DETERMINATION BEST SOIL MANAGEMENT PRACTICES BYSOIL QUALITY ASSESSMENT OF ERDEMLI MICROCATCHMENT

Karwan Fatah MAARUOF

Master Thesis

Department of Soil Science and Plant Nutrition

Supervisor: Prof Dr. ALAADDİN YÜKSEL

2017

REPUBLIC OF TURKEY
BINGOL UNIVERSITY
INSTITUTE OF SCIENCE

DETERMINATION BEST SOIL MANAGEMENT PRACTICES BY SOIL QUALITY ASSESSMENT OF ERDEMLI MICROCATCHMENT

MASTER THESIS

Karwan Fatah MAARUOF

Department Institute : SOIL SCIENCE AND PLANT NUTRITION

Supervisor of Thesis : Prof Dr. ALAADDİN YÜKSEL

January 2017

REPUBLIC OF TURKEY
BINGOL UNIVERSITY
INSTITUTE OF SCIENCE

DETERMINATION BEST SOIL MANAGEMENT PRACTICES BY SOIL QUALITY ASSESSMENT OF ERDEML MICROCATCHMENT

MASTER THESIS

Karwan Fatah MAARUOF

Department Institute : Soil Science and Plant Nutrition

This thesis was approved unanimously by the following jury in the date of 16/01/2017

Prof Dr. ALAADDİN YÜKSEL President of the Jury	Prof. Dr. Recep GÜNDOĞAN Member	Assoc. Prof. Dr. Abdulkadir SÜRÜCÜ Member

The above results has been approved by

Prof. Dr. İbrahim Y. ERDOĞAN
Director of the institute

PREFACE

To begin with, I thank God for his blessing who made me able to complete and perform this study with success. I would like to thank my supervisor Prof. Dr. Aladdin Yuksel for his patience and guidance throughout this long project.

My gratitude and appreciation are dedicated to the presidency of Bingol University, the deanery of College of Agriculture and to the head of soil and plant nutrition Department for their necessary facilities during the work.

Deepest gratitude to Prof Dr. Abdulkadir Sürücü for his encouragement and scientific advices throughout the period of this work. I am also grateful to Dr.Ali Raz demirkiran. For his valuable remarks. Special thanks to Dr. Yassin Demir for her comments and corrections. I express my thanks also to, Dr. Veysel Turan. And Kadriye, laboratory that helps me in my work by a process. I would like to thank Dr. Nuri. That helps me in my making map. I would like to thank all of my friend’s special Mr. Zaniar Jamal.

Last but not least, I express my sincere gratitude to my family for their support, cheerfulness, patience, and encouragement. Finally, I thank all those who assisted me in doing my work.

Dedication

I dedicate this work to my parents and my sisters.

Karwan Fatah MAAROUF
Bingol 2017

CONTENTS

LIST OF SYMBOLS AND ABBREVIATIONS

SYMBOL	:	DESCRIPTION
pH	:	Hydrogen Ion Concentration
EC	:	Electrical Conductivity
$CaCO_3$	:	Carbon Calcium
OM	:	Organic Matter
K_2O	:	plant-Available Potassium
P	:	Phosphorus
K	:	Exchangeable Potassium
NT	:	Total Nitrogen
P_2O_5	:	Available Phosphorus
Na	:	Exchangeable Sodium
Texture Class	:	Include (Soil sand, silt and clay)
BMP_S	:	Best Soil Management Practices
GIS	:	Geographic Information System
GPS	:	Global Positioning System
ANOVA	:	Analysis of Variance
$NaHCO_3$	:	Sodium Bicarbonate
POX	:	Peroxides

$K_2Cr_2O_7$	:	Potassium Dichromate
H_2SO_4	:	Sulfuric Acid
m	:	Meter
cm	:	Centimeter
Kg	:	Kilograms
G	:	Gram
ha	:	Hectare
meq	:	Millieqivalant
%	:	Percentage
ppm	:	Parts Per Million
C°	:	Degree Celsius
mm	:	Mille Meter
ml	:	Milliliters
Hr	:	Hour
SQ	:	Soil Quality
NPK	:	Nitrogen , phosphorus and potash
SOM	:	Soil Organic Matter
H	:	Hydrogen
NaH_2PO_4	:	Sodium Phosphate Mono basic
S.S.	:	Sampling Site
D.w	:	Distilled Water
HNO_3	:	Nitric Acid
M	:	Morality
NH4OAc	:	Ammonium Acetate

$Na_2HPO_4.2H2O$	:	Sodium Phosphate Dibasic Dehydrate
MM	:	Molar Mass
SPSS	:	Statistical Packages for the Social Sciences
CT	:	conservation tillage
UNESCO	:	United Nations Educational, Scientific, Culture Organization
μS	:	Microsites
Pg	:	Propylene Glycol
FAO	:	Food and Agriculture Organization
NS	:	Number samples
Km2	:	kilometer square

LIST OF FIGURERS

LIST OF TABLES

ERDEMLI MIKROKABUĞUNUN TOPRAK KALITESI DEĞERLE-NDIRMESIYLE EN İYI TOPRAK YÖNETIM UYGULAMALARININ BELIRLENMESI

ÖZET

Mikrohavzalar, su ve havanın çevre kalitesinin korunması, bitki ve hayvan verimliliğinin sürdürülmesi, hidrolojik toprak özelliklerinin belirlenmesi, toprak erozyonunun azaltılması, toprak kirliliğinin önlenmesi, yeraltı suyunun arttırılması ve su temini için arazilerin sulanması gibi birçok nedenden ötürü hayati önem taşımaktadır. Bu araştırmanın amacı, Bingöl ili Erdemli mikrohavzasının bazı toprak kalite parametrelerinin değerlendirmesiyle en iyi toprak yönetimi uygulamalarını belirlemektir. Çalışmada belirli bir alanda bitkisel üretimin iyileştirilmesinde en iyi toprak yönetimi uygulamalarının rolünü değerlendirilmeye çalışılmıştır. Çalışma ağırlıklı olarak toprak kalitesinin ve toprak yönetimi uygulamasının geliştirilmesine odaklanmıştır. Bu amaçla 839 717 hektarlık bir alanda 80 noktadan 0-30cm,30-60cm,60-90cm ve 90-120 cm derinlikten toprak örnekleri alınmıştır. Çalışma alanine ait haritalar, Erdemli Mikrohavzasından elde edilen sayısal verilerin Bingöl Üniversitesi Uzaktan Algılama Merkezi'nde analiz edilmesiyle hazırlanmıştır,Araştırma alanı topraklarının fiziksel ve kimyasal analiz sonuçları ortalama; organik madde %2,1pH, 7,8.Elektriksel iletkenlik 430, 32 µS/cm,($CaCO_3$)% 2, 18, (P_2O_5)11, 495 ppm,(K_2O)190,46 ppm, Kum %42,3 ve Kil%29,10 ve silt %28,57 ve toplam azot % 0,121 ve sodyum 76.94 ppm, toprak kalitesi ve mikrohavza.olarak bulunmuştur Elde edilen sonuçlara göre araştırma alanı topraklarının organic madde ve kireç içerikleri düşüktür. Ayrıca toprakların tuzluluk sorunu bulunmamıştır.Diğer yandan toprakların bünyesi kumlu tın ve kumlu killi tın sınıfında olup toplam azot, P_2O_5 ve K_2O içeriği bakımından düşük bulunmuştur. En iyi toprak yönetimi uygulamalarının belirlenmesi, tarımsal üretimi iyileştirmek için önemlidir.Mikrohavzada toprak kalitesinin iyileştirilmesi, organik madde ilavesi ve toprağa azot eklenmesi gibi birçok uygulamayla ilgilidir. Uygulamaya gerek olmadan toprağın organik madde ve bitki besinlerini muhafaza etmesi, bitki besinlerinin erozyonla giderilmesinden kaynaklanıyordur. Ayrıca, topraktaki yüksek kaliteli organik madde ve bitki besin maddeleri, toprak kalitesinin iyileştirilmesine ve yüksek tarım üretiminin artmasına neden olmuştur.

Anahtar kellimler: toprak yönetimi, toprak haritalaması, toprak kalitesi ve mikrohavza.

DETERMINATION BEST SOIL MANAGEMENT PRACTICES BY SOIL QUALITY ASSESSMENT OF ERDEMLI MICROCATCHMENT

ABSTRACT

The microcatchment.is vital for many reasons including, maintaining water and air quality in environment, sustaining plant and animal productivity, determining the hydrology soil properties, reducing soil erosion, preventing soil pollution, increasing ground water and irrigating lands to manage water supply. The aim of this research is to determinate the best soil management practices by soil quality assessment of Erdemli microcatchment in Bingol province. İn study was to assess the role of best soil management practices in improving crop production in the study area. The study was mainly focused on improving the soil quality status and soil management practice. The soil samples were taken from a depth of 0-30 cm, 30-60 cm, 60-90 cm, and 90-120 cm. The suitable method of total of 80 points was taken in 839717 hectares. The maps of the study area were prepared by analyzing the numerical data obtained from the field at Bingöl University Remote Sensing Center. The results of the physical and chemical analysis of the soil of the study area are determined: organic matter 2.1%, pH 7.18, electrical conductivity 430.323 µS/cm, $CaCO_3$ 2.18 %, $P_2O_5$11.49 ppm, K_2O 190.46 ppm, Sand 42.3%, Clay 29.10%, Silt 28.57%, total nitrogen 0.121% and sodium 76.944 ppm. According to the obtained results in this research, there is less organic matter and lime. Furthermore, there isn't soil salinity in the used area. The obtained texture class of the soil was sandy loam and sandy clay loam and less total nitrogen and stuffiness of K_2O, P_2O_5. Determining the best soil management practices is significant to improve crop production. Improving soil quality are related to many practices such as collecting water, addition of organic matter and adding nitrogen to the soil. Maintaining organic matter and plant nutrients of the soil without the practices might was due to the removal of plant nutrient by erosion. Furthermore, high-quality of organic matter and plant nutrients in the soil resulted in improving soil quality and increasing high agriculture production.

Key Words: soil management, soil mappings, soil quality and microcatchment.

1. INTRODUCTION

Soil is precious natural resources for various productions. Soil quality and soil management are a vital factor to continue and develop agricultural production. Soil management has a significant effect on agriculture management for six basic principles such as different types of tillage and practice of tillage that have an important influence to increase agricultural sustainability, improving soil quality through soil organic matter which has a positive impact on physical, chemical and biological property of the soil, retention of water and plant nutrients, increasing in soil biodiversity, reducing in soil erosion (Illinois Agronomy Handbook), preventing of soil pollution, managing of crop rotation to improve soil quality and providing basic nutrient and water to grow plants. Addition, nowadays, the soil erosion damage mainly is caused by flood and wind factors (Daily et al. 1997).

All topographic factors have an effected on crop production, the number, and type of tillage practices also are affected by topographic and province range rainfalls hits. Collecting water in a determination area is called basic that is crucial to reduce erosion and increase groundwater resulted in water availability for irrigation process in agriculture and providing in the electric sector and drinking water to people. But the number has point worse .These are practically depend be climatic and characteristics. Furthermore, the soil is a crucial resource to grow plants because of providing basic nutrients and water (Anonymous, 2016)

Soil management practices refer to the practices which improve the properties of the soil including physical, chemical, and biological sectors, these soil properties resulted in improved germination and crop growth (Ministry of Agriculture and water resources, 2001). Soil management process has a positive effect to avoid bad microorganisms in

The soil such as bacteria, fungi, protozoa, nematodes, arthropods. In addition, soil and releasing greenhouse gasses which these are resulted in increased agriculture production management is important for recycling nutrients and organic wastes, and also for storing (Anonymous, 2016).

As a result of topographic structure of the rainfalls are stored, it is collected in a channel of the runoff waters (catchment area) and called the entire basin of the area remaining in the domain of these events. The project consists of six essential practices: i. improving of irrigation management .ii.enhaning tolerance of crop variegates against drought and pest diseases. iii. Improved water conservation. iii. Making best decision by farmers based on analyses of soil and water supply system .iiii protection of flooding problem properly. iiiii. improved soil moisture content and reduce erosion. These practices not only have positive impact on environmental sustainability but also making resilience to climatic change rendering reports issued by (Daily et al. 1997)

Soils are a basic component of farm production because they supply water storage, aeration, nutrients, plant anchorage, and proper environments for soil microorganism. Farmers can assess treatment options and use decision- support tools to objectives. These decisions require a basic understanding of soil science principles, soil morphology, soil form origin, soil classification, nutrient cycling, and best soil management practices. Determining of soil profile and soil testing resulted in improving soil quality. Soil testing should include pH, EC, Om, carbonate calcium. Sodium, phosphorus, potassium, and total nitrogen data. The evaluation methods were undertaken to identify enhancing soil which resulted in increased agriculture productivity. Also these ways are used to determine the hydrologic characteristics of the soil preserve water and air quality. The The aim of this research is to determine the best soil management practices via soil quality assessment of Erdemli Microcatchment in Bingöl region and soil component to agriculture and also to restore those soils where have been damaged.

2. LITERATURE REVIEWS

Soil is the most effective factor that affects agriculture. To maintain soil, one must manage it, to manage soil there are some practices adopted. The main purpose of soil management is to take control over the level of pollutants in elope (runoff) during cultivating, and to change towards a level which is acceptable on both the environmental and economic forces. There are 'of course' a list of best maintaining processes that can adopt as a useful tool to overcome the classes of nutrients, pollutants sediments, soil erosion and other similarities. In the traditional ways of farming, the farmers use a system of soil, water, pest and traditional slope, they also used some techniques to manage their vegetation, and these techniques consist of the use of cover crop, nutrient controlling, maintenance tillage and finally the soil management. The aim of this last process (soil management) is to defend the soil and recover its compaction, crop rotation, and watering system rendering reports issued by (Altieri et al., 1991).

Soil management practices is not one specific process, but clearly each particular piece of land requires a different set of practices, but in beside there are also some several principles which can be applied on most situations better understanding is so reputable. (Altieri et al., 1991).These general principles concentrate mainly on the positive features of soil, and they can be summarized to the following points

- Developing and increasing the organic matters.
- Controlling the level of erosion to decrease it.
- Powering the infiltration of water.
- Extending the ability of water-holding ability.
- Reducing subsoil compaction.
- A smaller amount of discharge of agrochemicals to groundwater.

The conditions mentioned above are necessary, or by other words are fundamental to help soil functions in its most proper way, the aim of maintaining cannot be gained only by one or two from these steps rendering reports issued by Altieri et al., 1991.

The principles can be examined regarding the following sets:

- plowing strength,
- plow ability land identification,
- modification of crop,
- organic matter reinstatement, and
- Validation of soil input

To improve the chemical, biological, and physical properties of soil, one has to think about maintaining formations. One of these features contains condensed tillage that means minimum tillage, insulation tillage, direct drill, no-till, stubble-mulch field. Maintenance tillage underlying systems for maintaining the surface of soil is covered by residue after cultivating. This activity has its values for soil erosions, separation in case of minimizing tillage and soil cover especially in precarious periods in the cropping succession. (Ministry of Agriculture, 2001) .

Decreasing soil compaction from raindrops causes permeation to underground water and decreased tillage includes clod works with hands or machines, and the minimizing of different sorts of tillage. Decreased tillage structures integrate an amount of pesticides and nourishments when applied to the surface of soil for the purpose of reducing the impacts of runoff rendering reports issued by (Gumbs et al., 1993).

