Deanship of Graduate Studies

Al-Quds University

The Impact of Tobacco Cultivation on the Concentration of Macro and Micro Nutrients in Soil / Case Study Ya'bad Jenin

Saja Mohammad Abdelrahman Ghannam

M. Sc. Thesis

Jerusalem- Palestine

1440 / 2019

The Impact of Tobacco Cultivation on the Concentration of Macro and Micro Nutrients in Soil / Case Study

Ya'bad Jenin

Prepared By:

Saja Mohammad Abdelrahman Ghannam

B.Sc. Public and Environment Health

Arab American University- Palestine

Supervisor: Dr. Amer Marie

A thesis Submitted in Partial Fulfillment of Requirements for the Degree of Master of Environmental and Earth Science /Faculty of Graduated Study Al-Quds University

1440/2019

Al-Quds University

Deanship of Graduate Studies

Applied Earth & Environmental Science

Thesis Approval

"The Impact of Tobacco Cultivation on the Concentration of Macro and Micro Nutrients in Soil / Case Study Ya'bad Jenin"

Student Name: Saja Mohammad Abdelrahman Ghannam

Registration No: 21620391

Supervisor: Dr. Amer Marei

Master thesis submitted and accepted date: 9/5/2019

The names and signatures of the examining committee members are as follows:

1-Head of committee: Dr. Amer Marie signature :.....

2- Internal Examiner: Dr. Jawad Shoqair signature: .....

3- External Examinar: Dr. Saed Khayat signature: .....

Jerusalem- Palestine

1440/2019

Dedication

"To our Profit Mohammad (Peace and upon him)"

To everyone helped me achieve this dream

To my family

To my love

To my self

Declaration

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

Signed  ……..

Saja Mohammad Abdelrahman Ghannam

Date: 9 / 5 / 2019

Acknowledgments:

I am grateful to all of those with whom I have had the pleasure to work during this and other related projects. Each of the members of my Dissertation Committee has provided me extensive personal and professional guidance and taught me a great deal about both scientific research and life in general. I would especially like to thank Dr. Amer Marei, the chairman of my committee. As my teacher and mentor, he has taught me more than I could ever give him credit for here. He has shown me, by his example, what a good scientist (and person) should be.

Nobody has been more important to me in the pursuit of this project than the members of my family. I would like to thank my parents, whose love and guidance are with me in whatever I pursue. They are the ultimate role models. Most importantly, I wish to thank my loving and supportive husband Tariq, who provide unending inspiration.

Abstract

Tobacco cultivation is widespread in northern Palestine, it's one of the main crops Ya'bad city (study area) because they rely heavily on income and profit. Tobacco cultivation depends on curing leaves to production and marketing, and there are several types prevalent in the study area, the main type is Virginia tobacco. Tobacco plant works to absorb the macronutrients largely, because it is a leave crop that absorbs nutrients, leading to soil erosion. Therefore, the main objective of the study is to evaluate the impact of Tobacco cultivation on the concentrations of macro- and micronutrients nutrients in comparison with non-cultivated soil. Soil samples are collected from two depths, 5 and 10 cm.

No different of Nitrogen contents in 5 and 10 cm depth in tobacco soil 0.25 and 0.26 respectively, but in tobacco soil Nitrogen is lower than of non-treated soil 0.31 and 0.32 in 5 and 10 cm depth. Average phosphorus and potassium contents in tobacco soil in 5 cm depth are 18.1 and 342.6 mg/kg respectively, in 10 cm depth is 18.1 and 341.9 mg/kg, which is higher than the non-treated soil in two depth in Phosphorus is 14.4 and 279.9 mg/kg respectively, and in 10 cm depth in non-treated soil is 14.5 and 279.4 mg/kg, this was due to the addition of phosphate and potash fertilizer which was raised in the tobacco soil.

