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تقييم تأثير مسافات أنفاق الصرف بالمول والمادة المالئة له على بعض خواص التربة و إنتاجية محصولي الكتان والتيل وبعض العلاقات المائية فى منطقة شمال وسط الدلتا

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الملخص العربي

أقيمت تجربة حقلية فى مزرعة محطة البحوث الزراعية بسخا خلال موسمين زراعيين متتالين شتوي ٢٠٠٩/٢٠١٠ و صيفي ٢٠١٠ لتقييم تأثير الصرف بالمول (بالرمل أو بدون رمل) و على أبعاد مختلفة ٢ و٤ و٦ متر بين خطوط المول و بعضها على بعض خواص التربة الطبيعية و الكيميائية وكذلك على إنتاجية محصول الكتان صنف (سخا ٣) و محصول التيل صنف (جيزة ٣)

وصممت التجربة فى قطع منشقة كالتالي:-

وكانت المعاملات الرئيسية: المادة المالئةلانفاق الصرف بالمول-(مول بالرمل او مول بدون رمل)

ووضعت أبعاد الأنفاق (٢ ،٤ ،٦ متر) فى القطع المنشقة

وكانت أهم ألنتائج المتحصل عليها كما يلى :-

أدى استخدام الصرف بالمول ألي انخفاض الكثافة الظاهرية للتربة سواء بالرمل أو بدون رمل وكانت أقل قيمة للكثافة الظاهرية تحصل عليها عند ٢ متر مول وأعلى قيمة كانت عند ٦ متر مقارنة بالقيم المتحصل عليها قبل تنفيذ التجربة و بالنسبة للمسامية الكلية أخذت اتجاه مخالف للكثافة الظاهرية . .بينما أدى استخدام المول إلى ارتفاع قيمة معدل الرشح الاساسى للتربة مقارنة بقيمته قبل تنفيذ التجربة بينما اتضح ان معدل الرشح يزداد بنقصان المسافة بين خطوط المول مع كلا المحصولين وكانت أعلى قيمة لمعدل الرشح ١.٠٤ سم/ساعة تحصل عليها عند ٢ متر مول بالرمل فى الموسم الثاني و أقل قيمة لمعدل الرشح الاساسى كانت ٠.٨ سم/ساعة تحصل عليها عند ٦ متر مول بالرمل وبدون رمل فى الموسم الأول مقارنة بقيمته المتحصل عليها قبل تنفيذ التجربة حيث كانت ٠.٥٥ سم/ساعة .

ويتضح أيضا انخفاض قيم كلا من ملوحة وقلوية التربة مع استخدام الصرف المولى مقارنة بقيمتهما قبل تنفيذ التجربة وكان إنشاء ألمول بدون رمل أكثر فاعلية فى خفض الملوحة والقلوية مقارنة بالمول بالرمل فى الموسم الأول بينما إنشاء ألمول بالرمل كان أكثر فاعلية عن المول بدون رمل فى الموسم الثاني حيث انخفضت الملوحة بنسبة (٢٩.٤٥%و٣٢.٢%) مع المول بالرمل و بدون رمل على التوالي فى الموسم الأول و بنسب (٤١.٩ة%و٣٧.٢٩ %)مع المول بالرمل و بدون رمل على الترتيب فى الموسم الثاني وكذلك انخفضت القلوية بنسبة(١٥.٦٢ %و١٧.٧٦ %) مع المول بالرمل و المول بدون رمل على التوالي فى الموسم الأول (٢٣.٦٦.%و ٢٠.٤٨%) مع المول بالرمل و بدون رمل على التوالي فى الموسم الثاني

كانت إنتاجية الكتان والتيل مرتبطة بالمول حيث كانت الإنتاجية أعلى مع المول بدون رمل فى الموسم الأول بينما كانت الإنتاجية أعلى مع المول بالرمل فى الموسم الثاني .وبالنسبة لأبعاد ألمول كان الإنتاجية اعلي بالمول على أبعاد ٢متر وأقلها مع ألمول على أبعاد ٦متر مول

كان أعلى دخل للمزارع فى الاراضى المتأثرة بالأملاح وسيئة الصرف مع إنشاء الصرف بالمول على أبعاد ٢م

ويمكن التوصية بإنشاء الصرف بالمول فى الاراضى الطينية الثقيلة المتأثرة بالأملاح لتحسين بعض خواصها الطبيعية والكيميائية لتحسين إنتاجيتها.

EFFECT OF MOLE DRAIN SPACING AND FILLING MATERIAL ON SOME SOIL PROPERTIES, YIELD OF FLAX AND KENAF AND SOME WATER RELATIONS IN THE NORTH MIDDLE NILE DELTA REGION.