Preserving cover crops supports nitrogen and preventing its unwanted moves; in beside it decreases the average of erosion. In addition to what mentioned now a cover crop can collect nutrients to be used lately. The caver crop that is cultivated among the rows can be useful to move out unwanted weeds. Moderate planters can take benefits from cover crop for food for animals. Although this application may cause the decrease of vegetation, because of the existence of a value of nutrients (Gumbs et al., 1993).

Cover crop is defined by (Ongley et al., 1996) as the following: A cover crop is a crop of close-growing grasses, small grains grown primarily for seasonal protection and soil improvement. Usually, it is grown for one year or less. This means the time period of cover crop is mainly used with seasonal cultivations, the crops that lasting for one season and yield in few months or weeks.

The term of Conservation tillage means Eco-friendly tillage, its main aim is to create a paper soil atmosphere for germination, cultivating. CT is constructed to avoid practices that affect soil badly. The range of CT is wide and it can cover a list of different sorts of tillage, like the following:

- ✓ Minimum tillage and no-till.
- ✓ Direct drill and mulch tillage.s
- ✓ Reduced tillage and stubble- mulch. …etc.

In countries with advanced germination program especially USA and Bengal the Idea of CT is adopted as the main plot of endorsements for croplands, and this style inspired farmers from other countries and became familiar to the others in Brazil and south of America. This system will be highly productive if supplied with good rainfall. Another feature of CT is that it can be applied to crop production with low input level. CT principles cannot be affected badly under any conditions, and they also have the privilege of overcoming the need for verandahs or other stable edifices. But this does not mean the lack of disadvantages, in the opposite side there are several disadvantages that delay the operation of CT in conditions that are semi-aired. Thick plant covers supposed to be irreconcilable with the experienced strategy of using light plant populaces to suit low moisture availability. Crop scums may be of significance as feed for bullocks. Planting through shallow mulches difficult for animal-drawn planters but they me cause no problem with hand jab planters, and other kinds that contain minimum or less average of tillage. But all in all CT practices are for the means of controlling soil poverty and refining its efficiency (Ministry of Agriculture 2001).

One can talk about zero tillage also, which is tillage means that the land remains untilled before being planted, but here and there holes are dug for planting, or furrow planting is considered. Another term is minimum or reduced tillage; this practice means less possible tillage is operated for the purpose of breaking up rocky pans or compacted layers to develop water storage ability, insinuation and also to decrease resistance to rooting. As an aim of maintaining the residue of chemically killed or naturally dead cover can be removed from a land, this sort of management is called in-situ mulch managing system. The last term to be mentioned here is strip or zonal tillage. This sort is a precaution practice to divide the seedbed into two parts, or two zones, one is called in-seedling zone, the other is called soil management zone (Ministry of Agriculture 2001).

Soil erosion can be defined as the process of dispassion, passage, and detachments of the particles of soil. This process can be seen on two different faces and effects: one affects water, called water erosion, and the other is called wind(Mass passage- or- Mass movement).the erosion that is caused by human acts and activities is another different act or process that affects soil and displace it is called tillage or tillage erosion (Wildemeersch et al., 2011).

Water erosion is a natural built phenomenon, takes place when the organic matter content is lost, topography is affected, and the covering vegetation is exaggerated by intensive fall of rains. Human activities also can have their effect in this regard (Gay et al., 2009).

Aggregate breakdowns can occasionally cause erosion of cultivated soils. Examples of aggregate breakdowns contain mechanical aggregate destruction by rain and other physic- chemical dispersion. The priority of this sort of erosion depends on the inner structure of the rain constitution and the physic-chemical features of soil. The perceptivity of soil to this sort of erosion could be viewed and expressed by its stability (Le Bissonnais et al., 1996).

Wind erosion has a key impact on fine units and fallouts A great point can be mentioned in this regard is that the impacts of wind erosion on the production of agriculture can be felt and observed after passing a long time. There are also some different influences that can have a huge impact on the risk of wind erosion, such us land use. An issue that is caused tilth and cultivating instruments is tillage erosion. This erosion takes place and provides some lateral and vertical supplanting of soil. This event affects the values of nutrients and organic matter by arranging them, which can cause the appearance of some impoverished zones.

In the period of harvesting the crops, exporting the soil would be an important factor, in specific for a time when the harvested parts are located beneath the ground. This leads to lessening. This leads to lessening of the quality of soil.

The resident parts of animals and plants in different points of decomposition are called soil organic matter. This can be helpful for the soil by giving it several positive effects. A huge amount nitrogen, approximately 90-95% in an unfertilized soil becomes a source of available minerals like phosphorous and sulfur, underwrites to the Cation Exchange Capacity (CEC) that repeatedly providing 30-70% of water content and water flew rates. It is also helpful for many of bacteria that can be considered as useful.

So, that relief to endure soil fruitfulness by extemporizing retaining of inorganic nutrients of soil vegetation and fauna. It’s also a crucial reason allied with upgrading of deterioration of soil richness and fertility (Brawn et al., 1994) that has a lion part in founding the intrinsic property of soils. Organic matter has the ability of promoting the soil on several ways; it also can be helpful for the chemical, physical, and biological features of soil. Worth mentioning here that OM improves and develops the structure of soil by supporting its drainage of water to get move ways inside the soil, this by other words helps aeration and the ability of water holding. better understanding is so reputable.(Gardiner and Miller, 2004).

For a land’s soil, improvement, here, means facilitating plant root system and more resistance ability in struggling the appearance of disease. SOM can increase The soil that have a high OM component is naturally provided with water aggregates that affect soil particles by binding them altogether to give them the ability of resisting to not be broken down by rainfalls. On the other hand soil degradation is a threat that is expected OM depilation, when the depilation takes place. A situation like this should be reserved to accumulate carbon average in the soil to give a help to the soil to prevent it from being de-gradated. The soil that is cropped continuously loses its OM, building on this fact one has make assessments to the soil OM to identify its qualities.

Nitrogen is often considered as a major factor in the growth of the plants, and it is also one of the most prominent nutrients that are required for the nutrition of the plants. On the other face the lack of nitrogen is the greatest single cause of low crop. Nitrogen has presence almost in every single part of cultivating process, for instance it represents 95% to 99% of the organic form and 1% to 5% of the inorganic forms, and even the OM has nitrogen as its components about 5%. Building on the facts mentioned above one can argue that nitrogen represents as an indicator of the soil and it is a potential unit Gardiner and Miller, 2004).

Nitrogen is not always available in its organic form for the plants, but must be transformed to the accessible forms, either as the cationic usage like ammonium Ion (NH^{4+}) or as the Ionic form of Nitrate (NO^{3-}). There is a contradiction in the measurement of nitrogen, thus one cannot say that the total nitrogen represents the amount of the available nitrogen for the plants. But this component remains as an indicator for the soil. Thus nitrogen is highly needed for the appraisal of C-N proportions of soil. Nitrogen gives a hint of the practices of conversions of the organic N to the available N as Ammonia Nitrite and Nitrates better understanding is so reputable (Gardiner and Miller, 2004)

In comparison with the other essential elements for soil, following nitrogen, phosphorus has a prevalent power on ecosystems, naturally and agriculturally.

Phosphorus - lacking plants are habitually brutally undersized, because this chemical element has its share in the amalgamation of several necessary compounds upon which all vegetable and animal lives depends. None of the plants or the animals can remain surviving and growing, without phosphorus, because it is an essential element of the organic compound that is called the energy currency of Adenosine Triphosphate (ATP), (The foremost conservational snags related to soil phosphorus are land degradation that are caused by two diminutive available phosphorus and augmented eutrophication. When phosphorus was available in low range, this means that the soil has passed on broad losses of this essential element during stretched periods of relativity by the weak viability of the element in the recipes of some minerals like iron, aluminum, because these minerals are considered as the principal forms and shapes of phosphorus.DNA), and Ribonucleic Acid (RNA) (Barber et al., 1984).

The acronym pH refers to a French abbreviated form of hydrogen power, or by the French word (Pouvoir Hydrogen) which is the representation of soil reaction. It refers to the acidity of soil and can be measured by pH units.

pH can be seen as the minus value logarithm of the activity of hydrogen ion in which in an insipid clarification can be accounted as concentration (in gram mole per liter) its balance ranges between zero to 14 with a pH of 7 as the neutral point.

While from pH value of 7.7 to zero the soil is growing more, on the opposite side from 7 to 14 the soil increasing to be chalkier. So, building on the preceding facts the pH value can be considered as an important feature of soil as it regulates the availability of nutrients, physical conditions, and infectious activity better understanding is so reputable (Purohit et at., 2004).

There are several factors can affect soil pH values, including season of the year, soil formats, cropping processes the water content

One of the big impacts of pH is that, it can affect the minerals ability of solubility. For example inside the acidic soil, the phosphate ions re-join with iron and the other minerals like aluminum and manganese. While in the other sort of soils (alkaline. soils soluble phosphate ions adsorb on solid calcium carbonate surface, thus phosphorus is mainly presents at nearly pH 6.5, Rendering reports issued by (Gardiner and Miller, 2004).

In soil, potassium exists namely in three different forms:

- ✓ Fixed, or slowly available
- ✓ Readily available
- ✓ Relatively unavailable.

The potassium that is called available potassium (K) is that which is held in the soil solution by the effect of soil organic matter and also by non-fixing mud subdivisions in a redeemable form (Foth et al., 1990).

In the sequence of the basic mineral nutrient rudiments potassium follows P and N to stand on the third queue, and it is most likely to limit plant efficiency and productivity. After N potassium is the second mineral that is highly absorbed and digested by plants. (FAO 2006 a) reports that potassium has its main share in the function of more than 60 enzymes, and its function is helpful in providing resistance against some illnesses and pests.

Three different forms of K are mentioned above. The forms of k depend mainly on the soil type, but almost 90-98% of them is found in relatively unavailable form, while a small amount of 1% to 2% of the soil k is readily available to plants. As part of their nature plants cannot use K in its crystalline form which is insoluble. The purpose of the use of exchangeable k is to maintain equipoise with k in the solution process, and then both the exchangeable and soluble K formulates the available K. The exchangeable K can be useful to be used as a measure to assess the status of soil K and also for estimating the needed K for any planet rendering reports issued by (Al-Zubaidi et al., 2008).

Scientists (Ajiboye and Ogunwale 2008) for instance .agree that exchangeable K must not be used alone to assess K validity under rigorous cropping. This appears building on facts that the soils which are considered as sufficient in having considerable exchangeable K were unable to maintain that circumstances for a long period of time under exhaustive cropping with variable yielding rendering reports issued by (Mesfin et al., 1998).

Inorganic or mineral enduring ratios are habitually dawdling compared with the needs of plants. Worth mentioning that OM decomposition discharges ions faster than inorganic enduring, but almost most of the released ions re-function with the soil’s solid components before being absorbed by plants. Soil remains and the ashes of burned woods contain a ration of K and can been seen as a valuable source of this element. Even though the complete K contented of soil is frequently much times greater in comparison with the amount that is taken up in the period of growing season, but as usual in most conditions a few fraction of it is available to the plants.

The content of K and its accessibility differs according to the sort of parent material, the amount of weathering, management ways, OM and clay contents and types. Existing K grows with OM component, and this may be according to creation of favorable soil environment in the existence of OM.

Carbon (C) to Nitrogen (N) percentage expressed as (C: N) and represents the pointer of the net N mineralization and Accretion in any sort of soil. If O.M was rich in carbon ratio, it can deliver a fortunate source of energy to the bacteria and germs in soil. Accordingly OM fetches population enlargement of microorganism and also of a higher ingesting of mineralized N. As a matter of fact, condensed populations of microorganisms' residence the upper surface of soil and have entrée to the sources of soil N. the percentage is equivalence, if the substrate is high, there would be no pure mineralization and accretion of N. All in all the broader the C: N percentage of OM applied to the soil, the more is the need for applying N as a fertilizer. There are some ecological effects like temperature and precipitation with some other ecological and management factors that can affect the C: N ratio. If the average of rainfall is persistent, the C: N ratio is lower in warmer than in colder distinct. But correspondingly, however yearly temperatures are stable, the C: N ratio is expected to be higher in wet regions (Prasad and Power, 1997). Cultivating of a land results in the decrease of OM, total N and increase C: N ratio of soil. On the other side, moderately weak C:N in any soil of the cultivated land than forest is discussed (Achalu et al., 2012) these researchers believe that airing during the tillage and amplified temperature that enrich the rates of mineralization of OC than organic nitrogen expected to be the cause of the lower level of C:N in cultivated land. In their research (Abbasi et al. 2007) tackled the narrow C: N ratio in the soil of the cultivated pieces of N in cultivated lands

The replaceable Sodium (Na) reworks the chemical and physical possessions of soil, mainly by inducing puffiness and dispersion of mud and organic particles ensuing in curbing water penetrability and air movements and curst construction and nutritional illnesses (Sposito et al., 1989) rather more it similarly adversely affects the alignment, population and moves of the useful soil microorganism unswervingly through its toxicity

Effects and circuitously by adversely affecting the chemical and physical properties of the soil. Commonly, rich exchangeable Na in soil causes soil sodicity which affects both soil fertility and productivity. The lowest expected level can be taken as an occasion because Na concentration is not recommendable to high level because it makes soil be liable erosion and barren of useful organisms (Sposito et al., 1989).

The embryonic knowledge of the nature and properties of soil has served in better enunciation of the capacities and limits of soils to attuned land use over the years and sustainable agricultural productivity. Building on these, making tests to soil for a better understanding is so reputable (Tekwa et al., 2011).

The most prominent definition for soil testing is that which says that soil testing is procedure used to evaluate the nutrient supply power of a soil (chemical, physical, and biological assessment done to soil). In a narrower view soil testing means fast chemical examination of soil to evaluate the plant available nutrient status, acidity, and elemental toxicity of soil, while in a wider view, it represents a procedure that constitutes evaluation, interpretation, and amendment recommendations built on results of soil chemical analysis and other contemplations (Peck and Soltanpour 1990).

Land and they concluded that a greater microbial motion and more CO_2 progress and its loss to the zone in the top (0.00 to 0.2 Meters) soil layer resulted to the narrow C: N ratio. Confirm that the C: N ratio values in cultivated soils are higher than forest soil, because of the rapid loss of. With the contemporary growth in fertilizer costs and deterioration of soil fertility over time, the requirements for reputable soil testing along with proper understanding of the results have increased in importance of deciders on the opposite side of view (Nega and Heluf, 2013)

Details gathered from soil testing facilitate to foresee the amounts of nutrients required to supplement the supply in the soil. Furthermore, the details can be used to formulate and preserve fertility status of any field, foresee the possibility of getting a beneficial react to

Fertilization and liming, provide a foundation for recommendations on the value of fertilizers and lime to apply and assess the soil management status of soils on a watershed or national foundation by the use of test summaries. The tricky representative samples obtained, accurate analysis, correct interpretation factors that affect crop responses highly influence nutrient recommendations and crop regaining to applied nutrients. Soil testing helps to decrease any presumption in fertilization, this kind of test and determine total soil management values and levels. Thus soil testing can be seen as an accurate instrument to evaluate the management soils and soil quality. Rendering reports issued by (FAO, 2006 a).

Commonly soil productiveness is the progression of characterizing soil management grade in any given area and geo-encoding such details.

Rendering reports issued by (FAO, 2006 a) nutrient supply maps can be taught for farms, regions and countries on the foundation of soil testing.

Acceptable quality and quantity soil data domineering to empower the growth of the numerical spatial norms for soil mapping, and also to assess their outputs. These data should come from soil measurements, it will become important to develop and enable more sufficient techniques to measure soils and their features and properties. The information gathered from soil fertility maps can be useful for making plans to nutrient management procedures. Rendering reports issued by (FAO, 2006 a).

