SIGNIFICANCE OF NO- AND CONVENTIONAL TILLAGE IN COMBINATION WITH SOME LOCAL NATURAL AMENDMENTS AS RELATED TO SOIL PHYSICO-CHEMICAL PROPERTIES AND WHEAT PRODUCTIVTY IRRIGATED WITH LOW QAULITY WATER

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ABSTRACT:

A field experiment was conducted at Tamaya district, El-Fayoum Governorate, Egypt during two successive to seasons of 2008-2009/2009-2010 to evaluate the effect of either no- or conventional tillage practices as solely treatments or applied mineral N and P fertilizers alone or conjunction with some local natural amendments, *i.e.*, gypsum, farmyard manure and filter mud for ameliorating some soil properties, *i.e.*, organic matter content, pH, infiltration rate and moisture retention as well as grain yield of wheat (*Triticum aestivum* L., Sakha 69 cv.) plants as a next crop after rice (*Oryza sativa* L., Giza 176 cv.) and irrigated with a low quality of irrigation water.

The obtained results showed that in case of no-tillage, the rice plant residues of 10 cm height were left, and in turn caused an increase in each of soil organic matter content and infiltration rate vs a parallel decrease in soil pH value. The corresponding increase of soil organic matter content at the end of experiment reached 0.519 %, as a mean value for no-tillage vs 0.455 % in case of the conventional tillage in soil depth of 0-15 cm. Such pronounced increase in soil organic matter content positively reflected on wheat grain yield. Moreover, the grain yield was maximized with increasing the applied doses of N and P fertilizers. These increases achieved an usefulness at no-tillage practice as compared to the conventional one during the first season of 2008-2009, while an opposite trend was occurred at the next season of 2009-2010.

Practically, 32.44 cm irrigation water was used per year in case of no-tillage practice vs 39.66 cm in case of the conventional one, with superiority for no-tillage that could be saved 7.22 cm of irrigation water. Finally, the results emphasized the necessity of using 120 kg N + 25 kg P_2O_5/ha as fertilizer doses with farmyard manure or filter mud or gypsum under no-tillage practice for improving soil organic matter content and sustaining wheat-rice cropping sequence under the prevailing conditions of using low quality of irrigation water.

Key words: Soil organic matter, infiltration rate, soil pH, no-tillage, conventional tillage, rice-wheat cropping sequence, low quality water.

INTRODUCTION:

Despite its negative environmental impact, the rice wheat rotation is a popular and profit making cropping system for farmers of Tamaya-Fayoum. Rice (*Oryza sativa* L.)-wheat (*Triticum aestivum* L.) cropping sequence is also grown on soils irrigated with sodic waters are excessively poor in organic matter, soil fertility and physical properties, and then produce little biomass.

Conservation tillage can improve soil properties such as improving organic matter content, soil aggregation and lack of generation **(Taodor, 2005)**, however, crop response to conservation tillage can be widely variable. **Griffith *et al.* (1992)** showed an increase in organic matter with no tillage. The increase in organic matter was largest near the surface, while decreased with increasing the depth.

It is, therefore, essential that an alternative tillage option to augment their organic matter be evaluated **(Teador, 2005)**. The zero-tillage or minimum tillage coupled with residual effects of integrated use of organic manures and chemical fertilizers practices is likely to boor soil fertility and organic matter status of such soil. The practice of zero-tillage is picking up as an energy saving and economical preposition in the fertile alluvial belt of normal soil in Egypt in areas planted with long duration basmati rice with often results in to delayed wheat sowing.

Long-term no-tillage or reduced tillage systems have shown to increase soil organic matter content of the soil surface layer as a result of various interacting factors, such as increase residue return, less mixing and soil disturbance, higher soil moisture content, reduced surface soil temperature, proliferation of root growth and biological activity, and decreased risks of soil erosion **(Pankhurst *et al*., 2002 and Bdevins and Frie, 1993)**.

