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Spectroscopic Investigation of Macro and Micro Nutrients in Al-Uja Area Soil for Date Palm Trees

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Spectroscopic Investigation of Macro and Micro Nutrients in Al-Uja Area Soil for Date Palm Trees

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Dedication

I dedicate this effort to the soul of my martyr brother

Raed Mahmud Ahmad Abu Hammad

Asmaa Mahmud Ahmad Abu Hammad

Declaration:

I Certify that this thesis submitted for the degree of Master, is the result of my own research, except where otherwise acknowledged, and that this study has not been submitted for a higher degree to any other university or institution.

Signed:

Asmaa Mahmud Ahmad Abu Hammad

Date: 10 / 4 /2019

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Many thanks for my amazing family Abu-Hammad family, brothers and sisters and all their children's. And also for my new family Abu-Dayah family, for their big support to achieve my goals.

A special thanks for my lovely husband Moath abu Dayah. Thank you for your true love that give me a huge power to continue and thanks for holding my hands when the others left.

Finally:

Fun of Access is fleeting, the Secret is in the Journey

Abstract:

In this study, soil samples from Date Palm farm in Al-Uja area were collected from different four sites. Soil samples were collected from 0-20, 20-40, 40 -60, and 60-80 cm depth of equal 50cm distances from the trunk of the tree.

The main objective of this study was to develop and implement a new methodology for the first time in Palestine that study plant nutrients of soil, by using a spectroscopic techniques and give a better understanding for the relationship between soil and fertilizers based on vibrational mid-Infrared (IR) spectroscopy, fluorescence spectroscopy, fluorescence - Xray spectroscopy, and for macro and micro elements in soils samples mass spectrometer (ICPMS) was used.

The study is divided into two parts, the first one related to investigate the effect of using different types of fertilizers on soil using spectroscopic techniques, this part of study was carried out from real field area where blank and treated samples are collected from different four positions in Al-Uja area and consider as business as usual. The second part was conducted in the lab by using blank samples that were collected from filed and treats them by certain concentration of feed solutions that prepares in lab and then study the relation between these feed solutions and soil by using the same spectroscopic techniques.

For the first part of study, lab analysis for soil samples showed that the soil were sandy loam and loam in texture and the salinity rang were between saline and very saline soils with pH in range 7-8.5 and that was the favorite soil properties for date palm tree.

ICPMS analysis showed that the soil for all position of the study area site were suffered from the lack of micro nutrients, also the macronutrients levels were around the very low range at different depth except the sodium levels were very high in all positions.

The fluorescence analysis showed that the intensities for all positions decreases as the depth increase and that indicated that there was a strong binding between fertilizers and soil as soil depth increasing and in particularly in depth 80 cm.

The FTIR analysis showed a three bands assignment for all of positions and showed the intensity-depth dependents and they exhibiting the difference between fertilizers samples and control ones.

The X-rays analysis shows a powerful data that showed the minerals of soil of the study site for position one (P_1) and four (P_4), it showed that the most minerals were found in depth 60cm for both positions. And shows the most chemical compositions for the study area.

For the second part of study, the relation between fertilizers concentrations and soil were difficult to study because of there a various other variables effect this relation such as pH value variable and the environment variable, the fluorescence showed the intensity concentration dependent for the first two positions of the study site and showed a different relation for the other positions.

The ATR-FTIR analysis were a powerful tools, the spectrum showed the intensity concentration independent. And give a huge band assignments of functional groups peaks in soil.

This present study showed that the spectroscopic techniques were a useful tools for given a better understanding of the relationship between the depth of soil and the interaction between soil and fertilizer

The soil analysis indicates the over salinity of soil farm and this may refer to an increase of the underground level caused by excessive drought situations (high evaporation); and also refer for the using of high salts content water. This high values of salinity make a negative impact on soil such as high concentrations of soluble salts, and high soil pH, and a negative effect of sodium on the plant metabolism.

From results of the four positions on the study area it was clear that the applied fertilizers are not site- specific and not finely tuned to local soil chemical conditions. So it need a specific information on soil nutrients and improving soil fertility using agroforestry techniques.

We recommended also to make a up scaling study for all Date Palm trees areas in order to be soured if this deficiency presents in all sites or not.

For future work it's useful if study the relation between fertilizers and soil through a simulation study based on leaf/soil analysis and date palm requirements using these same spectroscopic techniques.

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دراسة طيفية للمغذيات الكبيرة والمغذيات الدقيقة في تربة منطقة العوجا لإشجار النخيل

إعداد: أسماء محمود ابوحماد

إشراف: أ.د.عامر مرعي

ملخص:

في هذه الدراسة، تم جمع عينات تربة من مزرعة نخيل التمر في منظقة العوجا من مواقع مختلفة من المزرعة مقسمة الى اربع مواقع، عينات التربة التي تم جمعها من اعماق مختلفة تتراوح ما بين 0-20 سم، 20-40 سم، 40-60 سم، 60-80 سم من مسافات متساوية قريبة من جذع الشجرة.