The dimension to which soil management maps can be considered for planning nutrient management approaches is an approach depends upon how exhaustive, recent the soil sampling is done, and also on which maps are based.

The soil management of alluvial soils is relationship have with kinds of deposited clay mineral. In tropics the most important clay minerals are kaolinite, illite (by contact with seawater) and montmorillonite. The physical soil management of alluvial soils mostly relationship have with structure and its swell and shrinks capacity (Brady et al, 1990).The lime contain little tropics This makes tropical alluvial soils some time acid and subjective to faster degradation of organic material, what in general implies low organic carbon. Content for these soils (Edelman and Van der Voorde, 1963).

3. MATERIALS AND METHOD

3.1. MATERALS

3.1.1. The Study Area

Erdemli Microcatchments located within the borders of the central district of Bingöl province; Bahçeli, Erdemli, Dışbudak, Erdemli, Gökdere, Kıran, Suvaran and Yumaklı villages are included.

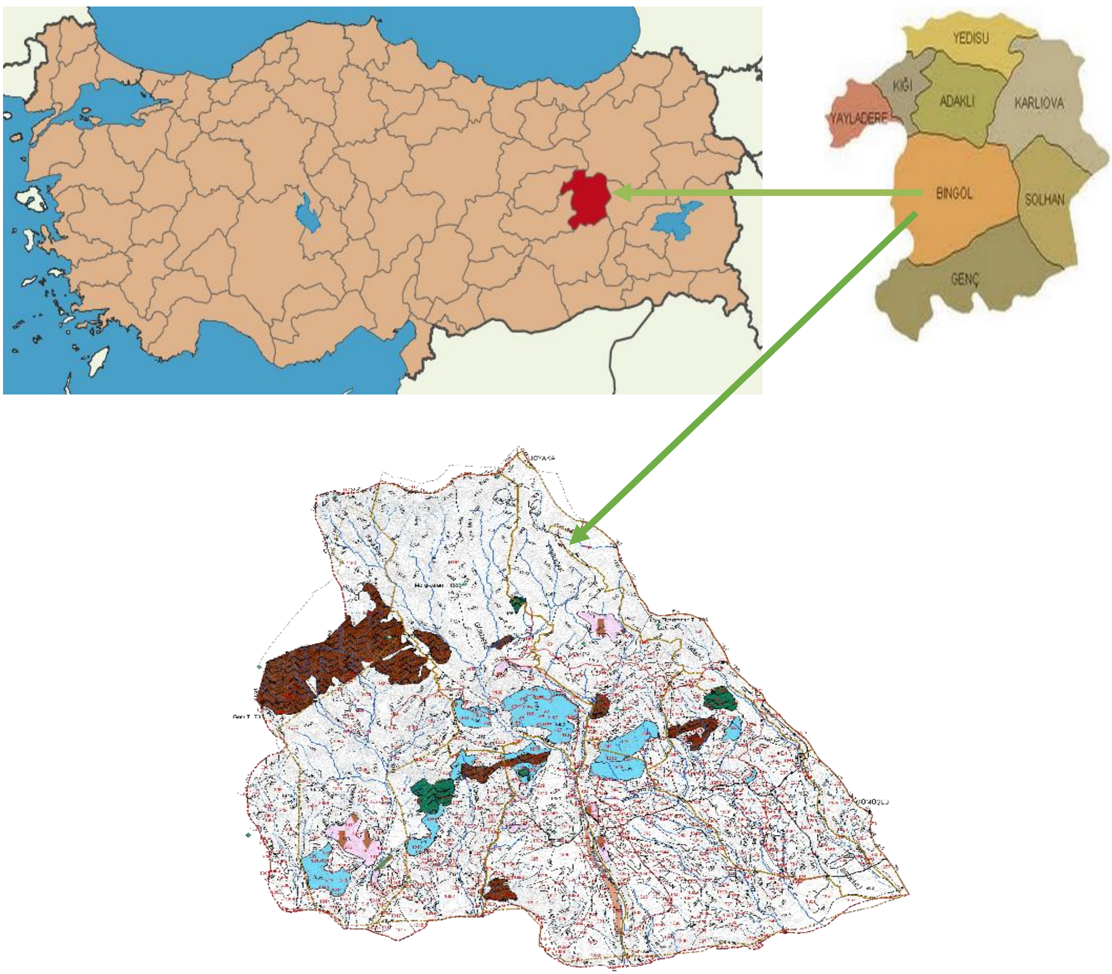

Figure 3.1. Map showing of Erdemli Microcatchment

Virtuous Micro catchments extend until the beginning of the Pali district boundaries and are located just off the central district of Bingol in the Central District. Micro catchments the elevation ranges from 980 meters to 2175 metehe average elevation is 1550 m, the annual average rainfall is 831.5 mm, the number of snowy days is 117, and the number of snowy days is 76.he region is estimated to be an increase in animal production, agricultural inputs in the event of favorable climatic and ecological conditions to be used in accordance with the land capability classmicrocatchment foragriculture land live bstock production (figure 3.1).

Table 3.1. GPS coordinates of the point where the soil profile taken Erdemli Microcatchment

		Coordinate				Coordinate				Coordinate				Coordinate	
p	elevation	E	N	P	elevation	E	N	p	elevation	E	N	P	elevation	E	N
P1	2076	620512	4296098	P21	1583	620483	4292959	P40	1573	619136	4292359	P61	1308	621058	4290582
P2	2016	621148	4295905	P22	1671	622342	4293317	P41	1558	620812	4292522	P62	1281	619886	4290273
P3	1799	618042	4294165	P23	1669	620930	4293899	P42	1510	618907	4292205	P63	1062	622596	4287651
P4	1826	617851	4294177	P24	1571	620896	4292738	P43	1505	618662	4292224	P64	1358	620305	4290335
P5	1496	616862	4291645	P25	1634	619278	4292881	P44	1606	616886	4292476	P65	1257	621022	4290245
P6	1713	616940	4292951	P26	1636	618954	4292744	P45	1620	616780	4292520	P66	1047	620604	4287702
P7	1725	618293	4293761	P27	1664	618793	4292886	P46	1546	616750	4291880	P67	1171	620774	4289082
P9	1660	620810	4293780	P28	1660	617260	4292688	P47	1725	616099	4292204	P68	1010	626821	4288318
P10	1680	622568	4293483	P29	1689	617185	4292818	P48	1575	616586	4291901	P69	1641	619074	4293050
P11	1709	622241	4293495	P30	1499	618050	4292604	P49	1561	616817	4292310	P70	1560	620503	4292523
P12	1693	618346	4293412	P31	1685	617321	4292906	P50	1412	622385	4291744	P71	1333	624765	4291805
P13	1694	618043	4293515	P32	1717	617089	4292865	P51	1411	624409	4291876	P73	1254	619076	4289918
P14	1684	617730	4293258	P33	1698	616739	4292857	P52	1353	622292	4291520	P74	1290	619406	4289920
P15	1639	617108	4292679	P34	1725	616417	4292540	P53	1050	620358	4287684	P75	1290	619393	4289647
P16	1566	617602	4292979	P35	1649	616656	4292666	P54	1272	623937	4291196	P76	1195	619054	4289615
P17	1647	618044	4293243	P36	1636	616983	4292638	P55	1271	624372	4291300	P77	1188	622295	4289285
P18	1748	618437	4293238	P37	1590	617392	4292540	P56	1202	624163	4290907	P78	1136	622477	4288434
P19	1693	618632	4293014	P38	1541	618327	4292560	P58	1170	617792	4288801	P79	1235	617741	4289341
P20	1623	619270	4293104	P39	1570	618625	4292525	P60	1298	621336	4290629	P80	1225	617390	4289121

Figure 3.2. The study area

3.1.2. Climate in Region Bingol

Bingol province varies according to the terms of the climate and topography of the district mostly continental climate is observed in the provincial border . Summers are hot and dry, it is seen that the harsh and cold winter . Rainfall is usually in the form of rain in spring and autumn months , the winter months are often seen in the form of sow . and annual evaporation is 1202.5 mm in total working in the highest temperatures in July and August (34.5 C) and the lowest temperature in January (-6.1 C) is observed evaporation increases with the increase of summer temperatures and in July (262.7 mm) to reach the highest level but evaporate . According to the data of the temperature regime of Bingol. It is located in the district now. Micro catchments ranged up to 2175 meters from 980 meters altitude the average elevation 1550 m, annual average rainfall of 831.5 mm, the number snowy day 117, while the number of days covered with snow is 76. When used in accordance with the land capability class Micro catchment with Appropriate climatic and ecological conditions for agricultural and livestock production it is estimated to be an increase in animaland production in the region with agricultural. .

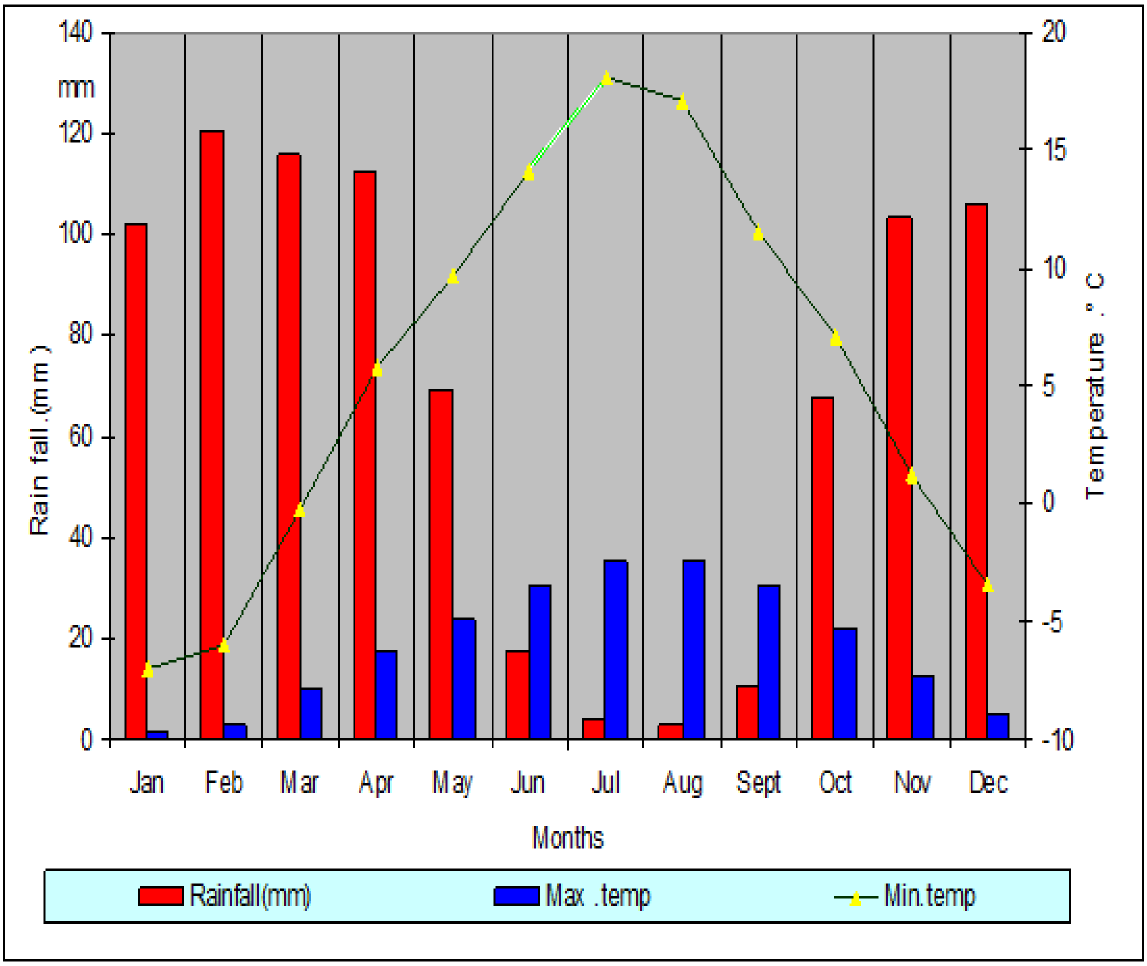

Figure 3.3. Mean (2015 - 2016) monthly rainfall, monthly maximum and minimum temperatures of the study area based on the records at bingol university station

Figure 3.3 shown in Mean (2015 - 2016) monthly rainfall, monthly maximum and minimum temperatures of the study area and the distributions according to the study area is Meteorological shown in table 3.2 According to this based on the records at bingol university station (bingol university.2016).

Table 3.2.The Meteorological Observation Value Erdemli Microcatchment

Latitude:: 38 K Longitude 40 D Elevation: 1250 m Report Time: 33		study area meteorological values												
METEOROLOGY ELEMENTS	RAPERIOD (YEAR)	Months												Yearly
		1	2	3	4	5	6	7	8	9	10	11	12	
Minimum Temperatures Average (° C)	33	-7	-6	-0.3	5.8	9.7	14.1	18.1	17.1	11.6	7.1	1.2	-3.4	5.6
Average of Maximum Temperatures (° C)	33	1.6	2.9	9.6	17.4	23.6	30.2	35.2	35.1	30.1	21.9	12.4	4.9	18.7
Average temperature (° C)	33	-3.3	-2.2	3.7	10.9	15.8	21.7	26.3	25.8	20.2	13	5.5	-0.3	11.4
Average humidity (%)	33	72.1	71.8	66	62.4	57.2	44.9	38.6	38.6	44.5	59.7	68.8	73.2	58.1
Average Pressure(HPa)	2	902.6	899.2	901.4	899.2	899	896.2	894.9	895.4	899.1	903.1	904.2	904.2	899.8
Wind Speed Average (m / sec)	33	0.6	0.6	0.9	1.1	1	1.1	1	0.9	0.8	0.6	0.6	0.5	0.8
Average total precipitation (mm)	33	102.1	120.4	116.1	112.6	69	17.8	3.6	2.7	10	67.7	103.3	106.2	831.5
Snow Covered Days	33	21.8	21.2	9.8	0.5	-	-	-	-	-	-	1.5	9.8	10.7
Average Cloudiness	31	5.2	5.4	5.1	5	3.7	1.7	1	1	1.4	3.3	4.3	5.3	3.5

3.1.3. Basin Characteristics

Microcatchment developed by virtuous Erinç in determining the characteristics of climate and rainfall is based on the proportion of medium to high temperature, rainfall Activity Index "was used. For this purpose, the climatic and vegetation type of the basin was determined by using the meteorological data (annual precipitation amount and mean maximum temperature values) obtained from the Central District of Erdemli basin between(1980 -2012) The 33-year meteorological data obtained from the basin adapted to the form has an index value of 44.4 mm / ° C. According to this result it has been found that in humid climates virtuous Micro catchments. The vegetation cover defined by the type of humid climate is the type of Moist Mountain Forest agricultural the climate type, rainfall index ,plant grain , given in Table 3.2.Activity Index

According to the form;

$\rightarrow$ $I_m = P / T_{om}$

I_m : rainfall activity index

P : annual precipitation (mm)

T_{om} : annual average high temperature (° c) is defined

Annual precipitation amount of Erdemli Basin is 831.5mm

The annual average high temperature is 18.7 ° C

According to this; If the annual activity Index = 831.5 / 18.7 the result is 44.4mm / ° C

Table 3.3 The study area rainfall event classes (2015)

Climate type	Rainfall index	plant grain
Very dry	I<8	Desert
Dry (K)	8<I<15	Desert - Step
Semi-Arid	15<I<23 Step	Step
Semi-Moist (FN)	23<I<40	ParkViewDriftwoodForest
Moist (N)	40<I<55	Moist Mountain Forest
Very Moist (sic)	55<I	Very Moist Zone Forest

3.1.4. Water balance

Climate classification is based on the principle of evaporation and precipitation and temperature and evaporation. The evaporation than rainfall in a place where there soil is saturated state and there occurs an excess of water. This is why it is so humid climate of the place. Otherwise, rain water does not accumulate in areas where the soil is less than the evaporation plant and the soil becomes unable to provide the needed water. It consists of a water shortage and drought in places like the climate of this place (Anonymous 2009).According to Thornthwaite method, benefiting from the climate research Bingol type Meteorological measurements were analyzed. Organized water balance statement of research interests graph is plotted according to this method. Water balance in Table3.4 the graph is shown in Figure 3.4.