In temperate regions, the no- tillage concept of soil management has been adopted with some success. The beneficial role of zero-tillage on wheat yield has been widely reported by **Aslam *et al.* (1993), Malik *et al.* (2002), Sing *et al.* (2002) and Hobbs and Gupta (2003)**. Studies by **Bhagat and Acharya (1988) and Bhagat and Verma (1991)** also reported that incorporation of plant residues, coupled with appropriate tillage, increase soil organic matter and if used as mulch, modifies soil temperature. Similarly the beneficial effect of residue mulch with minimum tillage for improving soil properties and sustaining maize-wheat cropping system were also reported by **Ghuman and Sur (2001)**. **Malik *et al.* (2002) and Singh *et al*. (2002)** reported that zero-tillage produced higher average yield of wheat in comparison to produced by conventional tillage. Although much is known about the changes in soil properties to soil tillage, relatively little information is available on changes the tillage operation brings in chemical and physical properties of reclaimed sodic soil under sodic water irrigation. These data are in harmony with those obtained by **El-Magraby (2001) and Ali *et al.* (2004)**.

The major objective of this study was at identifying the effects of tillage, crop residue and residual effect of organic on some soil properties and grain yields of rice-wheat cropping sequence grown on a sandy clay loam soil irrigated with low quality water.

MATERIAS AND METHODS:

a. Experimental sit:

A field experiment was conducted on a sandy clay loam soil at Tamaya, El-Fayoum Governorate and Egypt. Some physico-chemical properties and available nutrient status of the experimental soil, which were determined according to the described standard methods after **Black *et al.* (1965), *Page et al.* (1982) and Klut (1986),** are presented in Table (1).

Table (1): Some physio-chemical and fertility characteristics of the studied soil.

Soil characteristics	Value	Soil characteristics.	Value
Particle size distribution %		ESP	16.76
Coarse sand	32.1	ECe in dS m^{-1} (*Soil paste extract*):	4.25
Fine sand	20.3	*Soluble ions in soil paste extract(m molc L^{-1}):*	
Silt	25.1	Ca^{++}	6.36
Clay	22.5	Mg^{++}	9.14
Soil texture class	SCL*	Na^{+}	26.65
$CaCO_3$ %	8.20	K^{+}	0.35
Gypsum %	1.74	CO_3^{--}	0.00
Organic matter %	0.36	HCO_3^{-}	7.85
pH (1:2.5 soil water suspension)	8.24	Cl^{-}	28.90
		SO_4^{--}	5.75

Some available macro and micronutrients (mg/kg soil)			
N	P	K	Zn
44.85	5.32	214.20	0.42

*SCL=Sandy clay loam

b. Tillage experimental:

Experiment was laid out as a randomized complete block in a split plot treatment arrangement with three replicates. The plot treatments were 1) no-tillage with rice residues of 10 cm height for crop left on the surface and 2) conventional tillage without rice residues. The sub plot treatments included nine combinations of mineral N & P fertilizers, organic farmyard manure (FYM), filter mud (FM) and gypsum (G), *i.e.*, control of untreated soil, 75% N&P as recommended doses of (84.6 kg N + 18.7 P_2O_5 kg/ha), 100% N&P recommended doses of (115.2 kg N + 25.0 P_2O_5 kg/ha), 75% N&P recommended doses + gypsum (5 ton/ha), 75% N&P recommended doses + filter mud (4 ton/ha), 75% N&P recommended doses + farmyard manure (10 ton/ha), 100% N&P recommended doses + gypsum (5 ton/ha), 100% N&P recommended doses + FM (10 ton/ha) and 100% N&P recommended doses + FYM (10 ton/ha). Some chemical characteristics of both farmyard manure and filter mud are shown in Table (2).

Table (2): Some chemical characteristics of the used farmyard manure and filter mud.

Organic matter%	Total C	Total N	C/N ratio	Macronutrient %		Available micronutrients (mg kg^{-1})		
				P	K	Fe	Mn	Zn
Farmyard manure								
52.8	20.56	1.29	15.93	0.78	1.80	714	385	92
Filter mud								
57.27	33.21	2.35	14.13	0.85	2.59	539	218	86

However, the use of gypsum as soil amendment is commonly recommended to offset the deteriorating effects of sodic irrigation water. The farmyard as an organic manure and filter mud as an industrial waste of sugar are also in practice. The inorganic N&P fertilizers and organics were applied to rice crop as pre-treatments.