كان الهدف الرئيسي لهذه الدراسة هو تطوير منهجية جديدة تستخدم لاول مرة في فلسطين تحدد اهم المغذيات النباتية الاساسية للنبات وزيادة فهم العلاقة بين عمق التربة والتفاعل ما بين التربة والاسمدة المغدية بالإضافة الى فهم العلاقة بين اضافة تراكيز مختلفة من الاسمدة للتربة باستخدام تقنيات التحليل الطيفي القائمة على التحليل الطيفي للاشعة تحت الحمراء(IR) الاهتزازية، مطافية الفلورة(FS)، مطيافية الاشعة السنينة بالإضافة الى مطياف الكتلة(ICPMS) المستخدم في قياس العناصر المغذيات الكبيرة والدقيقة ايضاً. حيث اظهرت هذه الدراسة ان التقنيات الطيفية شكلت ادوات بحث مفيدة لإعطاء فهم أفضل للعلاقة بين الاسمدة والتربة.

اشتملت الدراسة على قسمين لكل قسم هدف يرمو اليه، القسم الاول هدف الى دراسة العلاقة ما بين عمق التربة والاسمدة المغدية والقسم الثاني كان الهدف منه هو دراسة العلاقة ما بين تركيز الاسمدة المغذية والتربة.

بالنسبة للقسم الاول من الدراسة، أظهر التحليل المخبري لعينات التربة ان التربة كانت طميية رملية وطميية في القوام، وأن رواسب الملوحة كانت تتراوح ما بين التربة المالحة والمالحة جدا مع درجة حموضة ما بين 7-8.5 وكانت خصائص التربة الكيميائية هذه جيدة نوعا ما لإنبات محصول النخيل. ومن تحليل ICPMS أضهرت النتائج ان كل المواقع في منطقة الدراسة تعاني من نقص نسبة المغذيات الدقيقة وايضا مستويات المغذيات الكبيرة كانت حول المدى المنخفض والمنخفض جدا بإستثناء مستويات الصوديوم التي كانت عالية جداً من جميع المواقع.

كما وأظهرت نتائج تحاليل الفلوريسنت ان كثافة الفلورة تتناقص مع زيادة العمق وهذا ما يشير الى وجود ارتباط قوي بين الاسمدة والتربة مع زيادة العمق وخاصة في العمق 80 سم. وأظهرت تحاليل FTIR ثلاثة مناطق لذروة الاطياف في جميع المواقع وتم دراسة التاثيرات الناجمة عن زيادة العمق على القمم المختلفة الموجودة في مناطق الذروة. حيث أظهرت النتائج الارتباط القوي الواضح الناجم عن الاعماق المختلفة للتربة مع الاسمدة.

وأظهر تحليل الاشعة السينية، بيانات قوية ومفيدة جداً أظهرت معادن التربة في مواضع بداية ونهاية منطقة الدراسة المتمثلة في الموقع الاول والموقع الرابع، حيث عثر على معظم المعادن متمركزة في العمق 60 سم لكلا الموقعين، كما وأظهرت انواع مختلفة من المعادة ظهرت في الموقع الرابع ولم تثبت ظهورها في الموقع الاول وهذا ما يدعي الى الاهتمام بالاختلاف بنسبة التسميد ما بين بداية ونهاية موقع الدراسة.

أما بالنسبة للقسم الثاني من الدراسة، كان من الصعب دراسة العلاقة بين تراكيز الاسمدة المختلفة والتربة بسبب وجود عدد من العوامل الاخرى المؤثرة على هذه العلاقة مثل درجة الحموضة او البيئة المحيطة للتجربة، جيث أظهر تحليل

الفلورة اعتماد كثافة الفلورة على التركيز حيث زادت نسبة الكثافة مع زيادة التركيز للمواقع الاولية من منطقة الدراسة، بينما اظهرت علاقة مختلفة تماما في المواقع الاخرى.

كما وظهر تحليل ATR-FTIR كأداة قوية واكثر افادة من FTIR لتزويده بمعلومات عن المواضع التي تظهر بها ذروة الاكاسيد على مدى رقم موجي اكبر من 3300سم$^{-1}$ كما وكانت النتائج تعطي ان الكثافة لا تعتمد على زيادة التراكيز.

اما بالنسبة للتوصيات الناتجة عن هذه الدراسة، فإننا نوصي بزيادة الاهتمام بإضافة المعذيات الكبيرة واعطاء المزيد من الاهتمام لإضافة المغذيات الدقيقة ايضاً .

نقترح في دراسة مستقبلية دراسة العلاقة ما بين إضافة الاسمدة وتأثيرها على نبتة تمر النخيل كنبات وكثمرة وذلك باستخدام ذات الاساليب الطيفية من اجل الحصول على صورة واضحة لتأثير إضافة الاسمدة على التربة والنبات على حدٍ سواء.