The area of the pick-water balance as shown in Figure 3.4 is shown. Accordingly, the water balance of the graph is defined under part 4.

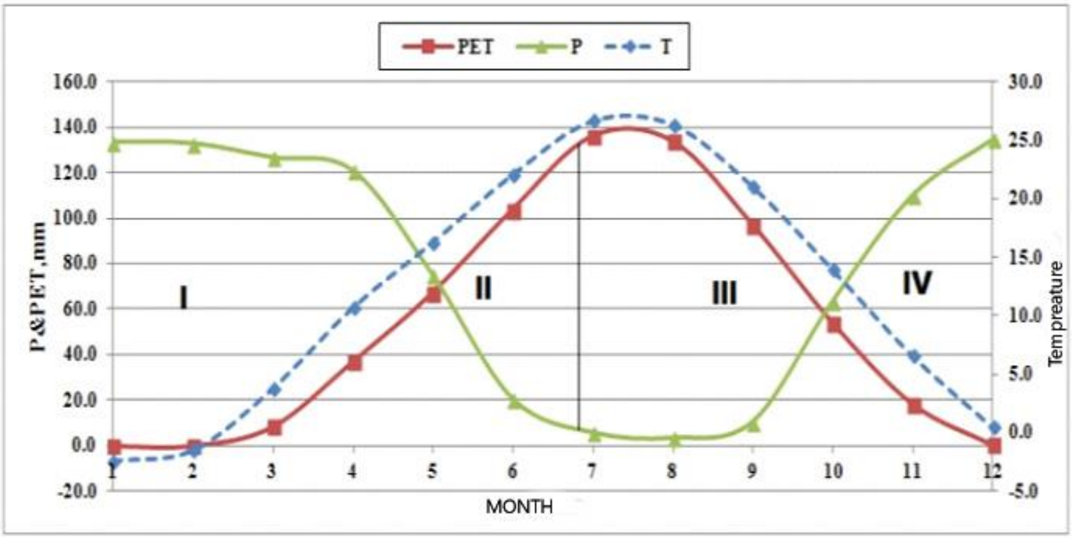

Figure 3.4. Water Balance (Demir et al., 2015)

1. Excess water is part. Starting from October, it will continue until the beginning of May. Precipitation is more, if the show is less evaporation than precipitation.

2. increasing evaporation. As a result of this it originates from ground water reserves necessary for evaporation. This process continues unchanged until the end of June.

3. this is the section showing the water is clear. Lack of water depletion in the emerging water reserves in the ground right to the end of June and continues until October this process. Lack of water has been identified with that of 5 mm (Demir et al., 2015).

4. The stored water until the beginning of October, after a period of lack of water phase increases the amount of rainfall and evaporation is reduced again by the beginning of October. During this period, the rains begin to fill again because it is so evaporation from soil reserves. This period continues until the end of November (Demir et al., 2015) Water balance statement is presented according to the workspace month as shown in Table 3.3. Accordingly, the amount of stored water in November, December, March, and April, while 100.0 mm during January, February, June, July, and August is 0 mm. When we look at the distribution of rainfall month in March, with most precipitation falls in February with 120.4 mm and 116.1 mm. In the months that rainfall is the lowest in August, while in July with 3.6 mm to 2.7 mm. The annual rainfall is 831.5 mm.

Water deficit of 163.3 mm with a maximum occurs in the beginning of October until the end of July, the water deficit is not seen in May. The annual water deficit was 424.2 mm.

Table 3.4. Water balance of the Erdemli Microcatchment

water balance of the Erdemli Microcatchment													
	Months												Yearly
	1	2	3	4	5	6	7	8	9	10	11	12	
Temperature	-2.9	-1.9	4.1	11.2	16.4	22.4	26.8	26.1	20.5	13.7	6.1	0.2	11.9
Precipitation (mm)	102.1	120.4	116.1	112.6	69.0	17.8	3.6	2.7	10.0	67.7	103.3	106.2	831.5
Temperature Index	0.0	0.0	0.7	3.4	6.0	9.7	12.7	12.2	9.0	4.6	1.4	0.0	59.8
Corrected (PE) (mm)	0.0	0.0	9.4	43.4	81.0	131.2	166.9	150.9	97.3	49.4	14.1	0.1	743.7
Water Storage (mm)	0.0	0.0	100.0	100.0	88.0	0.0	0.0	0.0	0.0	18.3	100.0	100.0	-
Water Storage Monthly Change (mm)	0.0	0.0	0.0	0.0	-12.0	-88.0	0.0	0.0	-	18.3	89.2	0.0	-
Humidity Ratio	0.0	0.0	11.3	1.5	-0.1	-0.8	-0.9	-0.9	-0.8	0.3	6.3	1,061	-
Water Front (mm)	0.0	0.0	0.0	0.0	0.0	25.4	163.3	148.2	87.3	0.0	0.0	0.0	424.2
Water Excess (mm)	0.0	0.0	106.7	69.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106.1	282.0
The actual evapotranspiration (mm)	0.0	0.0	9.4	43.4	81.0	105.8	3.6	2.7	10.0	49.4	14.1	0.1	319.5
Surface Flow (mm)	26.5	13.2	59.9	64.5	32.2	16.1	8.0	4.0	2.0	1.0	0.5	53.1	503.8

3.1.5. Geological Information and Soils Structure

Types of soil structure in the Erdemli micocatchment. Analysis of soil samples taken from the soil profile in the areas that will be plantation was built in Bingol University Faculty of Agriculture, Department of Soil Science, and Plant Nutrition Laboratory Stoniness of surface and profile in the emerging soil on bedrock are the structure metamorphic were bottled in the project area Isa around 20-30%, profile structure in the horizon structure granular, B horizon blokes, the structure prismatic, block structure, while the C horizons have a massive structure. Consisting of loose parent material Soil texture does not have any problems in the treatments usually sandy loam soil structure shown in Figure 3.5.and appendix 6.5,6.6,6.7,6.8, consideration.

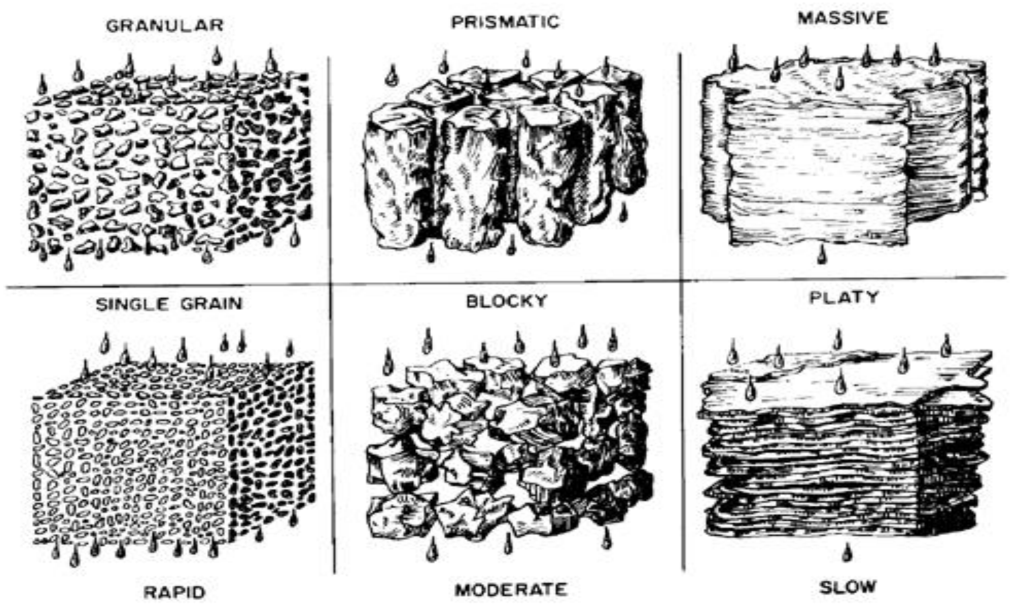

Figure 3.5. Types of soil structure in the Erdemli microcatchment

3.1.6. Area selection Soil Sampling and Preparation

Figure 3.6.showing the spatial distribution soil sampling and soil profile of the Erdemli Microcatchment four kinds of soil sampling method which are surface and profile were used to determine best soil management practices by soil quality assessment Erdemli Microcatchment. Soil change depending on the distance of the field after (300 x 300 m) like grid divided in to different the profile. Soil samples were collected from 839177

hectare. Locations, the north-south and east-west direction intermediate transects to determine 80 point in the study area were obtained, take soil depth (0-30, 30-60, 60-90, will be from 90-120 cm) depth .for each land use and land slope. In addition, 80 soil profiles were investigated and 291 soil samples were taken and analyzed from the area from each horizon of profiles.

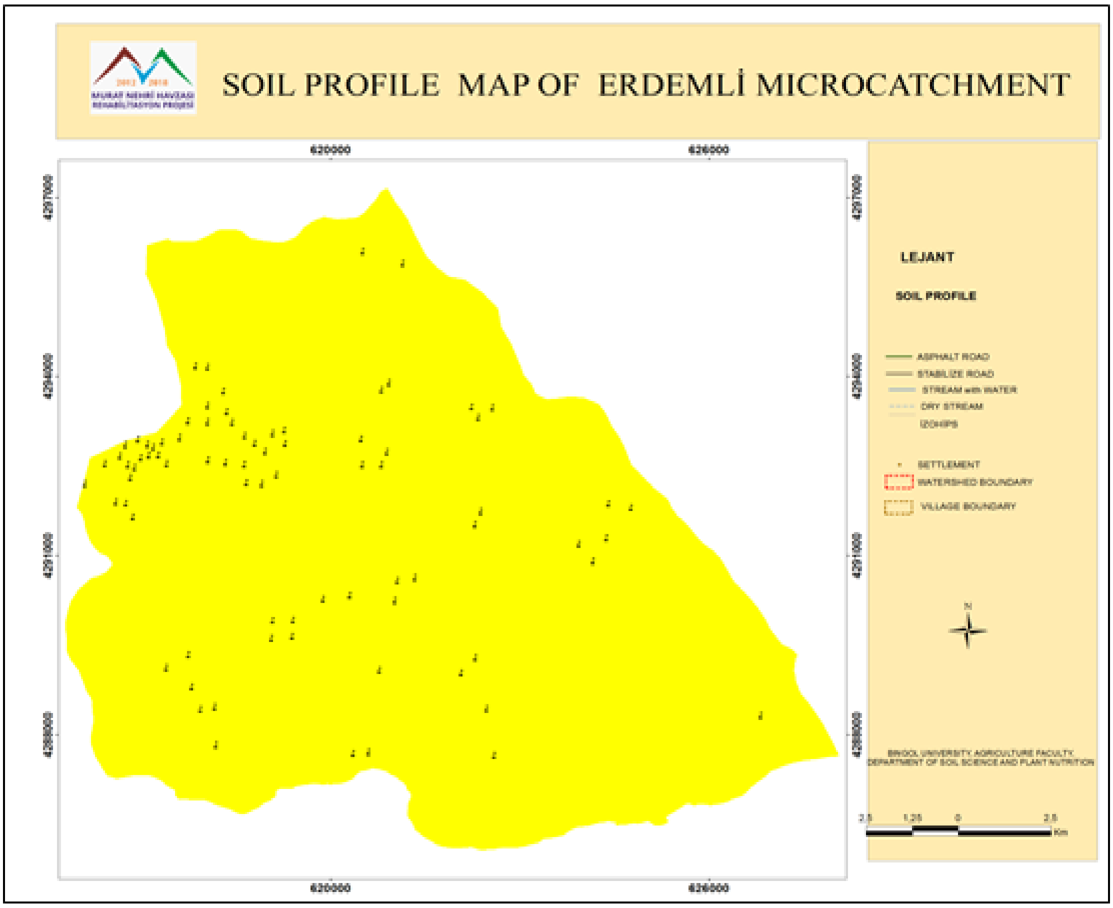

Figure 3.6.The spatial distribution soil sampling and soil profile of the Erdemli Microcatchment

3.1.7. Classification Slope of the Erdemli Microcatchment

Land slope has been investigated because it affects many features such as erosion, soil depth, soil texture, surface flow, and land use pattern and vegetation cover. It is also used as basic data on slope land classification (Çepel 1995). As seen in Figure3.6 and Table 3.5. Erdemli Microcatchment slope map of the study area and spatial distribution group slope and percentages shown. Accordingly 2301.57ha gentle slope group of 0-12%, 1392.38 ha in the 13-20% steep slope 3087.45 ha.

21-40% very steep, 1279.04 in the41.-60 gradient group has a 40% + gradient group is 336.9 hectares Microcatchment are seen that generally has a slightly inclined topography the area microcatchment between 0-12% slope is approximately about 27.41% and seems to have a suitable topography for agricultural activities . Also in the field it is between 13-20% slopes about 16.58 %, hill the area between the slopes of the area is between 21-40% and above 36.77% and 15.23% slope value of 4.01%.