Thirty days old seedlings of rice (Giza 176 cv.) were transplanted in standing water (5 cm depth) at spacing of 20 cm between rows and 15 cm between plants. A basal application of 38.6 kg N/ha as ammonium sulfate and 25 kg P_2O_5/ha as a single superphosphate were applied at the time of rice transplanting and remaining dose of nitrogen (40 kg N as ammonium sulfate) was top-dressed in two equal splits at 21 and 40 days after rice transplanting. The crop was irrigated with a sodic water of the Nile-drainage water mixture as well as with El-Bats drain as when required. The analysis of irrigation water is presented in Table (3). The cultural practices of rice crop were similar under both the tillage systems up till harvest stage.

Table (3). Chemical characteristics of the used sodic irrigation water.

Water pH	ECiw, dS/m	Soluble ions (mmolc L^{-1})							SAR	RSC
		Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{2-}		
8.98	2.50	2.50	1.50	20.85	0.15	6.00	10.80	8.20	14.78	2.00

In case of no-tillage treatment, wheat (Sakha 69 cv.) was sown in second week of November with the zero-tillage machine in the presence of standing stubble of rice crop. In case of the conventional treatment, sowing wheat was done in trenches with manual plough after preparing the field through three disking by power tiller. A basal application of 40 kg N/ha as urea and 25 kg P_2O_5/ha as single superphosphate was applied at the time of wheat sowing and remaining dose of nitrogen (80 kg/ha as urea) was top-dressed in two equal splits at 21 and 40 days after wheat sowing as pre-treatments. Gypsum, filter mud and farmyard manure were also applied to the wheat crop. Wheat crop was harvested in April. Yields of both grain and straw were recorded on air-dry basis (air temperature up to 35 ^{o}C).

c. Soil and water determinations:

Soil samples at a depth of 0-15 cm were taken before starting the experiment in 2008 and after the harvest of wheat in the first and second seasons of 2009 and 2010, respectively. The soil samples were air dried and grinded to pass through a 2 mm sieve, and then were subjected to determine soil pH in 1:2.5 soil water suspension using glass electrode. Soil organic matter content was determined by the method after **Walkly and Black (1934)**. Available N was determined by $KMNO_4$-oxidizable N **(Subbiah and Asija, 1956)**. **A**vailable P was determined by Olsen method **(Olsen *et al*., 1954)**. Available K was extracted with 1 N ammonium acetate (NH_4OAC) solution at pH 7.0 **(Jackson, 1967)** and measured by Flame Photometer. Infiltration rate was measured by Infiltrometer method **(Bouwer, 1986)**. Irrigation water was also determined for various parameters using analytical procedures outlines by **(Richards, 1954)**.

d. Statistical analysis:

The obtained data were analyzed by using the standard analysis of variance by MSTAT.

RESULTS AND DISCUSSION:

a. Soil organic matter content:

Soil organic matter content increased significantly in case of no-tillage at a depth of 0-15 cm soil as compared to the conventional tillage (Table 4).

Table (4): Effect of tillage practices and local natural amendments on soil organic matter content after wheat harvest.

Treatments	Soil organic matter content %			
	2008-2009		2009-2010	
	Conventional tillage	No-tillage	Conventional tillage	No-tillage
Control	0.364	0.395	0.361	0.401
75% N&P	0.378	0.454	0.380	0.449
100% N&P	0.401	0.437	0.409	0.468
75% N&P + gypsum	0.389	0.444	0.411	0.475
75% N&P + filter mud	0.392	0.493	0.432	0.526
75% N&P + farmyard manure	0.402	0.559	0.533	0.571
100% N&P + gypsum	0.497	0.542	0.494	0.549
100% N&P + filter mud	0.507	0.572	0.542	0.612
100% N&P + farmyard manure	0.497	0.581	0.530	0.624
Mean	0.425	0.497	0.455	0.519
L.S.D. at 0.05				
Tillage (A)	0.014		0.011	
Treatment (B)	0.018		0.020	
A x B	0.026		0.028	

The differences were usefulness during the growing season of 2008/2009 than the subsequent one of 2009/2010. The mean values of soil organic matter increased to 0.497 % in case of no-tillage treatment as compared with that 0.425 % in case of the conventional one during 2008/2009, and then it increased to 0.519 % in case of no-tillage as compared with that 0455 % in the conventional one during 2009/2010.

