectively. This results refer to the significant combination effect of CH and TR at a ratio of 3:5 and not singly. Moreover Fig 3c revealed that the central point of the tetrahedron has an available moisture equal 11.01% corresponding to treatment of 2:2:2:2 i.e. equivalent mixtures of the four used amendments. However the optimum combination for soil available moisture obtained by a mixture of CH and TR at the rate of 37.5 and 62.5 % in other words 0.4and 7.5 ton/feddan respectively.

Khaleel, *et al.*(1981) mentioned that water retention at fild capacity and wilting point were positively corelated with organic manures.

Regarding to soil porosity, it could be stated that the more important is not the soil total porosity but the pore size distribution. (De leenher and De Boodt, 1965) however Baver *et al.* (1972) stated that pore–size

FIG. (3)
Computer output of available [illegible] as affected by [illegible] manure, chicken manure, town refuse and sewage sludge.

FOUR COMPONENTS EXPERIMENTAL RESULTS (FACULTY OF AGR. ZAGAZIG UNIV.)

NUMBER OF TREATMENTS = 19, NUMBER OF REPLICATIONS = 4

EXPERIMENTAL DATA AND (MEANS)

1.	11.57	13.05	13.81	13.97	(13.48)
2.	12.37	12.40	13.68	11.65	(12.52)
3.	13.31	13.81	13.16	11.90	(13.00)
4.	10.43	11.44	11.81	11.66	(11.39)
5.	10.60	11.39	11.13	12.14	(11.05)
6.	12.39	12.53	12.96	12.53	(12.60)
7.	13.56	13.42	13.07	13.45	(13.25)
8.	13.37	12.36	12.97	13.66	(13.14)
9.	13.31	14.22	14.02	14.21	(14.14)
10.	12.47	12.78	12.31	12.15	(12.38)
11.	10.75	11.19	10.74	10.74	(10.86)
12.	13.03	12.06	12.03	11.05	(12.37)
13.	12.68	12.93	12.47	13.80	(12.97)
14.	11.98	13.02	11.64	11.63	(11.80)
15.	10.64	10.31	10.86	10.87	(10.78)
16.	11.39	11.37	11.83	11.55	(11.48)
17.	15.73	12.56	14.75	12.72	(13.68)
18.	12.53	13.40	13.16	13.06	(13.05)
19.	10.23	10.38	10.11	10.12	(10.19)

GENERAL MEAN = 12.1[illegible]7
MEAN ERROR = .1[illegible]7
CORRELATION COEFFICIENT= .[illegible]9
REGRESSION FISHER F(14 57)= 33.66802

RELIABILITY [illegible] TEST OF THE MODEL THROUGH THE LAST FOUR TREATMENTS

EXPERIMENTAL	THEORETIC	= DIFFERENCE	STD.STUDENT
16	11.46 - 12.92 =	-1.46	-[illegible]
17	13.68 - 12.37 =	1.31	1.[illegible]
18	13.05 - 11.77 =	1.28	[illegible]
19	10.19 - 12.18 =	-1.99	-[illegible]

THE SIGNIFICANT [illegible] OF THE SQUARE TEST FOR THE CALCULATED VALUE , MULTIPLY BY 10

X Minimum = 0 , X Maximum = 1

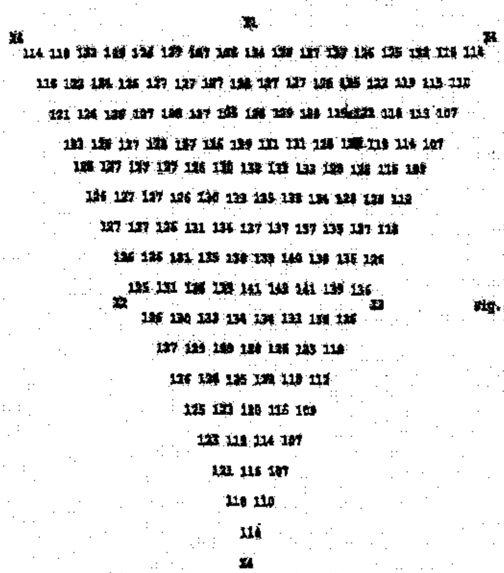

Fig. (3d)

X Minimum = .125 , X Maximum = .625

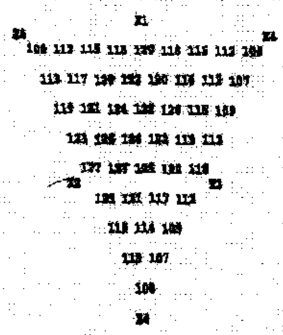

Fig. (3b)

X Minimum = .19 , X Maximum = .25

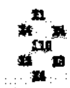

Fig. (3a)

MAXIMUM VALUE X1 = 14 . 3

OPTIMUM COMBINATION: (0.3 , 3.0 , 5.0 , 0.0)

FIG. (4):
Computer output of pore size distribution > 21 [illegible] as affected by [illegible], [illegible], TK & [illegible].