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ABSTRACT: *A field experiment was conducted at Sakha Agric.Res. Station during winter growing season (2009/2010) and summer season (2010) to evaluate the effect of mole drain types; sand back filling and without filling and distance between the mole drain lines 2,4 and 6m on some soil physical and chemical properties of the studied soil and on the productivity of flax and kenaf crops as well as some crop-water relations. Split plot design was used with three replicates. Main plots were randomly assigned by types of moles ;while sub main plots were also randomly assigned by distance between mole drain lines. The data showed that :-*

1- Soil bulk density , salinity and alkalinity were decreased with decreasing mole drain spacing from 6m to 2m with or without sand filling, as expected for the two seasons . The mean values of ECe were decreased by about 29.45 % with sandy mole and 32.2% with mole without sand in the first season. Also , values were decreased by about 41.91% with sandy mole and 37.29% with empty mole in the second season compared to initial values obtained, while the values of sodium adsorption ratio (SAR) were decreased by 15.62% with sandy mole and 17.76% with empty mole after harvesting of first season, and the corresponding values were dereased by about 23.66% and 20.48% with sandy mole and without sandy mole after harvesting of second season compared to values obtained before treatments

2- Basic infiltration rate increased after application treatments compared to untreated soil. The highest value of basic IR is(1.4cm/hr) was obtained with space of 2m after harvesting of second season while the lowest value is (0.8 cm/hr) was obtained with or without sand mole at 6m space after harvesting of first growing season compared to 0 .6 cm/hr for untreated soil after two growing seasons

3-The productivity of flax and Kenaf crops are highly significantly increased with mole drain types and decreasing the mole space compared to untreated soil, whereas the highest value of seed or straw of flax was obtained with 2m mole space while the lowest value was recorded under 6m mole spacing as well as Kenaf crop. The yield of Flax with mole without sand is highly significantly increased more than that with sandy mole . While the kenaf yield took the opposite trend.

***4.** The amount of applied irrigation water increased with unfilling sand mole in the first season while in the second season took the opposite trend . Also, the values increased with decreasing mole space, as well as the water productivity and water use efficiency took the same trend.*

Key words: *Mole Types, Salt affected soil, drainage depth, Soil properties, Flax, Kenaf and Plant growth.*

INTRODUCTION

Heavy clay soils with shallow open drainage and low permeability are predominant in the Northern area of the Nile Delta . These soils are always threatened by shallow saline groundwater .In the irrigated area, saline groundwater is a permanent source of soil salinzation that causes poor productivity (Moukhtar *et al* 2003). Moling or sub soiling will enhance downward movement of irrigation water carrying excess of salts from surface layer to drains. After words, regular subsequent irrigation will gradually reduce the salt content in groundwater in subsurface soil layers from linking with the upper ones

(Moukhtar *et al* 2002 and 2003). They also found that mole drains are generally considered to be the result of the physical shattering of the hard pans, which allows water penetration into the subsoil to increase . This may also accelerate the leaching of sodium from the subsoil, and consequently reduce the possibility reclamation time of the hardpan. Lickacz (1993) and Said (2002) revealed that soil compaction influenced soil strength, bulk density, distribution and continuity of pores with consequent an adverse effect on drainage, root penetration , aeration , biological processes and nutrients uptake. Said(2003)concluded that the cumulative and basic infiltration rate of the treated soil by subsoil were markedly increased relative to the untreated one .He also pointed out that the treated soil resulted in a sharp decrease in bulk density and penetration resistance in coincidence with a sharp increase in total porosity and macropores relative to the untreated one . Ramadan *et al* (2006) reported that 10 m drain spacing in clay soils had the lower values of bulk density and penetrability and the higher ones of porosity and infiltration rate as well as soil productivity comparing to 20 m and 40 m spacing. El-Sabry *et al.* (1992) observed the superiority of sand constructed moles with 3 m spacing since it led to the lowest values of both ECe and SAR and gave the highest value of basic infiltration rate of soil. Antar *et al* (2008) reported that rice and sugar beet yields were higher with mole drains than that without mole drains. The common reclamation and improvement processes applied for salt affected soils included improvement of soil physical properties through deep ploughing or mole drainage beside the use of suitable quantity of irrigation water in the presence of good drainage system (Gazia *et al*., 1996) Moreover ,many researchers had reported positive results of soil properties that can be obtained after applying adequate mole drain system especially in heavy clay salt affected soils(Walter and Bishay1992 and El-Sabry *et al*., 1992).

MATERIALS AND METHODS

A field experiment was conducted in clay soil area at Sakha agricultural Research Station farm ,Kafr El-Sheikh Governorate . Egypt during the two successive growing seasons (2009 /2010 and 2010) to evaluate the effect of mole drains type (with and without sand) and mole spacing (2m ,4m and 6 m) on some soil physical and chemical properties and yield of flax (Sakha 3) in winter growing season and Kenaf (Giza 3) in summer season .The soil has a clayey texture .

All agricultural practices were used with the two crops as recommended in the Middel North Delta area .Split plot design was used for statistical analysis as follows:- Main plots were randomly assigned by the mole types (mole with sand SM , mole without sand M and without mole (control) and sub plots were mole spacing (2m .4m and 6m) with three replicates.