Soil organic matter tended to improve in case of no-tillage treatment, which was also associated with an increase in grain yield. The soil organic matter increased with increasing the period of no-tillage practice. These results are in harmony with those obtained by **Malik *et al.* (2002)** who reported that organic matter increased in the soil with no-tillage practice. **Curtin *et al.* (2000)** pointed out that lower CO_2 fluxes under no-tillage than conventional one were more attributed to slower decomposition crop residues placed on soil surface of no-tillage than when they were incorporated. **Karlen *et al.* (1994)** found that under no-tillage, organic matter increased more as compared to mould board and chisel plow.

Generally, in case of no-tillage, soil organic matter content recorded the highest value (0.581 and 0.624 %) during the growing seasons of 2008/2009 and 2009/2010, consequently under the treatment of (100% N&P + FYM). In case of the conventional treatment, the corresponding soil organic matter content recorded usefulness values of 0.495, 0.507 and 0.530 %. On the other hand, soil organic matter content had the greatest values of 0.507 and 0.542 under the treatment of (100% N&P + filter mud) during the growing seasons of 2008/2009 and 2009/2010, respectively.

b. Soil pH:

The soil pH of a depth 0-15 cm soil layer remained at a slightly lower in case of no-tillage treatment than the conventional one, but the difference was statistically insignificant (Table 5). The tillage practices induced a reduction in the soil pH in most treatments. There was a slight decrease in soil pH from initial value of 8.20 in a season of 2008-2009 to 8.15 in 2009-2010 under 100% N&P treatment. Generally, under no-tillage soil pH value recorded the lowest values of 8.15 and 8.16 under (75% N&P + gypsum and 75% N&P + filter mud) and (100% N&P + gypsum and 100% N&P + filter mud), respectively, consequently the same results were obtained in case of conventional tillage.

Table (5): Effect of tillage practices and local natural amendments on soil pH after wheat harvest.

Treatments	Soil pH			
	2008-2009		2009-2010	
	Conventional tillage	No-tillage	Conventional tillage	No-tillage
Control	8.20	8.20	8.23	8.20
75% N&P	8.21	8.20	8.23	8.21
100% N&P	8.21	8.20	8.15	8.21
75% N&P + gypsum	8.17	8.15	8.16	8.15
75% N&P + filter mud	8.17	8.16	8.17	8.15
75% N&P + farmyard manure	8.18	8.17	8.17	8.17
100% N&P + gypsum	8.16	8.15	8.17	8.16
100% N&P + filter mud	8.17	8.15	8.18	8.16
100% N&P + farmyard manure	8.17	8.16	8.17	8.17
L.S.D. at 0.05				
Tillage (A)	n.s.		n.s.	
Treatment (B)	n.s.		0.02	
A x B	n.s.		n.s.	

c. Water intake:

The no-tillage treatment was maintained at a higher infiltration rate than the conventional one under all the applied mineral fertilizer/organic treatments. The magnitude of difference was greater in treatments with organic or gypsum as compared to N&P fertilizers alone (Table 6), which it was recorded the greatest value under using (100% N&P + filter mud) flowed by (100% N&P + gypsum) in both no- and conventional tillage practices, but it had 1.65 cm/h in case of no-tillage as compared with 1.46 cm/h in the conventional one. A higher water infiltration rate in case of no-tillage treatment could be due to the crop residues that were incorporated in this treatment. **Malik *et al.* (2000)** also reported that a higher infiltration rate was associated with no-tillage practice. In this connection, **Bruce *et al.* (1992)** reported that higher infiltration rate could be due to decomposition of crop residues. On the other hand, **Allmaras *et al.* (1996)** emphasized this phenomenon to the formation of water stable aggregates that could lead to increased soil infiltration rate.