FOUR COMBINATION EXPERIMENTAL DESIGN (FACULTY OF AGR. ZAGAZIG UNIV.)

NUMBER OF TREATMENTS = 19, NUMBER OF REPLICATES= 4

EXPERIMENTAL DATA AND (MEAN)

1.	27.85	26.16	28.12	26.62	(27.21)
2.	33.35	33.39	31.98	33.30	(33.24)
3.	21.60	28.98	27.00	25.42	(27.50)
4.	31.60	26.55	29.85	29.80	(29.45)
5.	30.44	29.58	30.42	31.30	(30.46)
6.	30.02	29.01	28.85	30.42	(29.61)
7.	23.78	23.38	23.40	23.46	(23.48)
8.	27.42	27.46	27.63	27.61	(27.53)
9.	27.00	25.75	27.42	26.38	(26.64)
10.	34.61	35.74	35.06	35.48	(35.22)
11.	30.66	28.45	31.24	30.65	(30.49)
12.	31.23	38.91	30.14	30.12	(31.35)
13.	28.62	28.80	29.93	28.73	(28.97)
14.	26.28	26.30	26.12	25.84	(26.14)
15.	32.68	31.81	33.39	33.32	(32.80)
16.	31.95	32.58	32.60	31.85	(32.22)
17.	26.83	27.88	26.40	27.61	(27.18)
18.	26.93	26.82	27.55	27.54	(27.21)
19.	31.52	30.82	31.63	31.76	(31.33)

GENERAL MEAN = 29.24697
MEAN ERROR = .3603736
CORRELATION COEFFICIENT= .9737791
EXPERIMENTAL FISHER F(18 57)= 55.40143

REALITY ADEQUATE TEST OF THE MODEL THROUGH THE LAST FOUR TREATMENTS

EXPERIMENTAL TREATMENT	- TABULAR	=DIFFERENCE	EXP. STUDENT
16 32.22	- 26.58	= 5.64	13.41
17 27.18	- 31.47	= -4.29	-10.51
18 27.21	- 28.34	= -1.13	-2.76
19 31.33	- 29.95	= 1.38	3.37

THE SIGNIFICANT ADEQUATE SECTOR OF THE SQUARE TEST FOR THE CALCULATED VALUE , MULTIPLY BY 10

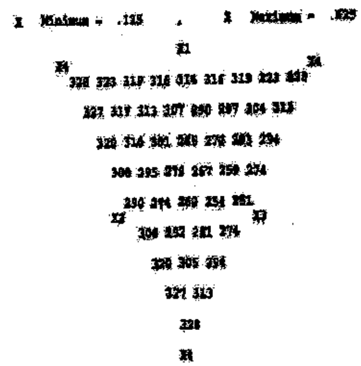

Fig. (4 b)

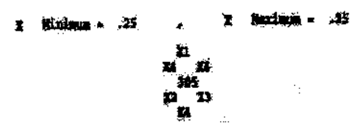

Fig. (4 c)

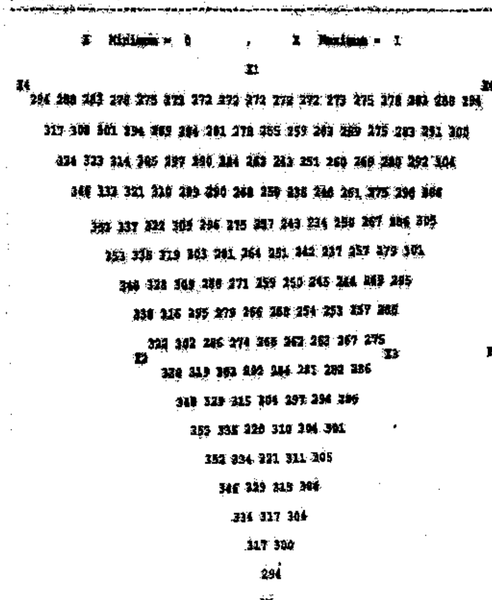

Fig. (4 a)