Soil samples were taken from soil layer namely 0-20 ,20-40 and 40-60 cm before planting and after harvesting of both crops and prepared for physical and chemical analysis according to Page (1982) ,Klute (1986) , Jackson (1973) and Richards (1954) .Infiltration rate was determined using double cylinder infiltrometer as described by Garcia (1978). The obtained data were recorded in Table (1) .

Flax was sowing on 10 December and harvested on 25 April (2009/2010) while the kenaf crop was sowing on 10 June and harvested on 10 October (2010) flax and kenaf plant samples were taken from all treatments for determination of seeds kg /fed. ,while straw ton/fed. for flax and the kenaf fibbers kg/fed.

Some Water relations :

Amount of irrigation water was measured by Cut- throat flume 30 × 90cm according to Skogerboe *et al*. (1973).

Actual water consumptive use :

Actual water consumptive use : was calculated according to the following equation (Israelson and Hansen ,1962) as follows:

$$CU = \sum_{I=1}^{I=n} \frac{\Theta_1 - \Theta_2}{100} \times \rho_b \frac{D}{100} \times 4200$$

Where, cu= actual water consumptive use (m^3/fed .)

n =number of irrigations

Θ_1=soil moisture content (%) after two days from irrigation

Θ_2 =soil moisture content (%) before the next irrigation

ρ_b=bulk density of soil (g/cm^3)

D =depth of soil layer

Table (1): some properties of the soil experimental area before treatments.

Soil depth (cm)	Particle size distribution			Texture grade	ECe dS/m at25^{o} c	SAR_e	ρ_p g/cm^3	Total porosity E%	Basic IR cm/hr
	Sand %	Silt %	Clay %						
0-20	25.85	27.34	46.81	Clayey	6.90	13.00	1.28	51.70	0.55
20-40	22.48	27.31	50.21	Clayey	9.10	14.90	1.33	49.81	
40-60	27.19	29.10	43.71	Clayey	13.86	18.40	1.35	49.06	
Mean	25.17	27.92	46.91	clayey	9.95	15.43	1.32	50.19	

Water use efficiencies(WUE):

A. water productivity:- it was calculated according to Doorenbos and Pruitt 1979 as follows:

$$W.P = \frac{\text{Yield kg/fed.}}{\text{Water applied m}^3\text{/fed.}}$$

B. Water use efficiency :-

Water use efficiency(WUE) :- was determined by dividing the crop yield in kg/feddan by water consumptive use in m^3/feddan (Amer.2011) as follows:

$$W.U.E = \frac{\text{Yield kg/fed.}}{\text{Actual water consumptive use m}^3\text{/fed.}}$$

Economic evaluation (profitability):

Profitability was calculated according to the equations outlined by FAO (2000):

1- Total return = yield X price (grain+straw) L.E.

2- Net return (NR) = total return - total cost.

3-Investment factor (IF) = total return / total cost.

RESULTS AND DISCUSSION

Soil bulk density and total porosity as affected by`different mole treatments:-

Soil bulk density is considered as one of the most important parameters which indicate the status of soil structure and consequently, soil water, air and heat regime (Richards 1954) .Results in Table (2) showed that values of soil bulk density (ρ_b) are generally increased with increasing soil depth in all types of moles and all tested mole spacing.

The lowest values of bulk density were found in the surface layer (0-20 cm) for sandy mole or unfilled with sand comparing to untreated soil .Also, the lowest values are achieved with 2m spacing while the highest values were obtained with 6m mole spacing. Data in the same table showed that the values of total porosity gave the opposite trend of those with bulk density. These results were found after harvesting of either flax or kenaf. These results are in agreement with those obtained by Ramadan, *et al.* (2006).

Basic infiltration rate (IR) ;-

Data in Table (3) showed that the values of basic infiltration rate were decreased with the elapsed time which increased with all tested drain spacing to reach the basic infiltration . The highest values of basic infiltration rate are achieved with 2m mole spacing comparing to that with 4m and 6m mole spacing or untreated soil. Such increase in basic infiltration rate may be due to the presence of better drainage condition with 2m drain spacing . This results are in a great harmony with those obtained by (Ramadan, *et al.* 2006) and (Antar , *et al*. 2008) . Concerning the effect of mole type on infiltration rate ,results revealed that the mole without sand are more effective on basic infiltration rate than sandy moles especially in the first growing season (flax crop), while with kenaf in the second growing season the sandy mole are more effective than unfilling mole. The value of basic infiltration rate is 0.55 cm/hr before planting and increased to 0.9 ,0.8 and 0.8 cm/hr with 2 ,4 and 6m spacing of sandy mole and increased to 1.0 ,0.9 and 0.8 cm/hr with 2 ,4 and 6 m spacing respectively for unfiling moles after the first growing season, while it was 0.6 cm/hr with untreated soil. In the second season, the basic infiltration rate values are increased to 1.2 ,1.0 and 0.9 cm/h with 2,4 and 6 m mole spacing ,respectively for unfiling moles and 1.4 ,1.1 and 0.9 cm/hr with 2 ,4 and 6 m spacing ,respectively for sandy moles, while the values were decreased with control treatments.

soil salinity (EC_{e}) and Sodicity (SAR_e)

Data in Table (4) clearly showed that the construction of mole drain is more effective in decreasing the values of ECe and SARe, and these values markedly increased with increasing soil depth . The mean values of ECe and SARe of soil decreased with unfillied moles or sandy moles compared to those obtained before treatments (9.95 and 15.43 dS/m) , respectively .