Calcium contents in tobacco soil is less than non-treated soil, in tobacco 5 cm depth is 1481.1 mg/kg and in 10 cm depth is 1492.3 mg/kg, and non-treated soil in 5 cm is 1615.9 mg/kg, in 10 cm is 1621.8 mg/kg, this could be due to the impact of phosphate and potassium fertilization, which led to calcium deficiency in the soil. The magnesium contents in both depths in the soil of tobacco was lower than the non-treated soil, in tobacco 5 and 10 cm is 332.3 and 333.2 mg/kg respectively, and non-treated soil in 5 and 10 cm depth is 336.9 and 338.8 mg/kg respectively, due to the high percentage of calcium in the soil of the study area, because of the nature of the parent rocks containing calcite. This led to the reduction of magnesium in the both soil and both depth, and also due to phosphate fertilization in tobacco soil, this lead to reduce the proportion of magnesium in tobacco soils. As for sodium, a small percentage in both lands due to lack of irrigation of the land is considered a non-saline land.

Average Micronutrients in two depth in tobacco land was not significantly affected. Iron, boron, zinc, copper, nickel, cadmium, manganese were the ratios of 6.6, 0.55, 0.24, 0.21, 0.21. 0.08, 0.06 mg/kg respectively, while in non-treated soil were iron, boron, zinc, nickel, copper, cadmium, manganese, the ratios were 4.00, 0.36, 0.22, 0.15, 0.14, 0.07, 0.04, respectively. Therefore, tobacco cultivation has a significant impact on the major nutrients. Micronutrients did not have much effect so there were no significant differences between the two lands.

دراسة تأثير زراعة التبغ على المغذيات الكبرى والصغرى في التربة في منطقة يعبد / جنين

إعداد: سجى محمد عبد الرحمن غنام

المشرف: الدكتور عامر مرعي

الملخص

تنتشر زراعة التبغ في شمال فلسطين، وهي واحدة من المحاصيل الرئيسية لمدينة يعبد (منطقة الدراسة) لأنها تعتمد اعتمادًا كبيرًا على الدخل والربح. تعتمد زراعة التبغ على معالجة الأوراق للإنتاج والتسويق ، وهناك عدة أنواع منتشرة في منطقة الدراسة، النوع الرئيسي هو تبغ فيرجينيا. يعمل مصنع التبغ على امتصاص المغذيات الكبيرة إلى حد كبير، لأنه محصول ورقي يمتص العناصر الغذائية بشكل كبير، مما يؤدي إلى تآكل التربة. لذلك فإن الهدف الرئيسي من هذه الدراسة هو تقييم تأثير زراعة التبغ على تركيزات المغذيات الكبيرة والمغذيات الدقيقة مقارنة بالتربة غير المزروعة. يتم جمع عينات التربة من عمقين، 5 و10 سم.

لا يختلف محتوى النيتروجين في عمق 5 و10 سم في تربة التبغ 0.25 و 0.26% على التوالي، ولكن في تربة التبغ يكون النيتروجين أقل من التربة غير المعالجة 0.31 و 0.32% في عمق 5 و 10 سم.

متوسط محتوى الفوسفور والبوتاسيوم في تربة التبغ بعمق 5 سم هو 18.1 و 342.6 ملغم/ كغم على التوالي، وعمق 10 سم هو 18.1 و341.9 ملغم / كغم، وهو أعلى من التربة غير المعالجة. الفوسفور والبوتاسيوم في التربة غير المعالجة في عمق 5 سم هو 14.4 و 279.9 ملغم / كغم على التوالي، وعمق 10 سم في التربة غير المعالجة 14.5 و 279.4 ملغم/ كغم، ويعزى ذلك إلى إضافة الأسمدة الفوسفاتية والبوتاسية التي تم اضافتها في تربة التبغ.

محتويات الكالسيوم في تربة التبغ أقل من التربة غير المعالجة، في تربة التبغ 5 سم 1481.1 ملغم / كغم وعمق 10 سم هو 1492.3 ملغم/ كغم، والتربة غير المعالجة 5 سم هي 1615.9 ملغم/ كغم، في 10 سم 1621.8 ملغم/ كغم، وهذا يمكن أن يكون بسبب تأثير التسميد الفوسفاتي والبوتاسي، مما أدى إلى نقص الكالسيوم في التربة. كانت محتويات المغنيسيوم في كلا العمقين في تربة التبغ أقل من التربة غير المعالجة ، في التبغ 5 و10 سم 332.3 و 333.2 ملغم /كغم والتربة غير المعالجة

بعمق 5 و 10 سم 336.9 و 338.8 ملغم/ كغم على التوالي، بسبب ارتفاع نسبة الكالسيوم في تربة منطقة الدراسة ، بسبب طبيعة الصخور الأم التي تحتوي على الكالسيت. وقد أدى ذلك إلى تقليل المغنيسيوم في كلا الارضين، وأيضًا بسبب تسميد الفوسفات في تربة التبغ ، مما أدى إلى تقليل نسبة المغنيسيوم في تربة التبغ. أما بالنسبة للصوديوم، فإن نسبته صغيرة في كلتا الأرضتين بسبب نقص ري الأرض, وايضا تعتبر أرضًا غير مالحة.