MAXIMUM VALUE TK = 23.4

OPTIMUM CONCENTRATION: (4.0 , 0.0 , 4.0 , 0.0)

distribution could be classified to non capillary pores or quickly drainable pores (>28.8u), coarse capillary or slowly drainable pores (28.8-0.19u) and fine capillary or water holding ones (>0.19u)

Data in Table 4 Fig 4 show the values of non-capillary pores or quickly drainable pores as affected by all the possible combination of the used amendments. The results reveal that the single treatment of FY, CH, TR and SS were 27.2, 32.2, 27.5 and 29.4 percent of total porosity respectively, these results suggested that FY gave the promotion effect comparing with the other used organic amendments, the order where FY < TR < SS < CH. Scanning the different values of Fig 4a could recognized other minimum of 23.4 this minimum corresponding to a combination consisting of 4:0:4:0 (of 8 point score) of FY, CH, TR and SS respectively. Suggesting that combination mixture of FY and TR at the ratio 1:1 resulted the minimum quickly drainable pores, which consider the optimal combination. Furthermore scanning the different values of Fig 4b indicates the number of 26.2 as a minimum one. This minimum corresponding to a combination of 1:3:3:1 (of 8 point score) of FY, CH, TR and SS respectively. However Fig 4c revel that the central point of tetrahedron has a quickly drainable pores 30.5 corresponding to treatment of 2:2:2:2 i.e. equivalent mixtures of the four used amendments. The obtained result pointed to the important of mixture application of FY with SS at 1:1 ratio.

Data in Table 4 Fig 5 show the values of coarse capillary or slowly drainable pores as affected by all the possible different combination of the used amendments. The results reveal that the single treatment of FY, CH, TR and SS were 3.54, 3.47, 4.72 and 3.25 percent of total porosity respectively, these results suggested that TR gave the promotion effect comparing with the other used organic amendments, the order where TR > FY > CH > SS. Scanning the different values of Fig 5a could recognized other maximum of 52.9 this maximum corresponding to a combination consisting of 0:3:5:0 (of 8 point score) of FY, CH, TR and SS respectively. Suggesting that combination mixture of CH and TR at the ratio 3:5 resulted the maximum slowly pores, which consider the optimal combination. Furthermore scanning the different values of Fig 5b indicates that their is no more maximum value .However Fig 5c revel that the central point of tetrahedron has a slowly pores equal 30.5

FIG.(5):
Computer output of pore size distribution percentage 9-25 MM as affected by PT CN, TR and SD.

FOUR COMBINATION EXPERIMENTAL RESULTS (FACULTY OF AGR. ZAGAZIG UNIV.)

NUMBER OF TREATMENTS = 19; NUMBER OF REPLICATES= 4

EXPERIMENTAL DATA AND (MEAN)

1.	3.82	3.58	3.66	3.08	(3.54)
2.	3.34	3.35	3.41	3.78	(3.47)
3.	4.40	4.86	4.50	5.12	(4.72)
4.	3.40	3.17	3.05	3.70	(3.35)
5.	2.75	3.37	3.50	2.58	(3.03)
6.	4.32	4.17	4.61	4.26	(4.34)
7.	2.19	3.83	3.34	3.94	(3.08)
8.	3.64	3.21	4.20	4.17	(3.95)
9.	4.96	5.31	5.06	5.49	(5.20)
10.	2.58	2.76	2.34	2.33	(2.50)
11.	3.88	4.30	3.79	3.91	(3.97)
12.	2.13	2.18	2.08	2.18	(2.12)
13.	4.10	4.25	3.71	3.74.	(3.95)
14.	3.73	3.88	3.23	3.35	(3.48)
15.	2.06	2.19	2.33	1.58	(2.04)
16.	2.23	2.22	2.30	2.46	(2.28)
17.	5.08	4.91	5.15	5.10	(5.06)
18.	4.65	4.83	4.80	4.76	(4.77)
19.	2.15	2.19	2.02	2.04	(2.10)

GENERAL MEAN = 3.615699
MEAN ERROR = .1349181
CORRELATION COEFFICIENT= .9649593
REGRESSION FISHER F(18 57)= 42.0247

QUALITY RESQUIRE TEST OF THE MODEL THROUGH THE LAST FOUR TREATMENTS

EXPERIMENTAL	TREATMENT	- TABULAR	=DIFFERENCE	PER.STUDENT
16	2.28 -	3.68 =	-1.40	-8.62
17	5.06 -	3.06 =	2.00	12.33
18	4.77 -	2.83 =	1.94	12.08
19	2.10 -	3.67 =	-1.57	-9.68