Table (2): soil bulk density (ρ_p g/cm^3) and total porosity (E%) as affected by different treatments:

seasons	Mole type*	depth cm	2m		4m		6m	
			ρ_p g/cm^3	E %	ρ_p g/cm^3	E %	ρ_p g/cm^3	E%
First season (flax)	SM	0-20	1.30	50.94	1.31	50.57	1.33	49.81
		20-40	1.32	50.19	133	49.81	1.34	49.43
		40-60	1.34	49.43	134	49.43	1.34	49.43
	Mean		1.32	50.19	1.327	49.94	1.337	49.56
	M	0-20	1.27	52.08	1.29	51.32	1.32	50.19
		20-40	1.31	50.57	1.31	50.57	1.33	49.81
		40-60	1.33	49.81	1.33	49.81	1.34	49.43
	Mean		1.303	50.82	1.310	50.57	1.33	49.81
Second season (kenaf)	SM	0-20	1.28	51.70	1.29	51.32	1.31	50.57
		20-40	1.31	50.57	1.32	50.19	1.32	50.19
		40-60	1.33	49.81	1.32	50.19	1.33	49.81
	Mean		1.307	50.69	1.210	50.57	1.32	50.19
	M	0-20	1.26	52.45	1.27	52.08	1.30	50.94
		20-40	1.29	51.32	1.30	50.49	1.31	50.57
		40-60	1.32	50.19	1.32	50.19	1.32	50.19
	Mean		0-20	51.32	1.297	51.07	1.31	50.57
	control		ρ_p =1.32			E%.=50.19		

* MS is mole with sand   * M is mole without sand

Table (3) : Basic infiltration (cm/hr) and cumulative infiltration depth (cm) as affected by different treatments.

Mole type	Spacing m	Before treatments		After first season		After second season	
		Basic IR	Cumul.	Basic IR	Cumul.	Basic IR	Cumul.
sandy mole	2	0.55	7.9	0.9	8.7	1.4	10.4
	4			0.8	8.2	1.1	9.5
	6			0.8	8.1	0.9	8.3
Unfiling mole	2	0.55	7.9	1.0	9.9	1.2	9.8
	4			0.9	9.1	1.0	9.0
	6			0.8	8.0	0.9	8.2
Untreated mole soil(control)				0.6	7.9	0.6	7.9

Table (4): Soil salinity (dS/m) and sodicity (SAR) after two growing seasons as affected by different treatments:-

Growing season	Mole type	Soil depth cm	Mole space m							
			2m		4m		6m		Mean	
			EC dS/m	SAR	EC dS/m	SAR	EC dS/m	SAR	EC dS/m	SAR
Before exp.		0-20	6.90	13.00	6.90	13.00	6.90	13.00		
		20-40	9.10	14.90	9.10	14.90	9.10	14.90		
		40-60	13.86	18.40	13.86	18.40	13.86	18.40		
		Mean	9.95	15.43	9.95	15.43	9.95	15.43	9.95	15.43
First growing season(flax)	SM	0-20	5.10	11.10	6.50	12.60	5.36	11.4		
		20-40	6.40	12.50	7.60	13.60	7.58	13.6		
		40-60	6.80	12.99	8.60	14.50	9.26	15.0		
	Mean		6.10	12.17	7.56	13.56	7.40	13.33	7.02	13.02
	M	0-20	5.10	11.10	5.30	11.40	6.10	12.20		
		20-40	6.20	12.30	6.80	12.90	7.70	13.70		
		40-60	6.50	12.60	7.20	13.20	8.94	14.80		
	Mean		5.93	12.00	6.73	12.50	7.58	13.56	6.75	12.69
	control		EC=9.96				SAR=15.74			
Second growing season (kenaf)	SM	0-20	4.15	10.00	4.73	10.70	4.95	11.00		
		20-40	5.25	11.30	5.85	11.90	6.25	12.30		
		40-60	5.85	11.90	6.85	12.90	8.11	14.00		
	Mean		5.08	11.07	5.81	11.83	6.44	12.43	5.78	11.78
	M	0-20	4.52	10.50	5.72	11.80	5.11	11.20		
		20-40	5.83	11.90	6.11	12.20	6.43	12.50		
		40-60	6.15	12.20	7.53	13.50	8.75	14.60		
	Mean		5.50	11.53	6.45	12.50	6.76	12.77	6.24	12.27
	control		EC=9.98				SAR=15.85			