Table 3.5. The spatial distribution slopes of the Erdemli Microcatchment

Slope area	Area(ha)	Rate %
0-12 gentle slope	2301.57	27.41
13-20 steep slope	1392.38	16.58
21 -40 very steep	3087.45	36.77
41-60 very hill	1279.04	15.23
60 high elevation	336.72	4.01
Total	**8397.16**	**100.00**

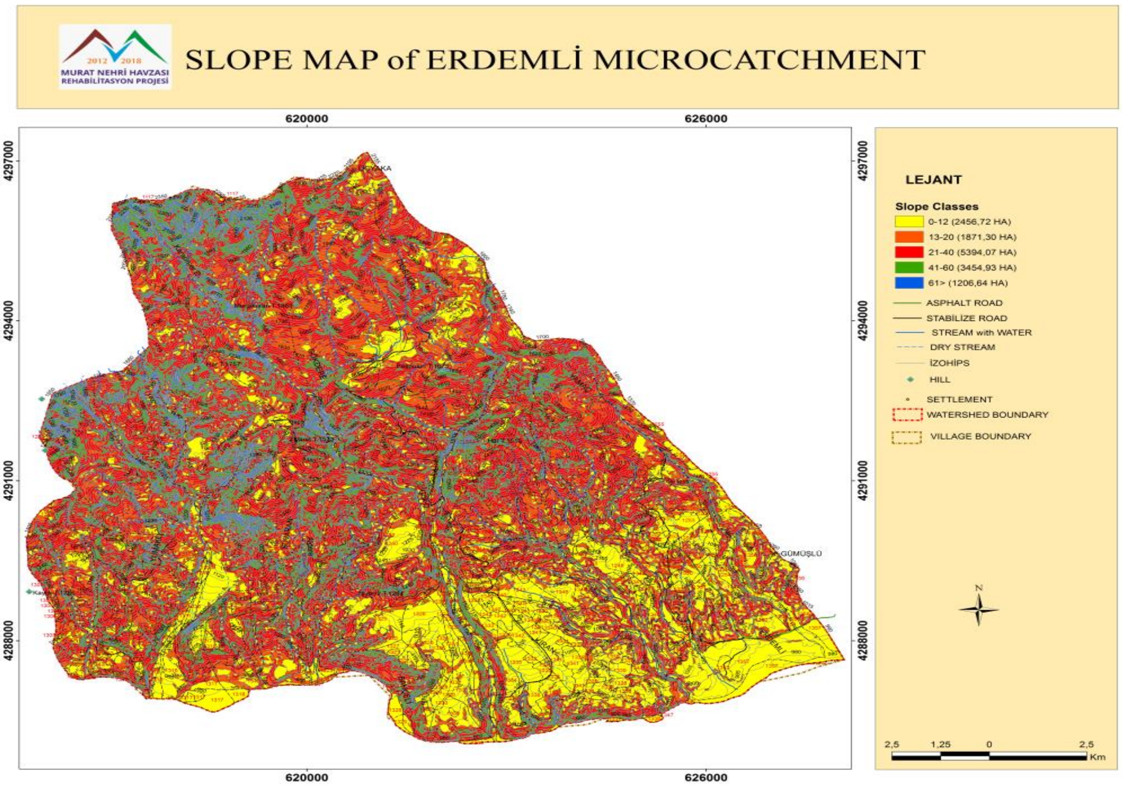

Figure 3.7. Map showing classification slope in the Erdemli Microcatchment

3.1.8. Soil color changes of the study area

The soil color changes of the classification According the depths as the seen from (0-30cm) is brown 7.5YR 5/2 and dark brown 10TR3/3 of the layers, and the 30-60 cm soil colors changes between brown 7.5YR 5/2,Light brown 7.5Y 6/4 of the layers, Descriptive change colors soil profile Table 3.6 the soil changes colors between 60-90cm 30-60cm same, the changes have light brown colors 90-120cm soil 7.5Y 6/4 of the layers, color in the area and generally classified According to FAO, as crisols .Alisols and Alluvia-UNSCO classification (2008), While in the soil changes colors in As seen in Erdemli Microcatchment of the Appendix 6.1, 6.2, 6.3, 6.4, consideration.

Table 3.6. Descriptive change colors soil profile of the Erdemli Microcatchment

horizons	Depth (cm)	Colors soil
O-A	0-30(cm)	The dominant soil color brown 7.5YR5/2 and dark brown 10YR 3/3 in the O-A horizons. increase clay topsoil and O.M and vegetation less lime,
B	30-60(cm)	The dominant soil color brown 7.5 YR5.2and light brown 7.5YR6/4 in the B. horizon boundaries are determined structure soil is angular Block,Granular,Medium Granular, ,Block
E	60-90(cm)	color change and structure soil between different B. horizon and E horizon few in the two layers, soil colors light brown 7.5YR 6/4, and structure soil is Weak Granular and Massive
C	90-120(cm)	The dominant soil color light brown7.5YR 6/4, the due to increase lime and ph. low O.M,

3.1.9. Land Use and Vegetation of Erdemli Microcatchment

Soil the total area of the project is estimated at 839 177 hectares. This total land is a to Arable land, grazing land, forest land, bushes and shrubs, construction and others which plant is one of the provinces with the richest forest areas of Eastern virtuous which caused the oak forest tree species as is common in insertions. These forests at 1900 m it shows up to a height distribution. While in the Figures 5-6 Consideration. Land Use as a result of the destruction of forests and steppes in a long time where literally destroyed the forest vegetation is seen. Status of use of this land is a total of 839177. Hectares of land in the province are as follows: 10.11% of agricultural land, forests of 60.49%" degraded forest 20.25% area, sandy area 2.51 %, river 0.01% efficient of forest 5.36% and residential 1.29%.Acoording in The table 3.7 show the range Land Use

Table 3.7. Type Land Use of Erdemli Microcatchment

Land Use Type	Area (ha)	Percent (%)
Degraded Forest	1700.51	20.25
Sandy Area	210.58	2.51
River	0.48	0.01
Forest Soil	5079.07	60.49
Efficient Forest	449.68	5.36
Residential	107.93	1.29
Agriculture	848.91	10.11
total	**8397.16**	**100.00**

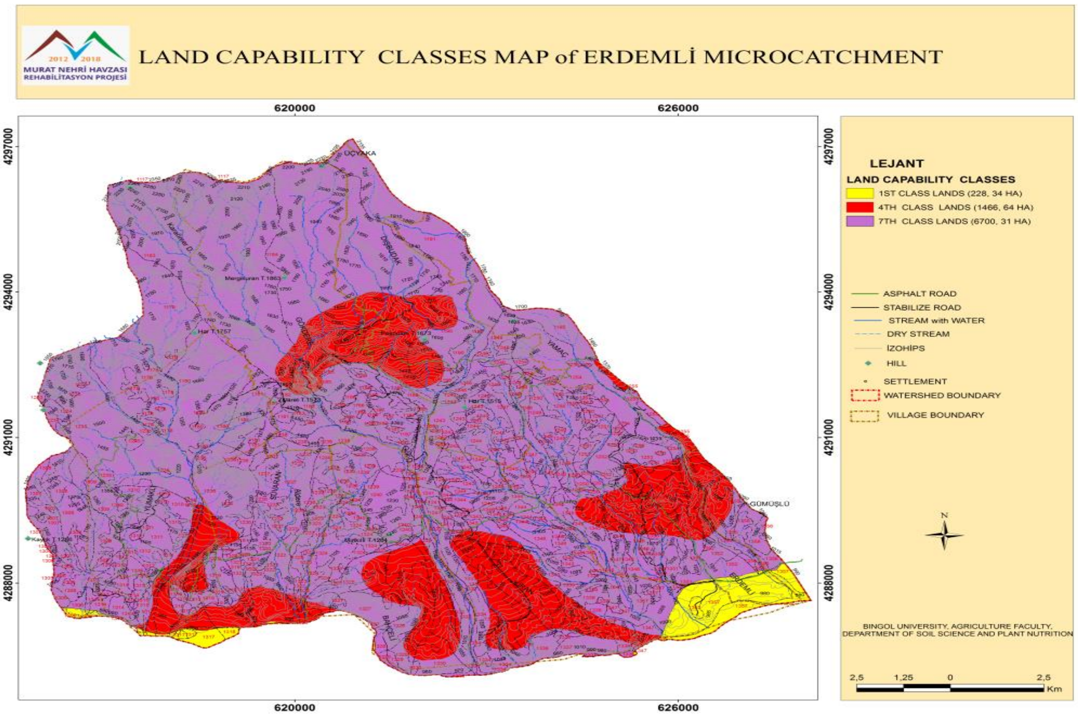

Figure 3.8. The map spatial distribution type land used classes of Erdemli Microcatchment

A. forest

B. grazing land

C. oak

D. Making agricultural activities on sloping land E. Natural Water Source

Figure 3.9. Type land use and vegetation in the Erdemli Microcatchment

3.1.10. Soil Profile of the Erdemli Microcatchment

Projected number of profiles is 80. Research will be held in 839717hectares, examples (0-30, 30-60, 60-90, will be from 90-120) cm depth .The means of this research determination of best soil management practices by soil quality assessment of Erdemli Microcatchment in Bingöl Province. Soil profiles in the study area, location profiles. Topography. Considering the observable characteristics such as vegetation were to graphical map. Excavators will be used GIS and in the opening of the profile. The two you will see different layers in the profile .this is layers in the profile. This is layers are called master horizons. This is horizons are see by difference ways. Such as color and soil structure and texture .in a typical forest soil, the you will see different layers in the profile. These are layers are called master horizons. This is horizons are see by difference ways such as color and soil structure and texture. In a typical forest soil, you are can to see all of or some master horizons O, A, E, B, C, and rock, While in the soil profile of the Erdemli Microcatchment As seen in table 3.8 and figures 3.10, 3.11, 3.12, 3.13,3.14,3.15,3.16 consideration.

Table 3.8. Descriptive soil profile of the Erdemli Microcatchment

Horizons	Depth(cm)	Definition
O-A	0-30(cm)	The layers increase O.M, clay and decrease lime.
E	30-60(cm)	Decrease O.M ,clay and increase lime
B	60-90(cm)	Up layers leaching in to the B horizons.
C-R	90-120(cm)	This layer's called bedrock highest $CaCO_3$,and OH ,sand

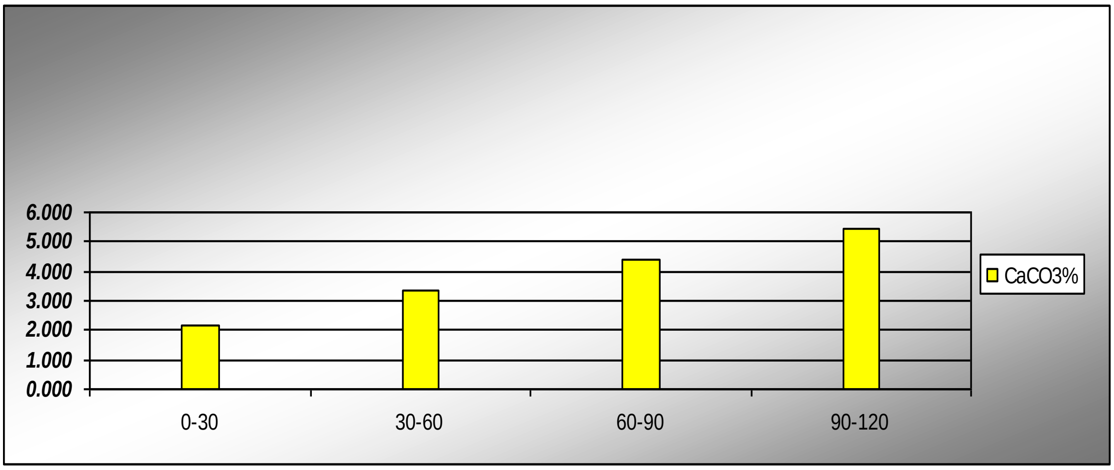

Figure 3.10. The spatial distribution of the soil $CaCO_3$ % in the soils horizon Erdemli Microcatchment

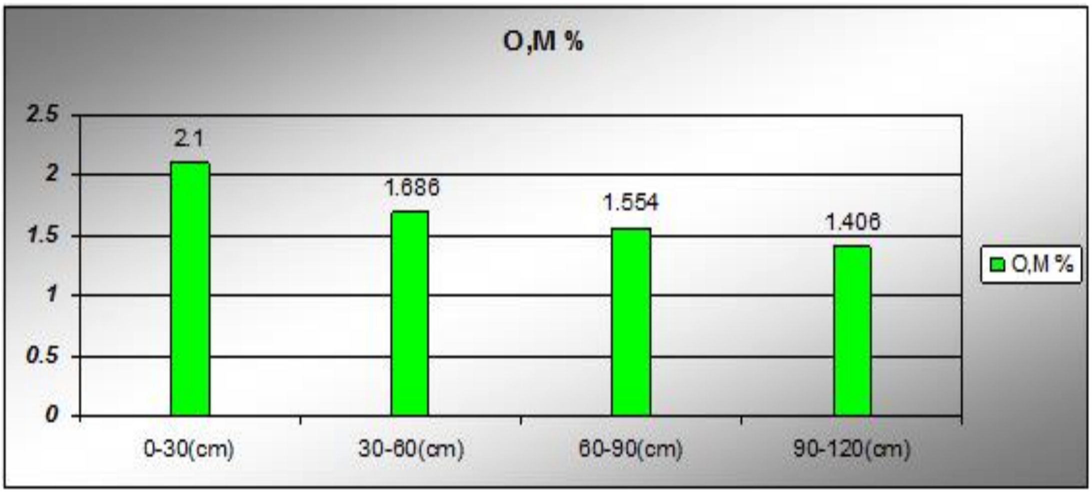

Figure 3.11. The spatial distribution of the soils O.M% in the soils horizon Erdemli Microcatchment

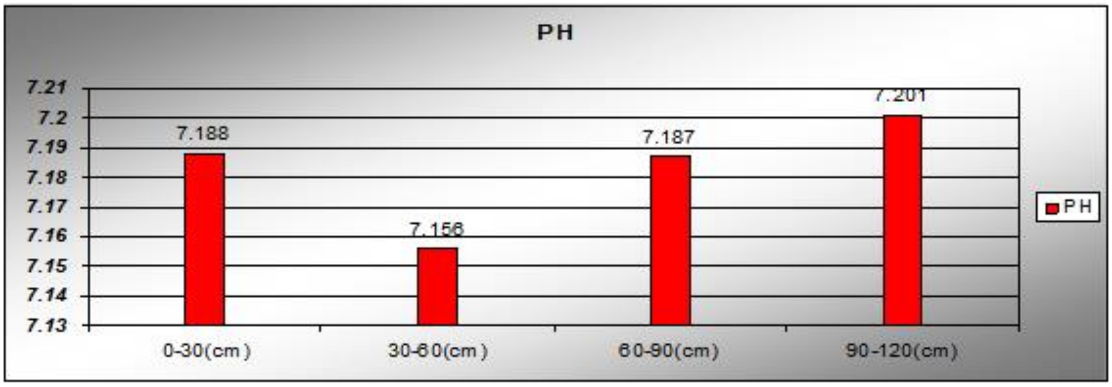

Figure 3.12. The spatial distribution of the soil PH in the soils horizon Erdemli Microcatchment

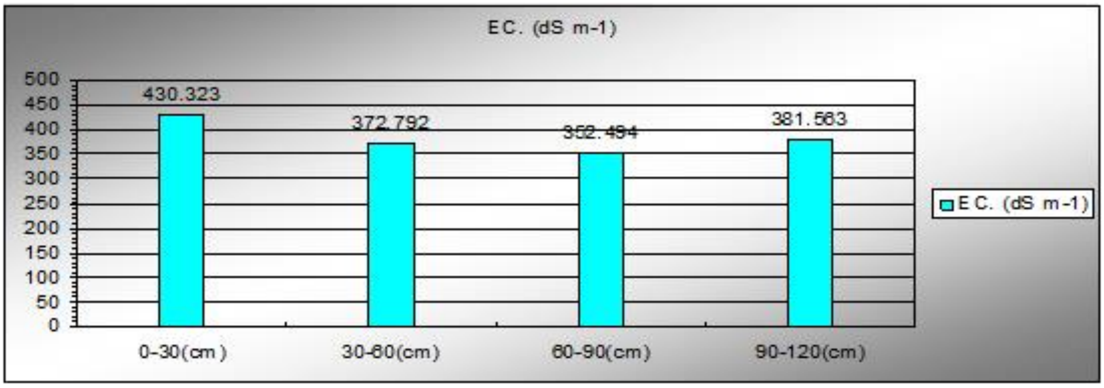

Figure 3.13. The spatial distribution of the soil EC % in the soils horizon Erdemli Microcatchment

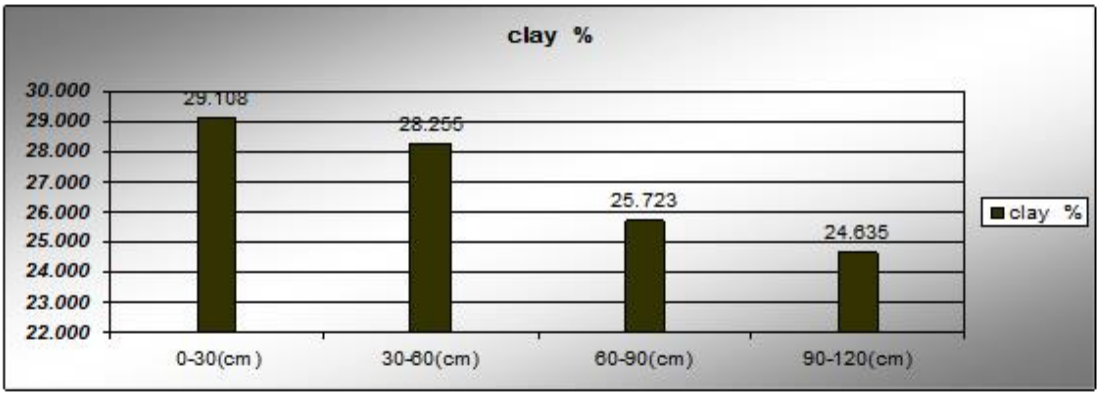

Figure 3.14. The spatial distribution of the soil Clay % in the soils horizon in Erdemli Microcatchment