THE SIGNIFICANT RESQUIRE SECTOR OF THE SQUARE TEST FOR THE CALCULATED VALUE , MULTIPLY BY 100

X Minimum = 0 , X Maximum = 1

X1

X4 X4

325 351 374 388 399 395 388 375 364 376 388 385 395 388 374 363 325

290 326 353 374 389 396 396 390 387 345 362 372 375 371 361 344

268 301 343 372 393 407 418 366 303 374 358 361 369 366 361

253 302 344 388 408 438 399 355 397 387 361 367 376 373

250 300 356 398 434 422 397 359 305 336 365 366 397

266 329 370 428 436 429 409 374 327 363 382 415

277 348 431 438 456 449 433 404 362 431 434

307 384 430 461 476 482 472 446 410 453

347 431 461 497 520 525 524 506 479

X2 X3 Fig. (5a)

307 368 418 486 473 480 474 453

277 328 365 418 437 442 434

258 317 352 394 412 415

250 307 351 381 397

253 308 381 379

266 320 361

298 343

328

X4

MAXIMUM VALUE YM = 5. 29

OPTIMUM COMBINATION: (0.0 , 3.0 , 0.0 , 0.0)

X Minimum = .125 , X Maximum = .625

X1

X4 X4

206 215 222 220 212 220 222 216 206

236 285 268 273 326 237 281 289

278 303 324 335 351 366 376

321 365 354 330 332 305

396 403 398 378 343

X2 X3 Fig. (5b)

331 320 348 309

278 383 274

286 238

204

X4

X Minimum = .25 , X Maximum = .25

X1

X4 X4

303

X2 X3 Fig. (5c)

X4

FIG.(6):
Computer output of para size distribution > 0.19MM as affected by FYM,CH,YE x
SS.

FOUR COMBINATION EXPERIMENTAL RESULTS (FACULTY OF AGR. ZAGAZIG UNIV.)

NUMBER OF TREATMENTS = 19; NUMBER OF REPLICATES= 4

EXPERIMENTAL DATA AND (MEAN)

1.	9.13	9.16	9.16	9.15	(9.15)
2.	9.39	9.40	9.37	9.40	(9.39)
3.	9.46	9.48	9.49	9.42	(9.45)
4.	8.87	8.83	9.00	8.54	(8.66)
5.	8.24	8.22	8.24	8.21	(8.23)
6.	8.69	8.57	9.00	8.50	(8.69)
7.	14.42	14.37	14.47	14.71	(14.49)
8.	9.29	9.34	9.39	9.16	(9.30)
9.	10.91	11.06	10.85	10.73	(10.91)
10.	10.62	10.65	10.61	10.60	(10.62)
11.	8.09	7.96	7.90	8.48	(8.02)
12.	11.80	12.00	12.00	11.40	(11.80)
13.	9.20	9.16	9.26	9.18	(9.26)
14.	8.69	8.72	8.73	8.58	(8.69)
15.	8.41	8.47	8.42	8.40	(8.43)
16.	7.56	7.58	7.55	7.62	(7.56)
17.	8.28	8.25	8.30	8.30	(8.28)
18.	8.73	8.68	8.80	8.80	(8.83)
19.	8.57	8.59	8.55	8.50	(8.97)

GENERAL MEAN = 9.193108
MEAN ERROR = 8.8080513-02
CORRELATION COEFFICIENT= .9973297
EXPERTION FISHER F(18 57)= 550.5665

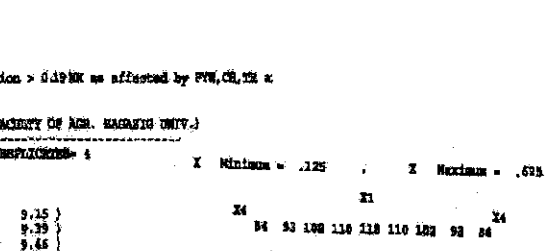

Fig. (6b)

REALITY ADEQUATE TEST ON THE MODEL THROUGH THE LAST FOUR TREATMENTS

EXPERIMENTAL TREATMENT	- TABULAR	=DIFFERENCE	RAT.STUDENT
16	7.56 - 11.44 =	-3.88	-58.71
17	8.28 - 10.08 =	-1.80	-25.76
18	8.83 - 10.79 =	-1.96	-28.09
19	8.57 - 9.52 =	-0.95	-13.61

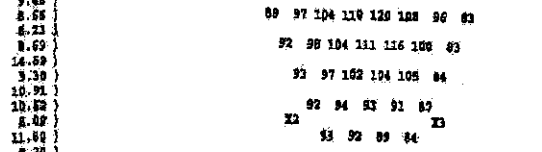

Fig. (6c)