Where : SM is sandy mole M is unfilling mole

The previous results showed that the leaching of salts was enhanced as the mole spacing decreased. Considering the effect of mole type ,it could be observed that the unfilled mole was better than the filled mole and without mole (control) in the first season since it gave lower values of EC_e and SAR In contrary of the first season, the filled moles of salts greater than the unfilled moles or without moles in the second season. promoted the leaching

After the harvesting of first season the reduction in EC_e value with unfilled moles was greater than the sandy moles by32.20 and 29.45 % , respectively.While after the harvesting of the second season the converse trend was observed (37.29 and 41.91 % in both moles , respectively) .The decreasing of SAR values was as the same as the trend of ECe ,where the values in the first season were greater with unfilled moles than with sandy moles by17.76 and 15.62 % respectively .While in the second season, the values with sandy mole were greater than with unfilled moles by 23.66 and 20.48 % , respectively .On the other hand ,the ECe and SAR values are higher for control than that for both mole types .

It is observed that , soil ECe and SARe values are decreased with decreasing mole drain spacing in both growing seasons . These results are similar to that obtained by Moukhtar, *et al.* (2003) and Antar, *et al.* (2008).

Crop yield

Data in Table (5) revealed that seed yield of flax in the first season was significantly increased with unfilling moles (496.1 kg/fed.) comparing to filling sandy moles (460.1 kg/fed) and soil without mole drain (325.6 kg/fed.) .The values of straw yield took the same trend of seed yield since the values with types of moles are 3.38., 3.08 and2.26 ton/fed ,respectively .

Concerning the mole spacing there are highly significant increase in seed and straw yield of flax with decreasing mole spacing from 6m to 2m in the first season .While the yield of kenaf in the second growing season ,data in Table (6) showed that , fiber and seed yields with sandy moles are highly significant increase than that with unfilling moles and without mole . Furthermore the effect of mole spacing on fiber and seed yields of kenaf are highly significant increased with decreasing mole spacing from 6 m to 2 m.

Table (5): Statistical analysis of flax yield in the first growing season as affected by different treatments :

treatments		Flax Seeds yield (kg/fed)	Straw yield of flax (ton/fed)
	Cont.	325.6 c	2.26 c
Mole type (m)	SM	460.1 b	3.08 b
	M	496.1 a	3.38 a
F test		**	**
LSD 0.05		12.56	0.137
LSD 0.01		20.82	0.228
Mole space (d)	2 m	441.6 a	3.12 a
	4 m	429.2 b	2.98 b
	6 m	411.0 c	2.63 c
F test		**	**
LSD0.05		5.77	0.077
LSD0.01		8.09	0.108
M*d		**	**

Table (6): Statistical analysis of kenaf yield in the second season as affected by different treatments

treatments		Kenaf Seed yield (kg/fed)	Fiber yield of kenaf (kg/fed)
	cont	255.66 c	966.33 c
Mole type (m)	SM	316.11 a	1102.22 a
	M	299.44 b	1047.55 b
F test		**	**
LSD 0 .05		5.60	13.15
LSD 0 .01		9.30	22.39
Mole space (d)	2 m	304.2 a	1098.77 a
	4 m	288.2 b	1020.11 b
	6 m	278.7 c	999.22 c
F test		**	**
LSD0.05		3.71	8.34
LSD0.01		5.21	11.69
M*d		**	**

Some-water relations:

A. Amounts of water applied

Data in Table (7) showed that the mole drain types and mole drain spacing had great effect on amount of irrigation water applied (m^3/fed) during the two growing seasons . The obtained results revealed that the amount irrigation of water applied for flax and kenaf increased with decreasing mole spacing with or without back filling sand .It is clear from the obtained data the highest value of applied water was achieved with 2m mole spacing with or without sand (1913.10 and 2021.18 m^3 /fed ., respectively) in the first growing season and (3684.61.60 and 3614.61 m^3/ fed . , respectively) with sand mole and unfilling mole in the second growing season .On the other hand , the lowest value of applied water was(1556.10 and 1767.78 m^3/fed .) at 6 m mole spacing with and without sand respectively for the first growing season .While these values were found to be (3297.65 and 3374.16 m^3/fed .) at 6m mole spacing without and with sand mole, respectively for the second season .It can be concluded that decreasing mole spacing led to increase the soil infiltration rate and improve status of water penetration for soil. Also, the construction of sandy mole resulted improving in water movement into soil .These results are in agreement with those obtained by Gazia *et al*.,1996)

Table (7): Irrigation water applied , Actual water consumptive use ,water productivity (kg/m^3) and water use efficiency(kg/m^3) as affected by different treat.

