

**DRAINAGE PARAMETERS AND WATER MANAGEMENT FOR  
LIGHT TEXTURED SOILS IN QALIUBIA GOVERNORATE**

**BY**

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## **APPROVAL SHEET**

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## **ABSTRACT**

**Mohamed Abdel Moneim Mohamed Abdalla . Drainage parameters and water management for light textured soils in Qaliubia Governorate. Unpublished Doctor of Philosophy Dissertation, Ain Shams University, Faculty of Agriculture, Department of Soil Science, 2000.**

The present work was carried out in Meet Kenana Pilot Area, Qaliubia Governorate, Egypt, to study the effect of drain depth and drain spacing on lateral discharge, water table depth, soil salinity and crop yield in light textured soils. In the same time, it aimed to evaluate the performance of one of the steady state equations (Hooghoudt) and one of the non-steady state equations (Glover Dumm) in such soils, to find out the optimum drain spacing and drain depth which could be recommended in light textured soils . The drain depths under study were 100 , 120 and 130 cm below soil surface, while , the drain spacings considered were 30, 40 , 60 and 120 m .

The results obtained showed reverse relations between the drain spacing and each of the occurrence percentages of water table deeper than 80 cm from soil surface, Relative Groundwater table Depth (RGWD), amount of salts removed from soil profile, Salt Leaching Index (SLI), lateral discharge (q) and hydraulic head at midway between lateral drains (h). On the other hand, the relations were direct with drain depth. Furthermore, both vertical downward seepage flux and natural drainage showed a reverse relation with drain depth, while a slight change was found concerning natural drainage rate with increasing drain spacing. The increase of drain spacing showed a pronounced decrease in vertical downward seepage flux. It was found also that, the water table occurrence percentages were close under 30,40 and 60 m drain spacing. The effect of drain depth on lowering the water table and leaching salts

from soil profile was not as clear as the effect of drain spacing . A highly significant direct relation was found between (q) and (h). Moreover, it was found that the calculated drain spacings by Hooghoudt equation were wider than those calculated by Glover-Dumm equation, and more close to the actual installed drain spacings. Therefore, it is recommended to apply Hooghoudt equation in Meet Kenana area (light textured soil) . The overall average vertical downward seepage flux ranged between 3.27 and 3.83 mm/day , while the overall average natural drainage rate ranged between 1.47 and 1.97 mm/day after the installation of tile drainage system . Highly significant relations were found between pressure head difference (dh) and (h) , (q) and natural drainage. The installation of tile drainage increased the yield of maize from 17.31 to 56.73 % , while berseem increased in yield from 13.22 to 133.62% and wheat yield increased from 8.15 to 19.74% . The general recommendation from the economic point of view, is therefore, to apply drain spacing of 60 m with 120 cm drain depth in the study .

**Key Words :**

Drainage parameters - drain depth - drain spacing - drainage equations – water table – lateral discharges – light textured soils – water management – soil salinity .

## المخلص

تم إجراء هذه الدراسة فى منطقة ميت كنانة بمحافظة القليوبية بهدف دراسة تأثير أعماق الحقلیات و المسافات بينها على تصرفات الحقلیات ، عمق الماء الأرضى ، ملوحة التربة وإنتاجية بعض المحاصيل فى الأرضى خفيفة القوام بجمهورية مصر العربية . من ناحية أخرى تهدف هذه الدراسة أيضا إلى تقييم أداء معادلة الصرف (هوخ هاوت) والتي تمثل معادلة التدفق المستمر و معادلة (جلوفر-دم) التى تمثل معادلة التدفق الغير مستمر فى حساب المسافة بين الحقلیات للوصول إلى المعادلة المثلى التى تصلح للتطبيق فى مثل هذه الأرضى خفيفة القوام . هذا بالإضافة إلى معرفة المسافة المثلى بين المصارف الحقلية و العمق الأمثل لها والتي يمكن التوصية بها فى الأرضى خفيفة القوام بجمهورية مصر العربية .