THE SIGNIFICANT ADEQUATE SECTOR OF THE SQUARE TEST FOR THE CALCULATED VALUE
, MULTIPLY BY 10

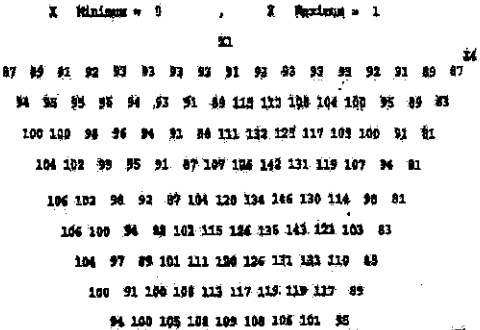

Fig. (6a)

MAXIMUM VALUE YR = 14.6

OPTIMUM COMBINATION: (4.0 , 8.0 , 4.0 , 8.0)

corresponding to treatment of 2:2:2:2 i.e. equivalent mixture of the four used amendments.

Regarding to the Fine capillary pores or water holding pores data in Table 4 Fig 6 show the values of fine capillary pores as affected by all the possible different combination of the used amendments. Results reveal that the single treatment of FY, CH, TR and SS were 91, 94, 95 and 87 respectively, these results suggested that TR gave the promotion effect comparing with the other used organic amendments, the order where TR > CH > FY > SS. Other wise scanning the different values of Fig 6a could recognized other maximum of 146 this maximum corresponding to a combination consisting of 4:0:4:0 (of 8 point score) of FY, CH, TR and SS respectively. Suggesting that combination mixture of FY and TR at the ratio 1:1 resulted the maximum fine pores, which consider the optimal combination. Furthermore scanning the different values of Fig 6b indicates that there is no more maximum value.

However Fig 6c revel that the central point of tetrahedron has a fine pores equal 82 corresponding to treatment of 2:2:2:2 i.e. equivalent mixture of the four used amendments.

These results suggested that the most effective combination to increase the water holding capacity of the sandy soil are a mixture FY and TR at the ratio of 1:1 these result confirmed with that obtained by El- Sersawy (1989) and El-Sersawy, *et al.* (1993) El-Hady, *et al.* and others .

Grain yield is one of the important character which considered the mean target of all the applied managements Table 4 show a highly significant correlation of wheat grain yield as affected by all the possible combination of farmyard manure, chicken manure, town refuse and sewage sludge r = (0.968). Data of Table 4 Fig 7 indicated that grain yield is ranged between 10.20and 5.68 ardab /feddan. However the located value of the four single treatments where 8.1, 8.0, 7.6 and 8.2 ardab /Fadden FY, CH, TR and SS respectively. These results suggested that SS gave the promotion effect comparing with the other used organic amendments, the order where SS < FY < CH < TR. These results could explain from the point of view that SS contained a high amount of organic substances, which supply plant with the macro and micronutrient needed by plant, compared with the other used material. Scanning the different values of Fig 7b shows the number