season	Mole type	Mole space / m	Amount of irrigation water applied (m^3/fed.)	Water consumptive use (kg/m3)	water productivity (kg/ $m^{3)}$		Water use efficiency (kg/ m^3)		Yield kg/fed	
					Seeds kg/fed	Straw or fibers	Seeds	straw or fibers	Seeds	Straw or fibers kg/fed
First season (flax)	Mole with sand	2	1913.1	1375.22	0.25	1.79	0.34	2.49	485.7	3430
		4	1666.56	1320.46	0.28	1.85	0.35	2.34	462.0	3090
		6	1556.10	1336.82	0.28	1.76	0.32	2.05	432.7	2740
	Mean		1711.92	1344.16	0.27	1.80	0.34	2.29	460.1	3086.6
	Mole without sand	2	2021.88	1472.80	0.25	1.82	0.35	2.50	513.7	3680
		4	1824.48	1318.56	0.27	1.97	0.38	2.73	500.0	3600
		6	1767.78	1306.39	0.27	1.63	0.36	2.20	474.7	2880
	Mean		1871.38	1365.92	0.263	1.81	0.36	2.48	496.1	3386.6
	control		1440.70	1260.60	0.24	1.69	0.26	1.79	325.7	2260
Second season (kenaf)	Mole with sand	2	3684.61	2807.70	0.091	0.33	0.12	0.43	335.3	1198
		4	3492.72	2677.92	0.09	0.31	0.12	0.40	312.7	1074
		6	3374.16	2568.72	0.089	0.30	0.12	0.40	300.3	1034.7
	Mean		3550.54	3401.86	0089	0.31	0.12	0.41	316.1	1102.2
	Mole without sand	2	3614.61	2653.80	0.089	0.31	0.11	0.42	321.7	1132.0
		4	3367.05	2527.14	0.088	0.30	0.11	0.40	296.3	1020.0
		6	3297.65	2491.75	0.085	0..30	0.11	0.40	280.3	996.7
	Mean		3401.86	2526.52	0.088	0.30	0.11	0.41	296.4	1049.5
	control		3451.07	2542.89	0.074	0.28	0.10	0..38	255.7	966.3

B. Actual water consumptive use:-

The seasonal water consumptive use for either flax and kenaf crops as influenced by different treatments are shown in Table (7). The obtained results showed that , the highest value of water consumptive use (1472.80 m^3/fed .) Was obtained at 2 m mole spacing without sand for flax crop in the first season ,and 2807.70 m^3/fed . at 2m spacing with sandy mole for kenaf crop in the second season .While the lowest values are 1306.39 and 2491.75 m^3/fed . at 6 m mole spacing in the first and second seasons respectively .It could be concluded that the established mole at 2m spacing led to increase the soil permeability consequently it received the highest amount of irrigation water applied .This finding is supported by Gazia *et al*.,1996)

C- Water Productivity(W.P)

Water productivity was determined for different treatments for both flax and kenaf crops are presented in Table (7). The highest values are (0.27 and1.97 kg/m ^{3})for seeds and straw , respectively of flax at 4 m mole spacing without sand and(0.091 and 0.33kg/m$^{3)}$ for seeds and fibers of kenaf crop with sandy mole at 2 m spacing . While the lowest values are (0.27and 1.63 kg/ m$^{3)}$for flax seeds and straw ,respectively at 6m mole spacing and (0.085and 0.30kg /m^3) fiber of kenaf at 6 m spacing without sand .On the other hand , moling at 2 m spacing received the highest amount of irrigation water . .These results are in agreement with El-Sabry *et al.,*1992).

D-Water use efficiency (W.U.E) :-

Data in Table (7) showed that water use efficiency for either flax and kenaf were affected by different treatments .The highest values of water use efficiency (0.38 and 2.73kg /m^3) for seeds and straw of flax ,respectively were recorded with 4 m mole spacing without sand in the first season , while the corresponding values with kenaf (0.12and 0.43kg /m^3) for seeds and fibers were obtained with sandy mole at 2m spacing. The lowest values of water use efficiency (0.32 and 2.05 kg / m^3) for seeds and straw, respectively were obtained with sandy mole at 6m spacing for flax crop in the first season, and (0.11and 0..40 kg /m ^{3}) for seeds and fibers of kenaf were obtained with moling without sand at 6m spacing in the second season . These results are in agreement with Walter and Bishay1992 and El-Sabry *et al*.,1992)

Economic Evaluation :

Economic evaluation of different treatments for yield of flax and Kenaf are presented in Table (8) . It is important to compare total costs and total return . Data in Table (8) showed total cost, total income and net return under types of mole drain at different spacing for flax and kenaf crops . Total income of flax is based on productivity of seeds kg/fed. and straw ton/fed. , while the total income of kenaf is based on the productivity of seeds and fibers in kg/fed.

Total costs included these items ;the mole installation ,agricultural practices ,fertilizers ,pesticide , seeds and land rent . Data indicated that net return (L.E.) of flax and kenaf yield were affected by mole drain where the net return value with mole drain was higher than control for both crops .Also , net return affected by mole drain spacing since it increased with decreasing mole spacing from 6m to 2m . The highest net return value (5860.6 L.E./fed.) was achieved with mole without sand at 2m spacing under cultivation of flax . While under cultivation of kenaf the highest value(5445.3 L.E/fed.)was obtained with sandy mole at 2m spacing . The highest values of investment factor were (3.25 and 3.07) were resulted from moling without sand at 2m spacing under cultivation of flax crop and with sandy mole at 2m spacing under cultivation of kenaf respectively . It can be concluded that the construction of mole drain at 2m spacing achieved the highest farmer income .