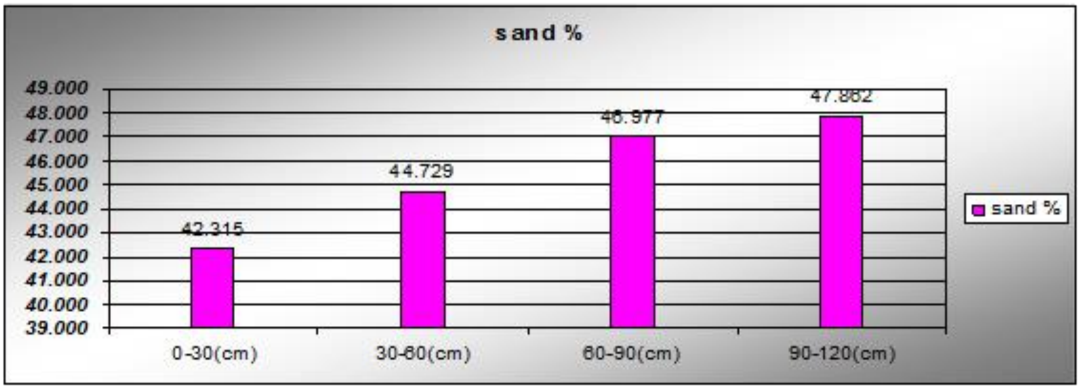

Figure 3.15. The spatial distribution of the soil sand % in the soils horizon in Erdemli Microcatchment

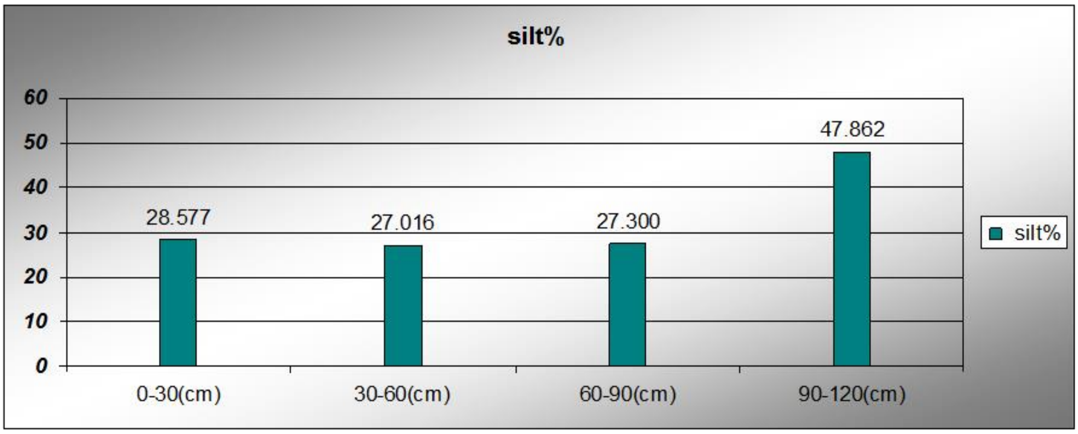

Figure 3.16.The spatial distribution of the soil silt (%) in the soils horizon Erdemli microcatchment

Profile No :32
Coordinate X: 617089, Y: 4292865

Profile No :33
Coordinate X: 616739, Y: 4292857

Profile No :34
Coordinate, X: 616417, Y: 4292540

Profile No :35
Coordinate ,X: 616656, Y: 4292666

Profile No :36
Coordinate, X: 616983, Y: 4292638

Profile No :37
Coordinate X: 617392, Y: 4292540

Figure 3.17 . showing number soil profile in the Erdemli Microcatchment

3.1.11. GIS and GPS will be used for Mapping of Study Area

Geographic Information System (GIS) will be used for mapping of study area**.** After the study area characteristics and soil properties are determined, the analysis results will be mapped by Arc Map GIS program .geographically referenced information storage is hardware and software system that is used to maintain and analysis. Integrated microchemist t studies, analysis of the basin are used effectively in monitoring and evaluation system. The virtuous basin project will also benefit effectively from GIS. For this purpose, "Bingol University and GIS Research Center" will play a role in an active way at all stages of the project.GIS using topographic (1:25000) map and Google earth/satellite image as resources, location map of the study area was developed using ArcGIS 10.3 By determine boundary coordinate points using GPS, delineation of microchemist was carried out. This microchemist was then classified into area differing from each other in land use type, surface soil color, elevation, and using determine slope and aspect, surface land feature (high, low, and flat) geographic location and using to determine best soil management practices and soil quality by explain mapping. After that the respective coordinate points. Determine Using GPS. Were fed into the GIS environment; then, polygons for the microchemist and making by program digitizing the recorded boundary points. Also using to determine soil classified in to different fertility categories, such as high, low .very low. Very high, medium .on of basis of the content of each selected soil type and soil quality and soil parameters. And using to determine best soil management which was mapped is soil. (PH and EC, OM, $CaCO_3$, Total N, available P, and available K, Na).

3.2. Method

3.2.1. Texture Classification Bouyoucos Method

Bouyoucos, GJ, 1936. Directions for Making Mechanical Analysis of Soils by the Hydrometer Method. Soil Sci. 42(3)

➢ Reagents

5% Calgon solution: weigh 50 g. of Calgon dissolve it in 1 liter of deionized water

➢ Procedure

Weigh 50 g of dry screened soil (use 100 g for sandy soils) into a 250 ml beaker, add 20 ml %5 Calgon solution, then add 200 ml distil water, stir the soil and water to mixed well and let stand overnight, transfer to a dispersion cup, and place the dispersion cup on the Humboldt mixer, and mix for 3 minutes, then transfer to a graduated cylinder which has volume of 1130 ml (but for sandy soil must use cylinder which has 1000 ml volume) and add distil water in to cylinder then complement the volume to 1130 ml, and stir thoroughly using the weighted disc shaped bar, alternatively, invert the cylinder 20 times, immediately place the hydrometer and the thermometer into the slurry, then record the hydrometer reading and the temperature after 40 seconds from the last mixing inversion, also after 2 hours, and again record the hydrometer reading and the temperature. Analyze a blank in the same manner without using soil this time. For temperature correction use a value of 0.4 for each degree temperature difference from 20 °C. Add or subtract this factor if the temperature is more or less than 20 °C, respectively.

➢ Calculation

40 Second Reading:

%Sand =100 - %(silt +clay)

2 Hour Reading:

$$\%\mathrm{Clay} = \frac{(\mathrm{A} - \mathrm{B})}{\mathrm{wt.soil}} \times 100$$

➢ **Determination of Silt**

$$\%\text{Silt} = 100 - (\%\text{Sand} + \%\text{Clay})$$

A = Sample hydrometer reading + temperature correction

B = Blank hydrometer reading + temperature correction

3.2.2. Soil pH and EC

pH was measured by electrometric method using (digital pH meter), by weighting (30) gram of soil from soil samples which was sieving with stainless-steel sieves that have the pores of 2 mm and put in to plastic beaker and added (30) ml. of deionized water, then mixed together very well with a spatula and let it a night, then shake the solution in the plastic beaker very well and read pH after the instrument was calibrated before reading each sample using buffer solutions of pH=(4, 7, and 9) as described by (Apha et al.,2012). Then by using same solution was measured EC by (digital conductance meter) by method (Black, 1965).

3.2.3. Total lime

0.5 g of soil sample was placed in a jar-shaped bottle. To avoid immediate reaction between acid and soil, 5ml of diluted HCl (3N) is put in a small plastic container in the jar shaped bottle, the bottle then was placed into a calcimeter, and the system was closed. The soil sample and the acid were allowed to react by shaking. The shaking was continued until the gas release stopped. Once the gas release ends, the volume of CO gas released at the calcimeter was noted (Vt). The pressure and the temperature values of the environment were measured by using barometer and thermometer respectively, and these values were recorded. The real gas volume (V0, at 0°C and 760 mmHg) was calculated by using Boyle-Mariotto formula (Gülçur, 1974).

- **Calculation**

$$V_0 = \frac{(V_t \times (b - e) \times 273}{760 \times (273 + T)}$$

$$CaCO_3\% = \frac{V_0 \times 0.4464}{A} \times 100$$

Where:

V_e= Gas volume read on calcimeter (cm^3)

b= Recovered Barometer pressure (mmHg)

e = vapor pressure of water at "t" °C (mmHg)

T= Temperature

A= Soil Sample weight (g)

3.2.4. Organic Matter

Organic carbon was determined by wet oxidation method (Walkley and Black, 1934) Nelson and Sommers (1996).

- **Reagents**

1-Potassium dichromate, 1 N: Weigh 49.04 g of reagent- grade K2Cr2O7 (dried at105 ºC), and dilute it in 1000 mL volumetric flask with distilled water.

2- Sulfuric acid, concentrated (not less than 96%).

3-Barium diphenylamine sulfonate 0.16 %: Weigh 0.16 g of the indicator and dilute it in 100 mL volumetric flask with distilled water.

4-Ferrous sulfate heptahydrate (FeSO4. 7H2O) solution, 0.5 M: Weigh 140 gofFeSO4. 7H2O and put in a 1000 mL volumetric flask and dissolve with distilled water. Add 15 mL of concentrated sulfuric acid and dilute with distilled water.

➢ **Procedure**

0.5 g of air dry soil sample (sieved to pass 100 µm) and 10 mL of 0.167 M K2Cr207 was added into a 500 mL Erlenmeyer flask, and the flask was gently swirled to accelerate the reaction. Then, 20 mL of concentrated H_2SO_4 was added to the flask, and it was heated for 1 min. The flask was allowed for about 15 min until it cooled, and later 200 mL of distilled water was put in the flask along with 13 drops of barium diphenylamine sulfonate indicator. At the final stage, the solution was titrated with 0.5 M FeSO4. When the end point was approached, the color of solution changed sharply from brown to dark green, and to greenish cast. The blank was also treated in the same manner, but without soil

3.2.5. Macronutrient (K and Na)

Ammonium acetate (1 N NH_4OAc at pH 7.0) method with 1/10 soil/solution ratio was used for extraction of soil available K and Na (Helmke and Sparks, 1996). The amount soil available nutrients in the filtrate were determined by (Fleayfotometr).

➢ **Reagents**

Weigh 77.1 g of NH_4OAc and put in 1000 mL volumetric flask, and add 900 mL of distilled water with continuously stirring. After mixing the solution, adjust the pH to 7.0 by using either 3 N acetic acid (CHCOOH) or $_3$N ammonium hydroxide (NH_4OH). Finally, dilute to a final volume of 1000 mL with distilled water.

➢ **Procedure**

4 g of air dry soil sample (<2 mm) and 40 mL of the 1 N NH_4OAc extraction solution were put into a 100 mL Erlenmeyer flask. The flasks were shaken for 1 hour on a mechanical shaker at a medium speed (RPM = 175). Then, the content was filtered through a funnel lined with Whatman No. 42 filter paper. Finally, the levels of extractable K, Ca, Mg, and Na in the filtrate were determined by Fleayfotometr.

3.2.6. Phosphor in soil

Soil available phosphorus was determined with or Olsen Method (Olsen et al., 1954) (Kuo et at., 1996). After extracting P with 0.5 M $NaHCO_3$, phosphorous in the extract was determined with Ascorbic Acid Method using a spectrophotometer.

- **Extraction reagent (0.5 N $NaHCO_3$)**

Weigh 42.0 g sodium bicarbonate ($NaHCO_3$) and dissolve it in a 1000 mL volumetric flask with distilled water and adjust the pH to 8.5 by used either 50% sodium hydroxide (NaOH) or 0.5 N hydrochloric acid (HCl).

- **Ascorbic Acid Reagent**

1-Sulfuric acid: 14 mL of concentrated H_2SO_4 is diluted in 100 mL volumetric flask with distilled water.
2- Ammonium moly date: Weigh 2 g of [$(NH_4)_6Mo_7O_{24}$. $4H_2O$] and dissolve it in 50 mL volumetric flask with distilled water.
3- Antimony potassium tartrate [K (SbO). $C_4H_4O_6$. ½ H_2O]: Weigh 0.1314 g and dissolve it in a 50 mL volumetric flask with distilled water.
4- Ascorbic acid, 0.1 M: Weigh 1.76 g of C_6H8O_6 and dissolve it in 100 mL volumetric flask with distilled water.
5-Mixed reagent: Mix thoroughly 100 mL of H2SO4, 30mL ammonium molybdate solution, 60 mL of ascorbic acid solution and 10 mL of antimony potassium tartrate solution. Dilute the solution to volume and mix well.

- **Extraction procedure**

2.0 g of air dry soil sample (<2 mm) and 40 mL 0.5 M $NaHCO_3$ were added into a 100 mL Erlenmeyer flask, and the suspension was shaked on a mechanical shaker at a medium speed (RPM= 165) for 30 min and filtered through Whatman no.42 filter paper. Finally, 3 mL of filtrate and 5 mL of ascorbic acid solution were mixed in a 25 mL volumetric flask and filled to volume with distilled water. The absorbance was measured at 880 nm by using spectrophotometer.

3.2.7. Determination of Total Nitrogen in Kjeldahl Digest

Bremner (1996) reported the Kjeldahl method for determination of total N in soils.

➢ **Reagents**

A-5.0 g of Kjeldahl tablets or digestion mixture (100:1:1000 CuSO4.5H2O/Se/K or 1:60:1670 (CuSO4/TiO2/K).

B- Sulfuric acid (H_2SO_4), concentrated (18 M).

C- Sodium hydroxide (NaOH) solution 40 %: Weigh 400 g of NaOH in a Erlenmeyer flask 1L, add 700 mL distilled water, and swirl until the alkali is dissolved. After the solution is cooled, fill up to volume with distilled water.

D- Boric acid indicator solution 2%: Weigh 20 g of pure boric acid in a 1 L Erlenmeyer flask, add about 600 mL of distilled water, and heat and swirl until the H_3BO_3 is dissolved. After the solution is cooled, add 20 mL of mixed indicator solution prepared by dissolving 0.099 g of bromocresol green and 0.066 g of methyl red in 100 mL of ethanol (CH_3CH_2OH). Then add 0.1 M NaOH cautiously until the solution is assumed a reddish purple tint (pH approximately 5.0), and fill the flask to 1 L with of distilled water.

E– Sulfuric acid (H_2SO_4) or Hydrochloric acid (HC1), 0.005 M standard.

➢ **Procedure**

0.5g soil sample was weighted then the sample was putted in a digestion tube. After that, 1 Kjeldahl tablets and 15 mL concentrated sulfuric acid (H_2SO_4) were added to each tube. The tubes were placed on a digestion rack, and then the mixture was heated to about 375°C- 400°C for 3 hours. After digestion, the flasks were allowed to cool, and 20 mL of distilled water was added to each tube (slowly, and with shaking). The tube was then placed in a distillation unit, in which N in the tube is converted to NH_3 gas by addition of a strong alkali (NaOH), and the released NH_3 gas is captured after condensation in a boric acid solution. The distillation process takes about 8 minutes, and as NH_4^+ is collected in a 150 ml Erlenmeyer flask with boric acid in it, the color of the solution changes from pink to green. After distillation, NH_4-N in the distillate was titrated with 0.01M H_2SO_4, and the color change at the end point was from green to pink.