Table (6): Effect of tillage practices and local natural amendments on soil infiltration rate at the end of rice-wheat cropping sequence.

Treatments	Soil infiltration rate (cm/h)	
	Conventional tillage	No-tillage
Control	0.68	0.70
75% N&P	0.76	0.78
100% N&P	0.79	0.87
75% N&P + gypsum	1.20	1.40
75% N&P + filter mud	1.28	1.40
75% N&P + farmyard manure	1.20	1.37
100% N&P + gypsum	1.48	1.60
100% N&P + filter mud	1.46	1.65
100% N&P + farmyard manure	1.40	1.58
L.S.D. at 0.05	0.019	

d. Water saving:

A total of five irrigations were given each year during wheat growing period (November to April). The average water applied in two years for the applied irrigation, *i.e.*, 1st, 2nd, 3rd, 4th and 5th were 9.88, 7.44, 7.51, 7.40 and 7.43 cm in case of conventional tillage treatment and 7.44, 6.20, 6.30, 6.18 and 6.32 cm in no-tillage treatment, respectively. Thus, the total irrigation water in the conventional tillage was 39.66 cm or 3966 m^3/ha, which was more than applied in case of no-tillage (32.44 cm or 3244 m^3/ha). Hence, no-tillage practices saved 7.22 cm or 722 m^3/ha of irrigation water, which equal 22.30% from the amount of irrigation water. **Malik *et al.* (2000)** reported that zero-tillage is more effective in increasing the efficiency of irrigation water, especially at the time of first irrigation.

e. Grain yield:

Grain yields of the two successfully harvested crops strongly reflected the pattern of tillage practice during the grown crop periods. The mean wheat grain yield of 6.37 ton/ha was slightly lower in no-tillage treatment as compared with yield of 6.48 ton/ha in the conventional treatment in growing season 2008-2009 (Table 7). After that, the mean grain yield of wheat was higher in no-tillage (7.03 ton/ha) as compared to that of the conventional treatment (6.61 ton/ha) in 2009-2010. However, where no crop residues were kept at the soil surface under the conventional tillage, and in turn grain yield consistently remained lower than that in no-tillage treatment during the season of 2009-2010. **Aslam *et al.* (1993)** observed that a higher yield obtained with zero-tillage was due to earlier planting. Also, **Waitrak (2004)** observed that the yield of wheat was not influenced by tillage practice. No statistically significant ($p>0.05$) interaction between tillage practice and fertilizer application was observed for grain yield of wheat during the two successive growing seasons. On the other hand, the treatment of (100% N&P + farmyard manure) was recorded the greatest wheat grain yield flowed by (100% N&P + gypsum) under no-tillage and conventional one, respectively.

f. Nutrients uptake:

The mean N, P, K and Zn uptake was slightly greater in the case of no-tillage treatment, however, their contents showed insignificant differences as compared with the conventional one. **Gillian and Hogt (1987)** also noted that crop N uptake in case of no-tillage was not different than observed for the conventional one.

Table (7): Effect of tillage practices and local natural amendments on grain yield of wheat.

Treatments	Wheat grain yield (ton/ha)			
	2008-2009		2009-2010	
	Conventional tillage	No-tillage	Conventional tillage	No-tillage
Control	1.52	1.57	1.67	1.82
75% N&P	5.40	5.32	4.72	5.50
100% N&P	6.85	6.55	6.67	6.97
75% N&P + gypsum	5.85	5.67	6.52	6.65
75% N&P + filter mud	5.85	5.65	6.22	6.72
75% N&P + farmyard manure	5.90	5.85	6.37	6.67
100% N&P + gypsum	7.42	7.15	7.55	7.90
100% N&P + filter mud	7.15	6.97	7.30	7.92
100% N&P + farmyard manure	7.45	7.8	7.57	7.95
Mean	6.48	6.37	6.61	7.03
L.S.D. at 0.05				
Tillage (A)	n.s.		n.s.	
Treatment (B)	0.254		0.255	
A x B	n.s.		n.s.	