Table (8): Values of flax and kenaf productivity kg/fed, total income, total cost and net return

season	Mole type	Mole space/ m	Yield kg/fed		Total cost L.E.	Total return L.E.	Net return (NR)L.E.	Investment factor (IF)
			Seeds kg/fed	Straw ton/fed or fiber kg/fed				
First season (flax)	Mole with sand	2	485.7	3.43	2700	7909.9	5209.9	2.93
		4	462	3.09	2650	7255.1	4605.1	2.73
		6	432.7	2.74	2610	6551.6	3941.6	2.51
	Mole without sand	2	513.7	3.68	2600	8460.6	5860.6	3.25
		4	500	3.60	2550	7757.9	5207.9	3.04
		6	474.7	2.88	2510	6987.2	4477.2	2.78
	control		325.7	2.26	2500	5251.8	2751.8	2.10
Second season (kenaf)	Mole with sand	2	335.3	1198	2700	8145.3	5445.3	3.07
		4	312.7	1074	2650	7422.7	4772.7	2.80
		6	300.3	1034.7	2610	7142.0	4532.0	2.73
	Mole without sand	2	321.7	1132	2600	7744.7	5144.7	2.96
		4	296.3	1020	2550	7043.3	4493.3	2.76
		6	280.3	996.7	2510	6790.0	4280.0	2.70
	control		255.7	966.3	2500	6422.0	3922.0	2.56

REFRENCES

Amer, A .M. (2011). Effect of water infiltration and storage in cultivated soil on surface irrigation .Agricultural water Management 98 (5):815-822

Antar, S.A., A.S. El-Henawy and A.A.E. Atwa (2008). Improving some properties of Heavyclay salt Affected soil As A Result of different subsurface tillage. Agric. .sci. Mansoura Univ. ,33(10):7675-7687

Doorenbos, J. and W.O. Pruitt (1979). Yield response to water, FAO irrigation and drainage paper ,33,Rome .

FAO (2000). Fertilizers And Their Use, Evaluation of Fertilizer Demonstrations. A pocket guide for extension officers. Fourth edition. Food and Agriculture organization of The United Nations . International Fertilizer Industry Association Rome, Fourth edition.

El-Sabry, W.S., M.A. Abou El-Soud, M.S.M. Abo-Soliman and M.A. El-Abaseri (1992). Effect of sandy back filled mole on some physical and chemical properties and productivity of clayey compacted soil. J. Agric. Sci. Mansoura Univ.,17 (8), 2790-2797

Garcia, I. (1978). Soil Water Engineering laboratory Manual Department of Agricultural and Chemical Engineering . Colorado State Unvi., Fortcoilins,Colorado,USA

Gazia, E.A.E., Somya A. Hassanein, H.A. Shms El-Din and M.S.M. Abo Soliman (196).Effect of some Amendments and mole Drain systems on rie yield,Water use efficiency and some soil properties. J.Agric. Sci. Mansoura Univ.,21(12):4701-4711

Israelson, O.W. and V.E. Hansen (1962). Irrigation principles and practices 3rd ed.John Wiley and sons .Inc.New York

Jackson, M.L. (1973). Soil Chemical Analysis .constable and company Ltd. London..

Klute, A. (1986). Methods of soil Analysis , Part 1:physical and Mineralogical methods (2nd ed).Am.soc. of Agron. Inc.

Soil sci. of Agron. Inc. Madison , Wisconsin ,USA
Lickacz, J. (1993). Management of solonetzic soils Agdex 518-8.Revised..Edmonton.Alberta,Canada.
Moukhtar, M.M, Aly I.N.Abdel-Aal, M.A.B.EL-Sheikh and M. I .I. Abdel-Khalik (2002). The role of Mole drainage in Degradation soils under saline ground water table, Egypt. The second international conference on sustainable agric. for food, Energy and industry September 8-13Beijing-China.
Moukhtar, M.M., Madiha H. EL-Hakim, A.S.A. Abdel.Mawgoud, A.I.N. Abdel Aal and M.A.B.EL-Shewikh (2003). Drainage and role of Mole drains for heavy clay soils under saline water table, Egypt Paper No.078.presented at the 9th international drainage workshop. September 10-13,2003 Utrecht, the Netherlands.
Page, A.L. (1982). Methods of soil analysis.Part2: chemical and Microbiological properties 2nd. Ed Amer.Inc.Madison.Wisconsin,USA chapter 12 :(199-223).
Ramadan, S.A., A.A.S. Gendy, N.I. Talha and A.A. EL-Leithi (2006). Effect of distance from drain line on crop unwheat der different rates of nitrogen fertilization in clay soil.J.Agric.,Sci.Mansoura univ.,31 (4): 2583-2591
Richards, I. A. (1954). Diagnosis and Improvement of Saline and Alkali Soils. Agric. Handbook No. 60. usa.D.,chapter 7,pp. (83-126).
Said, H.M. (2002). Effect of deep ploughing on some properties of corn yield in calcareous sandy clay loam soil. Egypt J.soil Sci.(4) 70
Said, H.M. (2003). Effect of tillage implements on the state of compacted different soils. Egypt J.Soil Sci.43 :91-107
Skogerboe, O.V., R.S. Bennet and W.R. Walker (1973). Selection and installation of cutthroat flume for measuring irrigation and drainage water .Pub. Colorado state University .pp. 593 .
Walter and G. Bishay (1992). Drainage guidline.World Bank Technical paper No.195.