- **Calculation**

%N in soil sample = (S –B) × N × ME × 100 /W

Where:

S: is ml of standard acid used in the titration of the sample distillate

B: is ml of standard acid used in the titration of the blank distillate

N: is the normality of the acid used in the titration of the distillate

ME: is the milligram equivalent weight of nitrogen (0.014 g)

W: is the mass of plant sample taken in gram for the preparation of the sample digest.

3.2.8. Static Analysis

Data that have been taken from the laboratory was tested and analyzed for each soil chemical and physical property. Soil management practices were subjected to descriptive statistical Analysis for determination of mean, maximum, minimum and standard deviation of mean for each variable. Mean difference all of soil samples 80 profiles .Soil samples was calculated and concluded accordingly. Also to detect the presence of significant difference between the two practices in soil physical .chemical properties, soil samples T-Test and z-test analysis were conducted by using SPSS-24 software computer at 0.01, significance level. The final output of the analysis was interpreted in words and figures depending on observed and critical stated for accepting or rejecting null hypothesis based on t calculated a maximum. Minimum and the mean values of each variable were displayed on table.

4. RESULTS AND DISCUSSION

4.1. Soil Management

Doubtless, one of the major features that are responsible for getting an acceptable crop yields, is the attendance of fundamental plant nutrients in the soil in adequate quantities and in willingly serviceable for supreme and coherent soil management, acknowledging the fertility status and physical possessions of a soil is fundamental.Testing the soil is one of the methods of confirming the fertility prestige of soil, so that recommendations in relation to deficient nutrients or soil amendments can be done.

Actually, soil testing has its share as an essential feature in any scheme of agricultural progress.(Andrews at al., 2004) Soil testing workrooms are found and built in so many places around the world, covering all areas in their own countries, where soils are tested, analyzed scientifically and rapidly, afterwards recommendations are made in respect of the fertilizer needs for different sorts of crops. But this fact does not mean respectively that all successful farming depends on the knowledge of physical, biological, and chemical properties of the soil, but in beside this is a matter concerning both soil and its management. Having obtained soil management methods means having the ability of the correct presentation of the relationship between the soil and its grown crops as its production. Although the obstacles of soil management can be different according to the climatic conditions of the soil and the expected crops to be grown, yet still there are some other essential factors which govern the choice of a soil management practices. One the most prominent features of good soil are its management. This means insuring a suitable physical condition of the soil and implies an agreeable regulating of soil moisture and air the conservation of soil OM which reassures granulations is a valuable consideration of a good tilth, afterwards all the tillage actions and timings have to be accustomed to cause the most decreasing destruction of soil aggregates.

4.1.1. Soil Quality

So many definitions have been suggested for soil quality, in the beginning of the 1990s, this term was defined to be “the capacity of a soil to function.” But this was not the end of the story, seven years later the American Society for Soil Science defines soil quality as “the capacity of a specific kind of soil.

To function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human Health and habitation” (Karlen et al., 1997) adopting the concept of the preceding definitions soil quality can be seen as an ability of soil in a situation that can satisfy its functions inside the bionetwork, that are affirmed by the combined actions as a bundle of several different properties of the soil. Taking agriculture in consideration, soil quality will be the soil’s suitability to support crops’ growth without being besmirched.

is among the scientists who believe soil quality to be measured by the quantity of crops produced. While there are others, who put their emphasize on the prominence of performing ho soil quality affects food quality or the habitat given for an inclusive array of biota. Plentiful other aspects associated with both living and dynamic nature of soil will be met if the procedure of soil quality is adopted in regard to various land uses, for instance; urban and industrial, rangeland and forest ecosystem, recreational uses… etc.

Budding uses of land uses are different issues, thus the concept of soil quality must be revised as relative more than absolute, and for that each piece of land has a natural ability to accomplish an explicit function. The establishment of the Soil Quality Institute (USAD. 2006) sees the concept of soil quality to be related to the method of sustainability of the use of soil and its management, in spite of this fact, in some cases the concentrations has been principally on contaminated land. To tackle this target the idea of soil quality should include soil fertility, its productivity, its degradation, and environmental quality. From this view the foremost activity is devoted to the evaluation of sustainable soil management schemes composed with the development of linked soil quality evaluations (Doran and Jones, 1996).

4.2. Characteristics of the Study area

Soil samples taken from the study area were analyzed and the results were analyzed in two parts. While the first part will define the characteristics of the basin section is designated as section will evaluate the second part of the basin soil characteristics.

It said in the section called Microcatchment characteristics, geographic information systems (GIS) are obtained from topographic characteristics, and slope relief characteristics. They constitute the catchment area size.

In the soil properties section, data 291 of soil samples collected from 80 point in total were analyzed

4.2.1. Basin Characteristics

Topographic Characteristics

4.2.2. Basin Area (Size)

The total area of Bingol virtuous Microcatchment 839717 ha.There is a relationship between the average sediment yields of the watershed area (Lee 1980). Basin area, hydrological relationships, soy so-economic characteristics, it is important that management and land classification and respect. Work in small watershed basin planning gives more significant results than working in large basins.

4.2.3. Basin Shape

Basin shape, basin area is grows different views. Time to leave the waters of the basin-shaped basin, directly affects the drainage system and hydrological features. The in discharge of water in the basin long time later, less than the danger of flooding and flood. The shape of the study area was shown in Figure 4.1. Catchment length (L) and width of the basin (B) is shown by letters.

The width is determined to connect the two farthest points of the basin, while the width is to combine the two farthest points in the basin width. According to this, basin length is

Microcatchment generally has a sufficient drainage network, river valley value 1.18 the drainage density is 3.25, the basin width is 9.93 km and the basin length is 16.51 km.

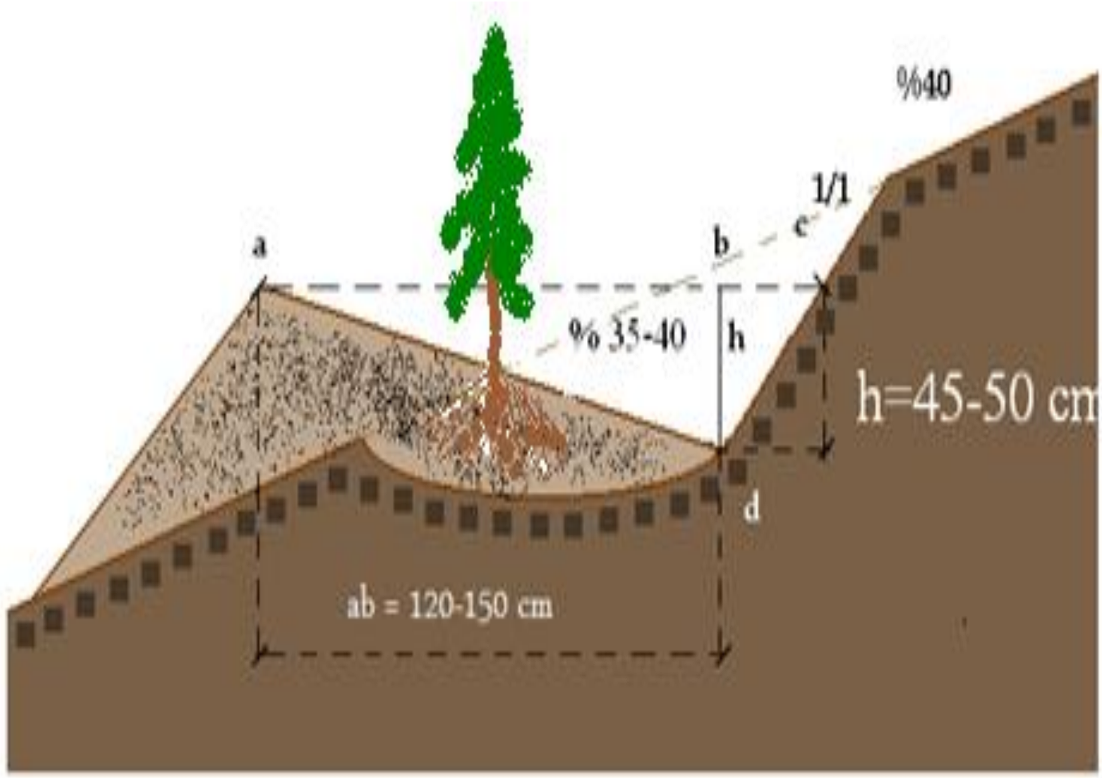

Figure 4.1. Saplings 40% Constructed Gradient Type Terrace Appearance Determination of terraces in the basin

Terrace December Account:

$$A = \frac{Q\ max}{C \ X \ I}$$

Q max: Max. Flow

I : The maximum precipitation amount in mm for 2 hours per 10 years period of thezone

A: Terrace ranges

(Q max) = 0.255 m^3 (taken from the ÇEM website according to terrace size)

4.2.4. Average Slope

Located in the slope topographic features, the need is of the utmost importance for both hydrologic water erosion. The average slope of the Microcatchment runoff and hence the formation of the shape of stream flow and peak flow hydrograph formation is an important factor (Aydin at al., 2009). Land slope refers to the degree of ruggedness of the land.

Land slope has been investigated because it affects many features such as erosion, soil depth, soil texture, surface flow, and land use pattern and vegetation cover. It is also used as basic data on slope land classification (Çepe at al., 1995).

As shown in Figure 4.2 and Table 4.1, the areal distribution and percentile ratios of the study area slope map and the study area slope groups are shown. According 8397.16 ha slope group of 0-12% slope has a 2301.57 ha, in the 13-20% group slope, 1392.38ha in 21-40% gradient group 3087.45mhas a 40% + gradient group is 3.1 hectares.

Table 4.1. The spatial distribution slopes of the Erdemli Microcatchment

Slope area	Area(ha)	Rate %
0-12 gentle slope	2301.57	27.41
13-20 steep slope	1392.38	16.58
21 -40 very steep	3087.45	36.77
41-60 very hill	1279.04	15.23
60.high elevation	336.72	4.01
Total	**8397.16**	**100.00**

The microcatchment is seen that generally has slightly inclined topography. The area of microcatchment are between 0-12% slopes, approximately about 27.41% seems to have a suitable topography for agricultural activities. Also in the range of 13-20% slopes about 16.58%, while the area between the slopes of the area is between 21-40% aslope about 36.77%. The slope area is between 40-60 and above 15.23 and 60% slope value of 4.01%.

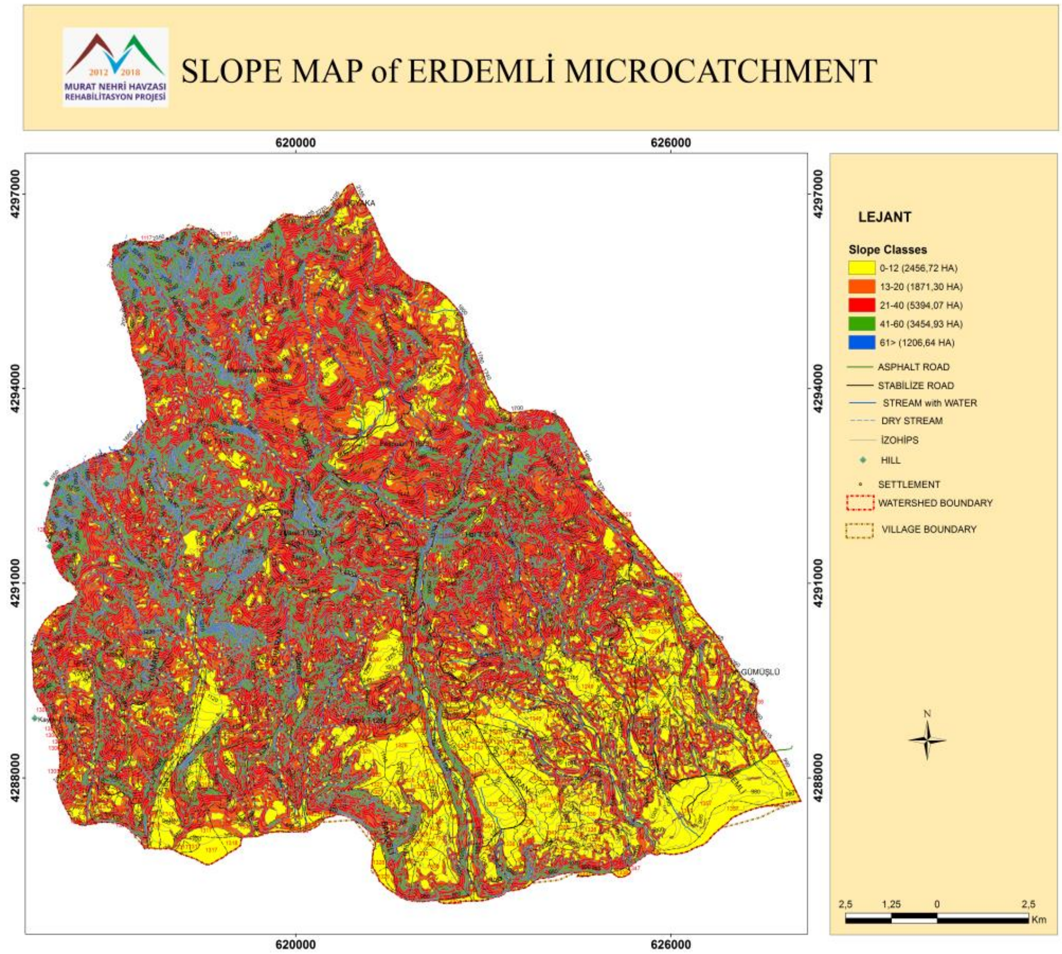

Figure 4.2. Map showing classification slope in the Erdemli Microcatchment

4.2.5. The Erdemli Microcatchment View Status

The spatial distribution and percentage ratios of the indications containing the directions of the route map as shown in Figure 4.3. are given in Table 4.2.According to the vineyard map it is observed that the general development of the basin in the North-South direction is distributed in a balanced manner according to this, total area of 571.35 ha and in the plain area of the study area 6,80% rate, the north and northeast views of the area 615.89 ha and 7.33%, eastern and southeastern views of the area 3042.18ha and 36.23% in the south and southwest views of the area 3275.44 ha and 39.01% rate and the west and northwest views of the area 892.3ha and constitute 10.63% rate. According the map view of the basin of the general direction of all the care that it is observed that the North-South advent distributed in a balanced way.