FIG.(8):
Computer output of wheat biological yield as affected by N1,N2,N3 and N4.

```
YOUR CORRELATION EXPERIMENTAL RESULTS (FACULT OF AGR. ZAGAZIG UNIV.)
-------------------------------------------------------------------
NUMBER OF TREATMENTS = 19, NUMBER OF REPLICATES= 4

EXPERIMENTAL DATA AND (MEAN)
-------------------------------------------------------------------
 1.    4.74    5.47    4.17    3.95  (  4.58 )
 2.    5.38    4.36    6.70    4.19  (  5.16 )
 3.    6.50    5.74    5.28    4.90  (  5.61 )
 4.    4.55    3.70    4.17    5.87  (  4.65 )
 5.    4.68    3.07    4.32    5.09  (  4.29 )
 6.    5.32    3.69    5.46    4.38  (  4.71 )
 7.    3.21    4.43    4.17    4.39  (  4.05 )
 8.    3.00    2.21    2.78    4.00  (  3.00 )
 9.    4.73    4.56    5.34    6.03  (  5.16 )
10.    4.07    4.26    4.04    3.28  (  3.89 )
11.    2.96    3.00    1.06    2.34  (  2.34 )
12.    3.55    4.70    3.94    3.54  (  3.93 )
13.    3.31    1.90    1.26    3.16  (  2.41 )
14.    2.95    2.20    2.00    2.76  (  2.46 )
15.    3.50    2.56    3.00    4.08  (  3.26 )
16.    3.77    4.42    3.08    3.70  (  3.74 )
17.    4.45    3.80    4.50    3.98  (  3.98 )
18.    2.39    2.85    1.90    1.39  (  2.13 )
19.    2.90    4.63    3.71    2.57  (  3.45 )

GENERAL MEAN  = 3.831842
MEAN ERROR    = .3269574
CORRELATION COEFFICIENT= .8344896
REGRESION FIGURE  F( 18 57 )= 7.497856

REALITY ADEQUATE TEST OF THE MODEL THROUGH THE LAST FOUR TREATMENTS
-------------------------------------------------------------------
EXPERIMENTAL TREATMENT - TABULAR -DIFFERENCE  ERR.STUDENT
  16      3.74 -   3.23 =   0.52        1.32
  17      3.98 -   3.94 =   1.03        2.60
  18      2.13 -   2.37 =  -0.24       -0.61
  19      3.45 -   3.42 =   1.03        2.64

THE SIGNIFICANT ADEQUATE SECTOR OF THE SQUARE TEST FOR THE CALCULATED VALUE
, MULTIPLY BY   100
-------------------------------------------------------------------
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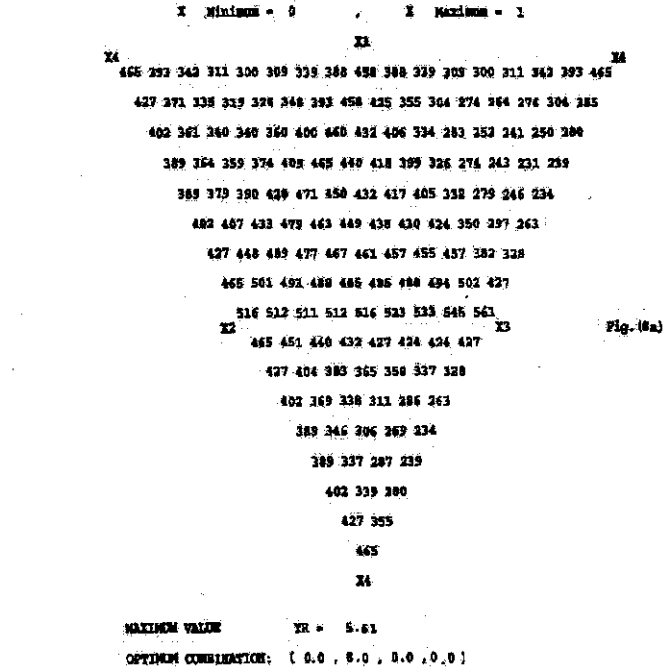

Fig.(8a)

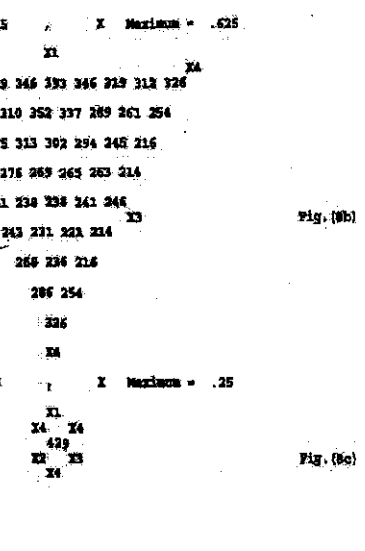

Fig.(8b)

Fig.(8c)