تقييم تأثير مسافات أنفاق الصرف بالمول والمادة المالئة له على بعض خواص التربة و إنتاجية محصولي الكتان والتيل وبعض العلاقات المائية فى منطقة شمال وسط الدلتا

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الملخص العربي

أقيمت تجربة حقلية فى مزرعة محطة البحوث الزراعية بسخا خلال موسمين زراعيين متتالين شتوي ٢٠٠٩/٢٠١٠ و صيفي ٢٠١٠ لتقييم تأثير الصرف بالمول (بالرمل أو بدون رمل) و على أبعاد مختلفة ٢ و٤ و٦ متر بين خطوط المول و بعضها على بعض خواص التربة الطبيعية و الكيميائية وكذلك على إنتاجية محصول الكتان صنف (سخا ٣) و محصول التيل صنف (جيزة ٣)
وصممت التجربة فى قطع منشقة كالتالي:-

وكانت المعاملات الرئيسية: المادة المالئةلانفاق الصرف بالمول-(مول بالرمل او مول بدون رمل)
ووضعت أبعاد الأنفاق (٢ ،٤ ،٦ متر) فى القطع المنشقة
وكانت أهم ألنتائج المتحصل عليها كما يلى :-

أدى استخدام الصرف بالمول ألي انخفاض الكثافة الظاهرية للتربة سواء بالرمل أو بدون رمل وكانت أقل قيمة للكثافة الظاهرية تحصل عليها عند ٢ متر مول وأعلى قيمة كانت عند ٦ متر مقارنة بالقيم المتحصل عليها قبل تنفيذ التجربة و بالنسبة للمسامية الكلية أخذت اتجاه مخالف للكثافة الظاهرية . .بينما أدى استخدام المول إلى ارتفاع قيمة معدل الرشح الاساسى للتربة مقارنة بقيمته قبل تنفيذ التجربة بينما اتضح ان معدل الرشح يزداد بنقصان المسافة بين خطوط المول مع كلا المحصولين وكانت أعلى قيمة لمعدل الرشح ١.٤ سم/ساعة تحصل عليها عند ٢ متر مول بالرمل فى الموسم الثاني و أقل قيمة لمعدل الرشح الاساسى كانت ٠.٨ سم/ساعة تحصل عليها عند ٦ متر مول بالرمل وبدون رمل فى الموسم الأول مقارنة بقيمته المتحصل عليها قبل تنفيذ التجربة حيث كانت ٠.٥٥ سم/ساعة .

ويتضح أيضا انخفاض قيم كلا من ملوحة وقلوية التربة مع استخدام الصرف المولى مقارنة بقيمتهما فبل تنفيذ التجربة وكان إنشاء ألمول بدون رمل أكثر فاعلية فى خفض الملوحة والقلوية مقارنة بالمول بالرمل فى الموسم الأول بينما إنشاء ألمول بالرمل كان أكثر فاعلية عن المول بدون رمل فى الموسم الثاني حيث انخفضت الملوحة بنسبة (٢٩.٤٥%و٣٢.٢%) مع المول بالرمل و بدون رمل على التوالي فى الموسم الأول و بنسب (ة٤١.٩%و٣٧.٢٩ %)مع المول بالرمل و بدون رمل على الترتيب فى الموسم الثاني وكذلك انخفضت القلوية بنسبة(١٥.٦٢ %و١٧.٧٦ %) مع المول بالرمل و المول بدون رمل على التوالي فى الموسم الأول (.٢٣.٦٦%و ٢٠.٤٨%) مع المول بالرمل و بدون رمل على التوالي فى الموسم الثاني

كانت إنتاجية الكتان والنيل مرتبطة بالمول حيث كانت الإنتاجية أعلى مع المول بدون رمل فى الموسم الأول بينما كانت الإنتاجية أعلى مع المول بالرمل فى الموسم الثاني .وبالنسبة لأبعاد ألمول كان الإنتاجية اعلي بالمول على أبعاد ٢متر وأقلها مع ألمول على أبعاد ٦متر مول

كان أعلى دخل للمزارع فى الاراضى المتأثرة بالأملاح وسيئة الصرف مع إنشاء الصرف بالمول على أبعاد ٢م

ويمكن التوصية بإنشاء الصرف بالمول فى الاراضى الطينية الثقيلة المتأثرة بالأملاح لتحسين بعض خواصها الطبيعية والكيميائية لتحسين إنتاجيتها.