Also, **Soon *et al.* (2001)** noted that the nutrients uptake was greater under no-tillage practice than the conventional one due to greater crop utilization of soil N under the first practice than the second one. The uptake of the studied nutrients in this experiment was significantly higher with application of (120 kg N and 25 kg P_2O_5/ha) when used in the previous crop having the treatments of gypsum at 5 ton/ha or filter mud at 10 ton/ha or farmyard manure at 10 ton/ha than involving (120 kg N and 25 kg P_2O_5/ha) alone (Table 8).

Table (8): Effect of tillage practices and local natural amendments on nutrients uptake by wheat (as mean values for the growing seasons).

Treatments	Nutrients uptake (kg/ha)							
	N		P		K		Zn	
	CT	NT	CT	NT	CT	NT	CT	NT
Control	21.68	14.24	3.76	3.92	29.6	31.2	0.073	0.820
75% N&P	58.80	59.28	8.56	8.80	61.6	68.0	0.132	0.133
100% N&P	70.32	62.96	12.08	12.56	79.2	80.0	0.146	0.152
75% N&P+gypsum	63.28	56.32	9.92	10.24	80.8	82.4	0.132	0.144
75% N&P+filter mud	64.08	56.72	10.56	10.80	82.4	84.0	0.145	0.148
75% N&P+farmyard manure	66.96	60.16	10.72	11.04	84.8	84.8	0.163	0.168
100% N&P+gypsum	82.32	84.40	14.32	14.40	96.8	97.6	0.185	0.184
100% N&P+filter mud	82.40	83.76	14.88	15.20	102.4	105.6	0.194	0.201
100% N&P+farmyard manure	85.44	87.68	14.80	15.60	100.8	102.4	0.201	0.203
Mean	71.69	68.90	11.97	12.32	86.08	88.08	0.161	0.165
L.S.D. at 0.05								
Tillage (A)	n.s.		n.s.		n.s.		n.s.	
Treatment (B)	5.620		1.168		5.880		0.011	
A x B	n.s.		n.s.		n.s.		n.s.	

Conclusion:

The results of this research showed that no-tillage practice in comparison with the conventional tillage caused an increase in soil organic matter and infiltration rate. This practice also decreased soil pH value. The no-tillage practice either alone or with the residual effect of gypsum or filter mud or farmyard manure is an effective option to sustain higher yields of wheat under use of low quality irrigation water in a rice-wheat cropping sequence. Besides, no-tillage practice saved about 722 m^3/ha of irrigation water and also saved two disking and planking operations.

REFERENCES:

Abou Yuossef, M.; Ali, M.H. and El-Kot, A.S. (2007). Evaluation of sugar can filter mud as a soil conditioner under irrigation with saline water .Annals. of Agric. Sci. Moshtohor, 45 (1): 469-487.

Ali, M.H.; Ali, A.A. and Alaga, M.D. (2004). Interaction effect between tillage depth and soil conditioners on calcareous soil productivity under irrigation with saline water. Egypt. J. Appl.Sci., 19 (3): 399-414.

Allmaras, R.R.; Pikul, Jr.; Douglas, J.L and Rickman, R.W. (1996). Temporal character of surface seal/crust: influence of tillage and crop residues. In: A.(Eds.) Real World Infiltration. Colorado water Resources Research Institute Information Series 86, Fort Collins, CO, 171-188 pp.

Aslam, M.; Majid, M.; Hashmi, A.N. and Hobbs, I.P.R. (1993). Improving wheat yield in the rice wheat cropping system of the Punjab through zero tillage. Pakistan J. Agric. Res., 14: 8-11.

Bhagat, R.M. and Acharya, C.L. (1988). Soil water dynamics during wheat growth under different soil management practices. J. Indian Soc. Soil Sci., 36: 389-396.

Bhagat, R.M. and Verma, T.S. (1991). Impact of rice straw management on soil physical properties and wheat yield. Soil Sci.,152: 108-115.

Black, C.A.; D.D. Evans; L.E. Ensminger; J.L. White and F.E. Clark (1965). Methods of Soil Analysis. Am. Soc. of Agron. Inc., Madison, Wisconsin, USA.

Blevins, R.L. and Frie, W.W. (1993). Conservation tillage: An ecological approach to soil management. Advance in Agronomy, 51: 33-78.