و شملت معاملات الدراسة المسافات بين المصارف 30 ، 40 ، 60 ، 120 متر بينما كانت معاملات أعماق المصارف 100 ، 120 ، 130 سم من سطح الأرض . وقد أوضحت النتائج أن هناك علاقة عكسية بين المسافة بين الحقلیات وكلا من النسبة المئوية للماء الأرضى المتواجد على عمق أكبر من 80 سم من سطح الأرض ، عمق الماء الأرضى النسبى RGWD ، كمية الأملاح المزالة من القطاع الأرضى ودليل غسيل الأملاح SLI ، تصرفات الحقلیات وكذلك الضاغط الهيدروليكي فى منتصف المسافة بين الحقلیات ، بينما كانت العلاقة طردية مع عمق المصارف .

علاوة على ذلك ، وجد أن هناك علاقة عكسية بين عمق الحقلیات والرشح الرأسى لأسفل ومعدل الصرف الطبيعى ، بينما بزيادة المسافة بين الحقلیات انخفض معدل الرشح الرأسى لأسفل بدرجة واضحة وحدث تغير غير ملموس فى معدل الصرف الطبيعى . كما أكدت النتائج أن النسبة المئوية للماء الأرضى المتواجد على عمق أكبر من 80 سم من سطح الأرض كانت متقاربة تحت معاملات المسافات بين الحقلیات 30 ، 40 ، 60 متر ، وبناء على ذلك مع الأخذ فى الاعتبار الناحية الاقتصادية فإنه يوصى بتنفيذ المصارف على مسافة 60 متر مع عمق المصرف 120 سم بمنطقة ميت كنانة و التى تمثل الأرضى خفيفة القوام .

كما برهنت نتائج الدراسة أن تأثير المسافات بين الحقلیات على تخفيض مستوى الماء الأرضى و غسيل الأملاح من القطاع الأرضى كان أكثر وضوحا من تأثير أعماق الحقلیات .



ولقد وجد أيضا أن هناك علاقة موجبة عالية المعنوية بين تصرفات الحقلية و الضاغط الهيدروليكي في منتصف المسافة بين المصارف ، علاوة على ذلك وجد أيضا أن قيم المسافات بين المصارف المحسوبة بمعادلة هوخ هاوت كانت أكبر من تلك المحسوبة بمعادلة جلوفر - دم ، و كانت قيم معادلة هوخ هاوت أقرب لقيم المسافات الفعلية المنفذة على الطبيعة من تلك المتحصل عليها من معادلة جلوفر - دم ، وبناء على ذلك يوصى بتطبيق معادلة هوخ هاوت بمنطقة ميت كنانة التى تمثل الأراضى خفيفة القوام .

و قد أوضحت الدراسة أيضا أن متوسط الرش لأسفل بمنطقة ميت كنانة تراوح بين 3.27 و 3.83 مم / يوم بينما تراوح متوسط الصرف الطبيعى بالمنطقة بين 1.47 و 1.97 مم / يوم ، كما وجدت علاقة موجبة عالية المعنوية بين الفرق فى الضغط الهيدروليكي ( dh ) وكلا من الضاغط الهيدروليكي فى منتصف المسافة بين المصارف ( h ) ، تصرفات الحقلية ، الصرف الطبيعى .

و أكدت الدراسة أن تنفيذ شبكة الصرف المغطى بمنطقة ميت كنانة أدت إلى زيادة إنتاجية محصول الذرة بنسبة تتراوح بين 17.31 % - 56.73 % ، بينما تراوحت الزيادة فى محصول البرسيم بين 13.22 % - 133.62 % ، كما زاد محصول القمح بنسبة تتراوح بين 8.15 - 19.74 % .

وبناء على هذه النتائج وبالأخذ فى الاعتبار الناحية الاقتصادية فإنه يمكن التوصية باختيار المسافة بين الحقلية 60 متر مع عمق المصرف 120 سم فى الأراضى المصرية الخفيفة القوام مع تطبيق معادلة هوخ هاوت عند حساب المسافة بين الحقلية فى هذه الأراضى .

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