```
MAXIMUM VALUE          YR =  5.61
OPTIMUM COMBINATION:  [ 0.0 , 0.0 , 0.0 ,0.0 ]
```

i.(9): Computer output of wheat straw yield as affected by FY,CH,TH and SH.
OUR COMBINATION EXPERIMENTAL RESULTS (FACULTY OF AGR. ZARIA/ABU.)

NUMBER OF TREATMENTS = 19; NUMBER OF REPLICATES= 4

EXPERIMENTAL DATA AND (MEAN)

1.	14.51	17.07	15.97	14.95	(15.63)
2.	18.53	11.46	18.70	15.29	(16.00)
3.	17.17	18.46	15.06	15.60	(16.56)
4.	14.65	13.28	14.87	16.27	(14.77)
5.	12.20	12.06	16.12	15.09	(13.37)
6.	15.62	13.65	15.61	14.28	(15.04)
7.	14.65	16.23	14.17	15.08	(15.63)
8.	11.26	11.98	10.28	12.20	(11.43)
9.	13.57	13.16	17.62	18.23	(15.65)
0.	12.32	13.70	12.65	11.60	(12.62)
1.	11.46	12.00	12.23	12.84	(12.13)
2.	15.44	16.23	14.10	11.54	(14.33)
3.	12.51	12.73	15.25	11.34	(12.96)
4.	12.44	9.48	10.72	9.84	(10.60)
5.	11.07	11.48	13.74	13.80	(12.46)
6.	11.27	16.39	11.13	13.46	(13.31)
7.	17.98	13.94	14.67	16.36	(15.49)
8.	11.45	11.49	9.78	10.67	(10.85)
9.	10.57	15.97	16.05	10.97	(13.39)

GENERAL MEAN = 13.70711
ERR ERROR = .7589973
CORRELATION COEFFICIENT= .7603164
REGRESSION FISHER F(18 57)= 4.338728

REALITY ADEQUATE TEST OF THE MODEL THROUGH THE LAST FOUR TREATMENTS

EXPERIMENTAL TREATMENT	- TABULAR	=DIFFERENCE	ERR.STUDENT
16	12.31 - 13.22 =	-0.90	-0.99
17	15.48 - 12.28 =	3.26	3.56
18	10.85 - 11.45 =	-0.60	-0.66
19	13.39 - 11.50 =	1.89	2.07

THE SIGNIFICANT ADEQUATE SECTOR OF THE SQUARE TEST FOR THE CALCULATED VALUE
MULTIPLY BY 10

X Minimum = .125 , X Maximum = .525

X1

X4 X4

124 122 126 131 143 131 126 122 124

120 122 138 139 132 121 115 113

130 125 135 126 122 112 106

123 132 125 119 113 104

130 122 116 111 106

X2 X3

123 116 109 104

120 112 106

120 113

126

X4

Fig. (9b)

X Minimum = .25 , X Maximum = .25

X1

X4 X4

134

X2 X3

X4

Fig. (9c)

X Minimum = 0 , X Maximum = 1

X1

X4 X4

148 132 122 116 114 117 125 136 155 134 129 137 114 115 122 132 146

137 125 118 116 119 125 136 153 152 136 124 116 114 116 123 134

130 122 118 119 125 136 151 150 150 134 123 117 115 118 126

126 122 122 127 136 150 149 149 150 135 124 119 118 121

126 125 129 137 150 149 149 149 150 136 126 122 121

129 132 139 151 150 149 150 151 152 139 130 126

136 142 153 152 151 151 152 153 156 143 135

146 156 154 153 153 154 155 157 160 148

160 158 157 156 156 158 160 162 166

X2 X3

146 144 143 142 142 144 145 148

136 134 132 132 132 133 135

129 127 126 125 125 126

126 124 122 121 121

126 124 122 121

130 127 126

137 134

148

X4

Fig. (9a)

MAXIMUM VALUE YH = 16.9

OPTIMUM COMBINATION: (8.0 , 8.0 , 8.0 , 8.0)

102 as a general maximum, this maximum corresponding to an interpolated four combined treatments consisting of 1 : 5 : 1 : 1 (of the 8 points score) of FY, CH, TR, SS respectively.

This result suggested that combination effect of FY: CH: TR: SS at the rate 1.2: 0.66:1.5: 2.5 ton/Fadden respectively, resulted the highest grain yield ardab /Fadden. However Fig 7c indicated that the central point of the tetrahedron has a grain yield equal 8.3 ardab/ Fadden corresponding to treatment consist of 2 : 2 : 2 : 2 i.e. equivalent mixture of the four used amendments. However soil organic matter is vital to the sustainable use not only for sandy soil but even to all the other kind of soil in general ,in this respect it should clarify that the grain yield of the (blank) treatment is equal to 6.94 ardab/feddan. This evidence the role of organic matter on grain yield. Abdel-Samad and Eid (1995) reported that most of the yield parameter were improved by increasing the rate of different organic matter resources. Fanous and Mikhail (1997) stated that the addition of Belarusian peat, town refuse combined with NPK fertilizers resulted in an increase in wheat grain yield reaching about 45:56 %.Tahoun *et al.* (2000) summarized the effect of organic matter in soil as improving soil tilth. Many scientists working with organic matter came to the same conclusion.