Bouwer, H. (1986). Intake rate: cylindrical infiltrometer. In: Klute, A. (Ed), Method of Soil Analysis. Part 1. Agronomy 9. ASA, Madison, WI, 825-887.

Curtin, D.; Wang, H.H.; Selles, F. and Campbell, C.A. (2000). Tillage effects on carbon fluxes in continuous wheat and fallow- wheat rotation. Soil Sci. Soc. Am. J., 64: 2080-2086.

El-Maghraby, S.E. (2001). Influence of tillage depth and organic residue placement on calcareous soil productivity under irrigation frequencies with high saline water. Egypt, J. Appli. Sci., 17(2): 331-349.

Ghuman, B.S. and Sur, H.S. (2001). Tillage and residue management effect on soil properties and yields of rain fed maize and climate. Soil Tillage Res., 58: 1-10.

Gillian, J.W. and Hoyt, G.D. (1987). Effect of conservation of tillage on fate and transport of nitrogen. In: Logan, T.J. (Ed.), Effects of Conservation Tillage on groundwater Quality: Nitrate and A pesticides. Lewis Publ., Chelsea, MJ, 217-240.

Griffith, D.R.; Moncrief, J.F.; Eckert, D.J.; Swan, J.B. and Breitbach, D.D. (1992). Crop response to tillage systems. 25-33 pp, In: Conservation tillage systems and management: crop residue management with no–till, mulch-till.1stEd., MWPS-45, Mid West plan Service, Ames, Iowa.

Hobbs, P.R. and Gupta, R.K. (2003). Resource- conserving technologies for wheat in the rice- wheat System: Issues and Impact. ASA Special Publication, 65 pp.

Jackson, M. L. (1967). Soil Chemical Analysis. Constable and Company Limited, London.

Karlen, D.L.; Wollenhaupt, N.C., Erbach, D.C. (1994). Long term tillage effects on soil quality. Soil Tillage Res., 32: 313-327.

Klute, A. Ed. (1986). Methods of Soil Analysis. No. 9 Part 1, Amer. Soc. Agron., Inc. Madison, Wisconsin, USA.

Lopez, F.C. and Pardo, M.T. (2001). The impact of tillage systems and crop rotations on carbon sequestration in a Calcic Luvisol of central Spain 1 World Congress on conservation Agriculture Madrid, October, 2001 pp., 1-5.

Malik, R.K.; Mehla, R.S. and Singh, B.K.(2000). Conservation tillage technologies and farmers participatory research, extension approaches in Haryana. In: Rice-Wheat Consortium paper Series 14 Proceeding of Farm-level Impact in Rice-Wheat Systems of the Indo-Gangetic Plains, 25-27 September 2000, New Delhi, India,.31-45 pp.

Malik, R.K.; Yadav, A.; Singh, S. and Malik, R.S. (2000). Herbicides resistance management and evolution of zero tillage: A success story. In: Research Bulletin, Haryana Agricultural University, Hisar, India.

Olsen, S.R.; Cole, C.V.; Frank, S.W. and Dean, l.A. (1954). Estimation of available phosphorus by extraction with sodium bicarbonate. United States Department of Agriculture.

Page, A.L.; R.H. Miller and D.R. Keeney (1982). Methods of Soil Analysis. Part 2: Chemical and Microbiological Properties. Second Edition, Amer Soc. of Agron. Madison, Wisconsin, USA.

Richardes, L.A. (1954). Diagnosis and improvement of saline and alkali soils. USAD Hand Book No.60.

Singh, S.; Samar, Yadav, A. and Malik, R.K. (2002). Long term effect of zero-tillage sowing technique on weed flora and productivity of wheat in Rice-Wheat Cropping zones of Indo-Gangetic Plains.In:Malik(Eds.) Herbicide Resistance Management and Zero Tillage in Rice-Wheat Cropping System. Proceeding of the International Workshop, Hisar, India,4-6 March,2002, CCSHA University, Hisar, India, 155-157 pp.

Soon, Y.K.; Clayton, G.W. and Rice, W.A. (2001). Tillage and previous crop effects on dynamics of nitrogen in wheat- soil system. Agron. J., 93: 842-849.