لم يتأثر متوسط المغذيات الصغرى في كلا العمقين في أرض التبغ بشكل كبير. كان الحديد والبورون والزنك والنحاس والنيكل والكادميوم والمنغنيز نسب 6.6 ، 0.55 ، 0.24، 0.21 ، 0.21. 0.08 ، 0.06 ملغم / كغم على التوالي، بينما في التربة الغير معالجة كانت الحديد، البورون، الزنك، النيكل، النحاس، الكادميوم، المنغنيز، كانت النسب 4.00 ، 0.36 ، 0.22 ، 0.15 ، 0.14 ، 0.07 ، 0.04 ، على التوالي. لذلك فإنّ زراعة التبغ لها تأثير كبير على العناصر الغذائية الرئيسية، لم يكن للمغذيات الدقيقة تأثير كبير لذا لم تكن هناك فروق ذات دلالة إحصائية بين الأراضي.

Table of content

Dedication I
Declaration I
Acknowledgments: II
Abstract III
الملخص IV
List of table VIII
List of figure IX
Chapter one 1
Introduction 1
1.1 History of tobacco cultivation 1
1.2 Physiology of tobacco plant: 4
1.3 Major types of tobacco plants 5
1.4 Fertilization of tobacco 5
1.5 Tobacco cultivation in the area study (Ya'bad) 6
1.6 Phases of tobacco cultivation 8
1.7 Soil types in Palestine 9
1.8 Tobacco cultivation and environment 9
1.9 Research Goals: 11
Chapter two 12
Literature review 12
Chapter three 18
Materials and methods 18
3.1 Study site and field experiment 18
3.2 Soil sampling and general soil characteristics 21
3.3 Lab work 22
3.2 Statistical analysis 26
Chapter four 27
Results and discussion 27
1.4 Soil pH and EC 27
2.4 Organic matter content 29
3.4 Macronutrients concentration 30

4.4 Micronutrient and heavy metals 43
Conclusion: 53
Recommendation: 54
References: 55
Appendixes 604

List of table

Table 1: Tobacco producing countries worldwide in 2016 (in 1,000 metric tons). 2

Table 2: Fertilizer need Kg nutrient/ha in some country about FAO. 6

Table 3: The land area in all town in Jenin disrtrict in 2017 according MOA. 7

Table 4: The CEC and Percent Base Saturation for tobacco soil in K, Mg, Ca, Na at pH=7.3. 42

Table 5: The CEC and Percent Base Saturation for controlled soil in K, Mg, Ca, Na at pH=7.5. .. 42