Regarding to wheat biological yield, data in Table 4 Fig 8 show wheat biological yield gram/pot as affected by all the possible different combination of the used amendments. The results reveal that the single treatment of FY, CH, TR and SS were 15.53, 16.00, 16.58 and 14.77 respectively, these results suggested that CH gave the promotion effect comparing with the other used organic amendments, the order where CH > FY > TR > SS. Furthermore scanning the different values of Fig 8b it could not recognized any other maximum, which mean that CH single treatment (1.07 ton/ feddan) were the most suitable variant to maintaining wheat plant with the soil optimal condition which are strong correlated with biological yield i.e. (straw + grain) ,in this context it could be stated that a significant correlation coefficient of 0.996 were detected. However Fig 8c revel that the central point of tetrahedron has a biological yield equal 13.4 gram / pot corresponding to treatment of 2 : 2 : 2 : 2 i.e. equivalent mixture of the four used amendments. These results agree with those of khadr, *et al.* (1988), Abdel –Magid, *et al.* (1995), Abdel–Samad and Eid (1995) and Fanous and Mikhail

(1997) and others .Furthermore, it could be stated that the blank treatment obtained a biological yield equal to 9.99 gram / pot emphasizing the role of organic material in sandy soil.

Data in Table 4 Fig 9 show wheat straw yield gram/pot as affected by all the possible different combination of the used amendments. The results reveal that the single treatment of FY, CH, TR and SS were 4.58, 5.16, 5.61 and 4.65 respectively, these results suggested that TR gave the promotion effect comparing with the other used organic amendments, the order where TR > CH > SS > FY. Furthermore scanning the different values of Fig 9b it could not recognized any other maximum, which mean that TR single treatment (12.00 ton/ feddan) were the most suitable variant to maintaining wheat straw yield . Nerveless it could be detected not high significant correlation coefficient of 0.712 in this situation. However Fig 9c revel that the central point of tetrahedron has a straw yield equal 4.29 gram/pot corresponding to treatment of 2: 2: 2: 2 i.e. equivalent mixture of the four used amendments. Furthermore, it could be stated that the blank treatment obtained straw yield equal to 3.50 gram / pot.

In conclusion, the obtained results generally show that treating sandy soil with using different clear that TR plays the promotion role either single or combined with other used amendments. This found could explained based on, the amount of applied material and cost price of it. As it was decided from the beginning that the cost will be equal 300LE feddan for any single or combined treatment, whereas the amount were different. The amount of FY or CH or TR or SS as a single treatments were 9.60 or 1.07 or 12.00 or 20.00 respectively amendments results in desirable modifications in both soil structure and hydro physical properties, which is considered a vital important target for sandy soil cultivation. Generally from all the results mention before, it is quiet .

However results suggested that it is better to used a hug amount of 12.00 ton /feddan of TR comparing with little used amount of 9.60 or1.07 ton/ feddan FY or CH respectively.

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تأثير بعض محسنات التربة العضوية علي إنتاجية الاراضي الرملية

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استخدم موديل الحاسب العلمي ذو الاربعة عوامل لدراسة تاثير عدد من التوليفات لمحسنات التربة العضوية (السماد البلدي ، سماد الدواجن، قمامة المدن و الحماة) علي انتاجية الاراضي الرملية مع زراعة القمح" سخا ٩٣" كدليل لبعض صفات التربة الكيماوية والطبيعية من خلال تجربة أصص لأرض رملية حديثة الاستصلاح (ارض الخطارة) وتم عمل ١٩ معاملة كل منها مكرر ٤ مرات وادخلت النتائج تحت الدراسة لتظهر ٢٤٩ نتيجة علي السطح وداخل هرم رباعي الاوجة متساوي الاضلاع كل راس من رووسة الاربعة تمثل التركيز الاعلي من احد العوامل تحت الدراسة وينخفض ذلك التركيز تدريجيا حتي يصل الي الصفر اعلي القاعدة المقابلة للراس ونتيجة لذلك تنشا شبكة من التقاطعات علي سطح الهرم وداخل جسم الهرم نفسة و كل منها تمثل توليفة من العوامل الاربع تحت الدراسة و تكلفة اى منها ٣٠٠ جنيها مصريا للفدان.

وقد أظهرت النتائج أن أعلي محصول لحبوب القمح نتج من المعاملة المستخدم فيها (٢,٥:١,٥:٠,٦٦:١,٢) طن/ فدان من السماد البلدي ، سماد الدواجن، سماد القمامة والحماة علي التوالي بينما امكن الحصول علي افضل نتيجة لكل من للكثافة الظاهرية و المحتوى العضوى والمسام الشعرية من المعاملة المستخدم فيها (١٠,٠٠:٣,٠٠:٠,١٣:١,٢٠) و(٢,٥:١,٥:٠,١٣:٦٠) و(٤,٨:٠:٠,٦: ٠) طن /فدان من السماد البلدي ، سماد الدواجن، سماد القمامة والحماة علي التوالي.