Subbiah, B.V. and Asija. G.L. (1956). A rapid method for the estimation of available nitrogen in soil. Curr.Sci., 25: 259-260.

Teodor, RUSU (2005). The influence of minimum tillage systems upon the soil properties yield and energy efficiency in some arable crops. J. Central European Agriculture, 6 (3): 287-294.

Waitrak, P.J. (2004). Tillage and residual nitrogen impact on wheat forage. Agron. J., 96: 1761-1764.

Walkley, A. and Black, C.A. (1934). An examination of the Degetjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Sci., 37: 29-38.

دلالة عدم خدمة التربة أو إجرائها بالإشتراك مع بعض المحسنات الطبيعية المحلية وعلاقتها بخواص التربة الفيزيوكيميائية وإنتاجية القمح المروى بمياة متدنية الصلاحية

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أجريت تجربة حقلية بمركز طامية، محافظة الفيوم، مصر خلال موسمين متتاليين ٢٠٠٨-٢٠٠٩/ ٢٠٠٩-٢٠١٠ لتقييم تأثير عمليات اللاخدمة، أو الخدمة كمعاملات منفردة أو إضافة أسمدة النتروجين والفوسفور المعدنية أو خلطها مع بعض المحسنات الطبيعية المحلية ممثلة فى الجبس أو مخلفات المزرعة أو مخلف طين مرشحات صناعة السكر لتحسين بعض خواص التربة (المحتوى من المادة العضوية، Soil pH، معدل الرشح، القدرة على الاحتفاظ بالماء، وكذلك محصول حبوب القمح (*Triticum aestivum* L., Sakha 69 cv.) عقب الأرز (*Oryza sativa* L., Giza 176 cv.) والتى تروى بمياه متدنية الصلاحية.

وتشير النتائج المتحصل عليها إلى أنه فى حالة عملية اللاخدمة، حيث تتواجد بقايا نباتات الأرز بارتفاع ١٠ سم من سطح الأرض، والتى تتسبب فى زيادة قيم كلا من المادة العضوية ومعامل الرشح، مقابل نقص موازى فى Soil pH value. ولقد وصلت الزيادة فى محتوى التربة من المادة العضوية فى نهاية التجربة إلى ٠.٥١٩ ٪ كقيمة متوسطة فى حالة عملية اللاخدمة مقابل ٠.٤٥٥ ٪ فى حالة إجراء الخدمة لطبقة من التربة بسمك ٠- ١٥ سم. ومثل هذه الزيادة المحسوسة فى المحتوى من المادة العضوية قد إنعكست بصورة إيجابية على محصول حبوب القمح. علاوة على أن محصول الحبوب قد تعاظم بزيادة الجرعات المضافة من أسمدة النتروجين والفوسفور. وهذه الزيادات قد حققت إستفادة أقل فى حالة عملية اللاخدمة مقارنة باجراء عملية الخدمة خلال الموسم الأول ٢٠٠٨-٢٠٠٩، بينما حدث إتجاها معاكسا فى الموسم التالى ٢٠٠٩-٢٠١٠.

عمليا، بالنسبة لاستهلاك المياه فأنة في حالة عملية اللاخدمة أستخدم ٣٢.٤٤سم من مياه الري علي مدار الموسم مقابل إستخدام ٣٩.٦٦ سم فى حالة إجراء عملية الخدمة، مشيرا لتفوق عملية اللاخدمة والتى تسببت فى خفض معدل الاستهلاك من مياه الرى بما يوازي ٧.٢٢سم. وبصفة نهائية، فان النتائج تؤكد أهمية إضافة ١٢٠ كجم N + ٢٥ كجم P_2O_5/هكتار كجرعات سمادية مع سماد مخلفات المزرعة العضوى أو مخلف طين مرشحات صناعة السكر أو الجبس في حالة عملية اللاخدمة لتحسين محتوى التربة من المادة العضوية وتدعيم إستدامة التركيب المحصولى أرز-قمح تحت ظروف إستخدام مياه رى متدنية الصلاحية.