List of figure

Figure 1 : Land cultivated in last three years in Jenin district..... 4
Figure 2 : Location of the tobacco and virgin soil sample in study area by GIS 18
Figure 3 : Samples of tobacco soil on 5, 10 cm depth 19
Figure 4 : Samples of virgin soil on 5, 10 cm depth. 20
Figure 5 : steps of extraction of soil samples and analyze ph. and EC 22
Figure 6 : atomic absorption spectroscopy (AAS) machine. 23
Figure 7 : by inductively coupled plasma mass spectrometry (ICP-MS) machine. 24
Figure 8 : acidification of soil sample to analyze micronutrient. 24
Figure 9 : furnace device for heating samples to analyses SOM 25
Figure 10 : pH properties of tobacco and controlled soil sample. 28
Figure 11 : EC properties of tobacco and controlled soil sample. 29
Figure 12 : Organic matter content in tobacco and controlled soils. (O.T is controlled soil) 30
Figure 13 : concentration of N in tobacco plot and control plot in depth 5 cm. 31
Figure 14 : concentration of N in tobacco plot and control plot in depth 10 cm 32
Figure 16 : concentration of P in tobacco plot and control plot in depth 10 cm. 34
Figure 17 : concentration of K in tobacco plot and control plot in depth 5 cm 37
Figure 18 : concentration of K in tobacco plot and control plot in depth 10 cm. 36
Figure 19 : concentration of Ca in tobacco plot and control plot in depth 5 cm. 37
Figure 20 : concentration of Ca in tobacco plot and control plot in depth 10 cm. 38
Figure 21 : concentration of Mg in tobacco plot and control plot in depth 5 cm. 39
Figure 22 : concentration of Mg in tobacco plot and control plot in depth 10 cm. 39
Figure 23 : concentration of Na in tobacco plot and control plot in depth 5 cm. 41
Figure 24 : concentration of Na in tobacco plot and control plot in depth 10 cm. 41
Figure 25 : concentration of B and Al in tobacco plot and control plot in depth 5 cm. 44
Figure 26 : concentration of B and Al in tobacco plot and control plot in depth 10 cm. 44
Figure 27 : concentration of Fe in tobacco plot and control plot in depth 5 cm. 46
Figure 28 : concentration of Fe in tobacco plot and control plot in depth 10 cm. 46
Figure 29 : concentration of Cu, Cd, Zn, Ni and Mn in tobacco plot and control plot in depth 5 cm……..……..…50
Figure 30 : concentration of Cu, Cd, Zn, Ni and Mn in tobacco plot and control plot in depth 10 cm…….....50

Chapter one

Introduction

1.1 History of tobacco cultivation

1.1.1 Tobacco cultivation in the world

The history of tobacco cultivation starts around eight thousand years ago, when two species of the plant, Nicotiana rustica and Nicotiana tabacum dispersed by Amerindians through both the southern and northern American continent. Was called the (holy herb) because they used it in medicine to treat dental pain, until the very end of the fifteenth century no one outside the American continents had any knowledge of the cultivated varieties of this plant. Today its grown in more than 120 countries, and its manufactured product are known to virtually everyone (Galloway, 1995).

Tobacco is one of the few crops entering world trade entirely on a leaf crop and is the most widely grown commercial non-food plant in the world. Tobacco is grown as far north as 60° N latitude and south as 40° S latitude in over 100 countries including China, India, Brazil, United States, and Indonesia (Simmons, J., 2004). The statistic of amount of tobacco produce in the worldwide in 2016, in this year, China was the biggest tobacco producer worldwide with an amount of some 2.8 million metric tons of tobacco produced (Table. 1). (Marlene Greenfield, 2016).

In Pakistan, especially in Khyber Pakhtunkhwa, tobacco is major cash crop for the farmers. The chemical composition of tobacco leaf plays a key role in the evaluation of tobacco quality. The absolute and relative amount of these constituents not only depends on crop varieties and maturity, soil, climatic condition and curing process, but also depends on the responsive mineral nutrition of tobacco crop, such as boron (Ali, et al., 2015).

Table 1: Tobacco producing countries worldwide in 2016 (in 1,000 metric tons).

Country	Tobacco production
China	2850.62
India	761.32
Brazil	675.55
USA	285.18
Indonesia	196.15
Zimbabwe	172.27
Zambia	124.64
Pakistan	116.16
United Republic of Tanzania	102.47
Argentina	93.67

Around the world, cultivated tobacco about 3.9 million ha, of which 60% is flue-cured tobacco, 13% is Burley tobacco, and 12% is Oriental. The mineral nutrient requirements of different tobacco types vary according to their specific characteristics, resulting in the need to formulate different fertilization programs in order to maximize the yield, profitability, and quality (Hoyos et al., 2015).

1.1.2 Tobacco cultivation in Middle East North Africa (MNA)

The Middle East and North Africa (MENA) region includes 19 countries: Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates (UAE) and Yemen. In 1999, MENA accounted for 3.7% of the world's total cigarette consumption, and 5% of the world's population. So cigarette consumption shows an increasing trend in many MENA countries (East, 2001).

Tobacco remains an attractive crop for farmers. Its cultivation utilizes significant portions of agricultural land in the southwest Asia that might otherwise have been used for much-needed rice or other food crops. Tobacco agriculture is further encouraged by support from the cigarette manufacturing companies and tobacco industry (Guazon, 2008).