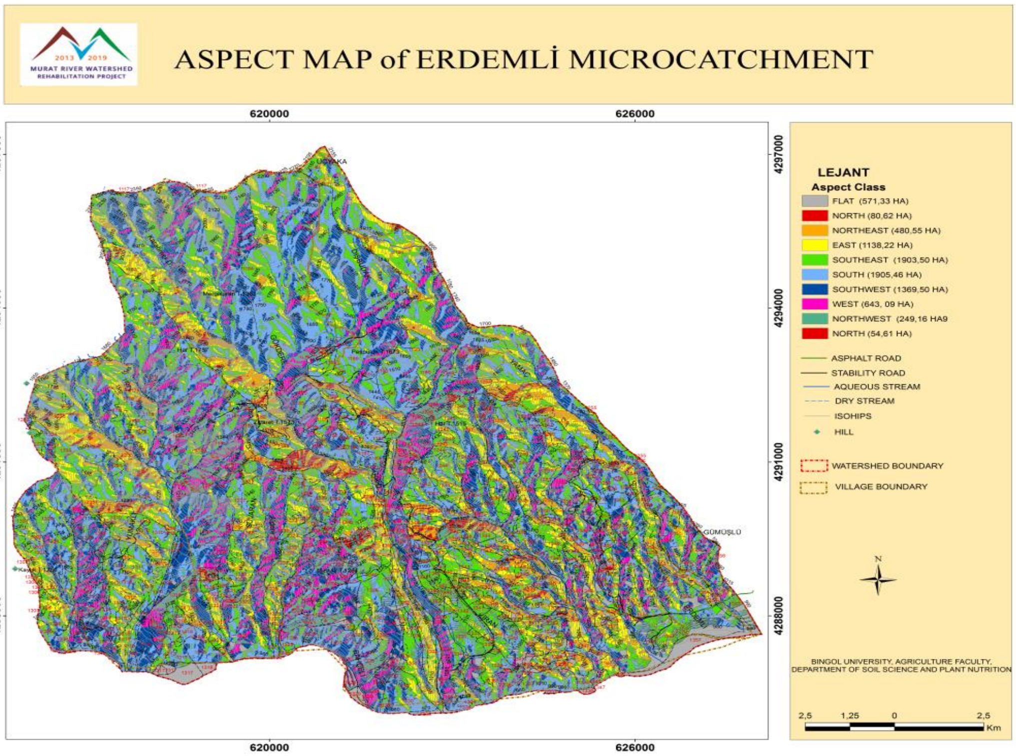

Figure 4.3. The spatial distribution map aspect of Erdemli Microcatchment

Table 4.2. The spatial distribution and percentage ratios aspect in the Erdemli Microcatchment

The Study area spatial Distribution		
Classification	Alan (ha)	Rate (%)
Flat	571.35	6.80
North	135.29	1.61
Northeast	480.6	5.72
East	1138.27	13.56
Southeast	1903.91	22.67
South	1905.86	22.70
South West	1369.58	16.31
West	643.12	7.66
Northwest	249.18	2.97
Total	**8397.16**	**100**

4.2.6. Average Elevation of Erdemli Microcatchment

Table 4.3. The spatial distribution and percentage ratios Elevation in the Erdemli Microcatchment

The spatial distribution Elevation in the Erdemli Microcatchment		
Elevation's	Area (ha)	Percentage (%)
960-1000	453.01	5.39
1000-1250	3554.75	42.33
1250-1500	1875.06	22.33
1500-1750	1354 .44	16.13
1750-2000	710.44	8.46
2000-2250	401.96	4.79
2250-2370	47.50	0.57
Total	**8397.16**	**100**

The highest point on the watershed boundary of the basin height maximum height, the height in the basin outlet refers to the minimum height Distribution according to study area so raises the height map and study areas are shown in figure 4.4. And table 4.3.

Accordingly, with the largest share in the work area height 1000-1250 meters altitude 3554.75 hectares and has a height ratio is 42.33%. Second row. which has the largest share of1250-1500 meters altitude and rate of 22.3and 31875.06% hectares, from1500 to 1750 meters altitude 1354.44 hectares compared to 16.13 % and, from 1750 to 2000 meters altitude 710.44 ha and compared to 8.46 , from 960-1000 meters altitude in the area of 453.01 ha and the rate is 5.39 % and from 2000-2250 meters altitude 401.96ha compared to4.79%, and range last with a maximum height of 2001-2175 meters high covering a minimum area of 47.50 hectares compared to 0.57%.

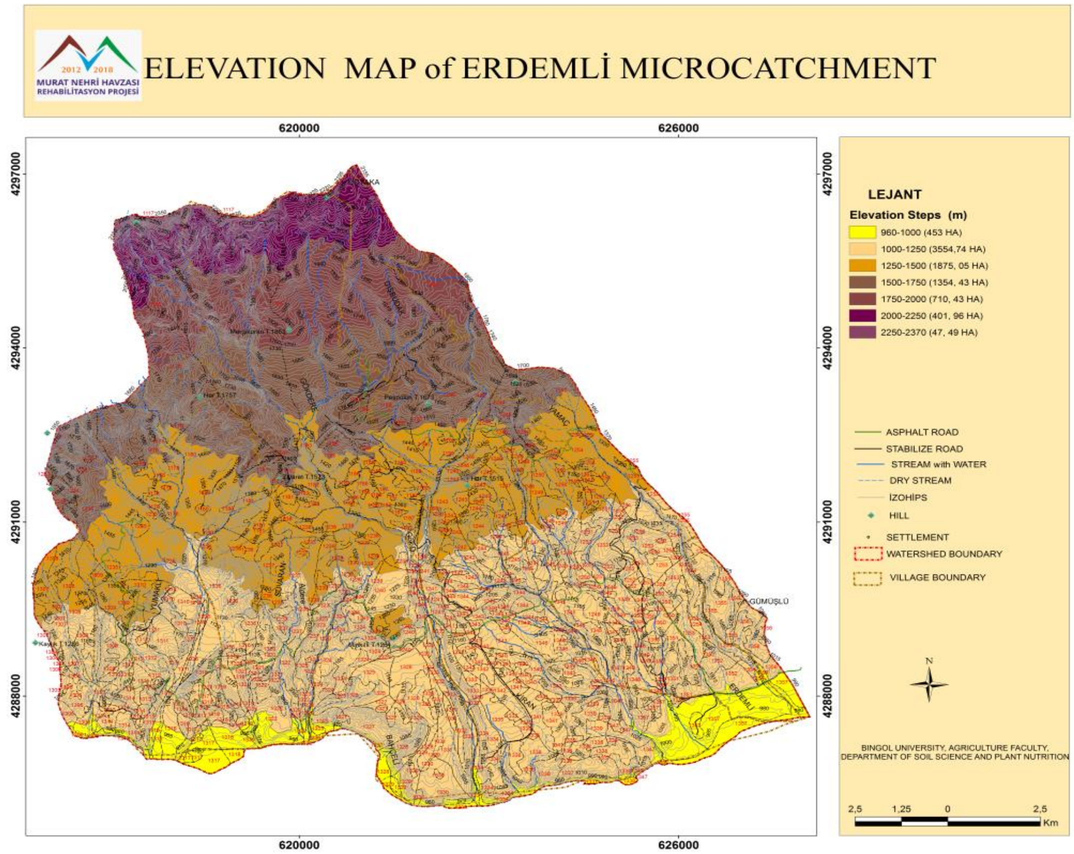

Figure 4.4. The Elevation map of Erdemli Microcatchment

4.3. The study area Descriptive Statistics of soil

4.3.1. Descriptive Statistics of soil

In the study area and predetermined 0-30cm, 30-60cm, 60-90cm, and 90-120 cm depth, a total of 80 points, soil samples from various physical and chemical analyze were carried out. Analysis of physical and chemical properties of the soil table 4.4, 4.5, 4.6, and 4.7 are shown.

As shown in Table 4.4, the clay content of the study area at 0-30 cm depth is 29.108% on average, the sand content is 42.315 %, and the silt content is 28.577%. The pH level in this study was ranged between 5.810 and 8.210, the mean value was 7.188, the EC level in this study was ranged between 108 us/cm to 1507.000 us/cm and the mean value was 430.323 us/cm, can be seen. The organic matter level in this study was ranged between

0.418% to 5.810%, and the mean value was 2.100%, the Lime level in this study was ranged between 0.467% and 30.628%, and the mean value was 2.184%.The total Nitrogen (TN) levels in this study was ranged between 0.001 % and 0.868 %,and the mean value was 0.121 %.The Potassium (K_2O) levels ranged between 26.220 ppm to 488.300 ppm and the mean value was 190.468 ppm, the sodium (ppm) levels ranged between 26.220 ppm. 488.300 ppm and the mean value was 190.468 ppm, the available phosphorus (P_2O_5ppm) levels ranged between 1.650 ppm to 100 ppm and the mean value was 11.495 ppm.

Table 4.4. Descriptive statistics of the study area (0-30 cm) (samples number = 80)

Parameter	Depth(cm)	N.S	Means	Minimum	Maximum	Std. deviation
$CaCO_3$%	0-30	80	2.184	0.467	30.628	0.417
O.M %	0-30	80	2.100	0.418	5.810	0.935
pH	0-30	80	7.188	5.920	8.210	0.485
EC. (us/cm)	0-30	80	430.323	108.000	1507.000	251.675
Clay %	0-30	80	29.108	2.863	64.777	10.136
Sand %	0-30	80	42.315	10.492	84.125	13.299
Silt %	0-30	80	28.577	8.751	44.070	6.699
T.N %	0-30	80	0.121	0.001	0.868	0.128
K(ppm)	0-30	80	190.468	26.220	488.300	104.3207
Na(ppm)	0-30	80	76.944	16.150	291.500	39.142
P (ppm)	0-30	80	11.495	1.650	100	12.833

As shown in Table 4.5, the clay content of the study area at 30-60 cm depth is 28.255% on average, the sand content is 44.729%, and the silt content is 27.016%. The pH level in this study was ranged between 6.250 to 8.330 the mean value was 7.156 The of EC level in this study was ranged betwee109.300 us/cm to 829 us/cm and the mean value 372.792 us/cm, can be seen. The organic matter level in this study was ranged between 0.297 % to 5.810, and the mean value was1.686 %, the Lime level in this study was ranged between 0.467% and 38.098 %, and the mean value was 3.379%.

Table 4.5. Descriptive statistics of the study area (30-60 cm) (samples number = 77)

Parameter	Depth(cm)	N.S	Means	Minimum	Maximum	Std. deviation
$CaCO_3$%	30-60	77	3.379	0.467	38.098	5.828
O.M %	30-60	77	1.686	0.297	5.810	0.889
pH	30-60	77	7.156	6.250	8.330	0.515
EC. (us/cm)	30-60	77	372.792	109.300	829.000	158.257
Clay %	30-60	77	28.255	2.736	64.777	11.888
Sand %	30-60	77	44.729	11.092	82.821	15.985
Silt %	30-60	77	27.016	8.909	42.697	7.026

As shown in Table 4.6, the clay content of the study area at 60-90 cm depth is 25.723% on average, the sand content is 46.977%, and the silt content is 27.300%. The pH level in this study were ranged between 6.230 and 8.170 the mean value was 7.187, The EC level in this study was ranged between 101 us/cm to 867.000 us/cm and the mean value 352.494 us/cm can be seen. The organic matter level in this study were ranged between 0.440 % to 5.810%, and the mean value was 1.554%, the Lime level in this study was ranged between 0.560% and 46.688%, and the mean value was 4.412%.

Table 4.6. Descriptive statistics of the study area (60-60 cm) (samples number = 70)

Parameter	Depth(cm)	N.S	Means	Minimum	Maximum	Std. deviation
$CaCO_3$%	60-90	70	4.412	0.560	46.688	8.358
O.M %	60-90	70	1.554	0.440	5.810	0.895
pH	60-90	70	7.187	6.230	8.170	0.499
EC. (us/cm)	60-90	70	352.494	101.000	867.000	157.775
Clay %	60-90	70	25.723	1.509	50.744	11.754
Sand %	60-90	70	46.977	13.809	89.730	16.810
Silt %	60-90	70	27.300	8.761	72.069	9.066

As shown in Table 4.7, the clay content of the study area at 90 -120cm depth is 24.635 % on average, the sand content is 47.862%, and the silt content is 27.503%. The pH levels in this study were ranged between 6.250to 8.450the mean value was7.201.The of EC levels in this study was ranged between 71.900 us/cm and 1036.000 us/cm and the mean value 381.563 us/cm can be seen. The organic matter levels in this study were ranged between 0.169% and 5.810%, and the mean value was 1.406%, the Lime level in this study was ranged between 0.000% and 54.158% the mean value was 5.412 %.

Table 4.7. Descriptive statistics of the study area (90-120 cm) (samples number = 64)

Parameter	Depth(cm)	N.S	Means	Minimum	Maximum	Std. deviation
$CaCO_3$%	90-120	64	5.412	0.000	54.158	10.464
O.M %	90-120	64	1.406	0.169	5.810	0.923
pH	90-120	64	7.201	6.250	8.450	0.554
EC. (us/cm)	90-120	64	381.563	71.900	1036.000	186.535
Clay %	90-120	64	24.635	2.843	65.117	11.058
Sand %	90-120	64	47.862	13.036	87.775	16.553
Silt %	90-120	64	27.503	8.661	44.902	8.410

4.3.2. Correlation Analysis of the Study Area Soils

Two or more variables of the analysis technique in the analysis of correlation relationship with each other are used. Decide on the degree of correlation analysis for looking at the relationship between interpreting the correlation coefficient in the examples given. The correlation coefficient r and is shown with values ranging from -1 to +1. Correlation coefficient (r) = 0 in cases where there has been a relationship between variables, where between 0 and +1 that there is a positive association variables headaches positive relationship between the variables are increasing the variable increases, the other variable also shows a reduction in the increase in the provision of a variable other variables, a negative correlation (Gökmen at al., 2015).

Table 4.8. Correlation analysis of the study area soil (0-30 cm)

Variables	Lime	O.M	pH	EC	clay	sand	Silt	N	K	Na
$CaCO_3$	1									
O.M	-0.264	**1**								
pH	0.422**	-0.354	**1**							
EC	0.151 *	-0.035	0.454**	**1**						
Clay	0.180 *	0.004	-0.209	0.096	**1**					
sand	-0.222	-0.028	0.079	-0.122	-0.871	**1**				
silt	0.169	0.048	0.159	0.098	0.215*	-0.668	**1**			
TN	-0.134	0.341	-0.115	0.085	-0.067	-0.039	0.179	**1**		
K	-0.029	0.273	-0.264	0.144	0.346	-0.350	0.171	0.387**	**1**	
Na	0.082	-0.150	0.096	0.114	-0.256	0.357**	-0.321	-0.057	0.065	1
P	-0.067	0.067	0.007	-0.027	-0.088	0.056	0.022	0.143	0.169	0.149

** Significant at P <0.01 level * Significant at P <0.05 level

As shown in Table 4.8, the results of the correlation analysis with the aim of determining the relations between the chemical and physical properties of 0-30 cm depth of the study area soil are shown. According to the organic matter content of the sand content of P <0.01 significance level is a negative relationship in question. There was a positive correlation between silt content and clay at P <0.05 and positive correlation between pH and EC, sodium and lime at P < 0.01 level. According to the total nitrogen content of the potassium and Phosphorus content of P <0.01 significance level is a negative relationship in question.

As shown in Table 4.9, there is a negative correlation between the sand content of the clay content and the pH level of P <0.01 according to the results of the correlation analysis between 30-60 cm depth of the working area soil. The content of silt and sand content of P <0.05 significance level, a negative correlation between the pH of the sand content is concerned, P <0.01 significance level is a positive relationship between the clay, EC and pH and lime content of P <0.01 significance level a positive relationship was concerned.

Table 4.9. Correlation analysis of study area soil (30-60 cm)

Variables	$CaCO_3$	O.M	pH	EC	Clay	sand
$CaCO_3$	**1**					
O.M	-0.181	**1**				
pH	0.558**	-0.388	**1**			
EC	0.276*	-0.098	0.217*	**1**		
Clay	0.332**	0.165	-0.086	0.480**	**1**	
sand	-0.342*	-0.136	-0.047	-0.467	-0.914	**1**
Silt	0.216*	0.030	0.252*	0.250*	0.388*	-0.728

** Significant at P <0.01 level * Significant at P <0.05 level

Table 4.10. Correlation analysis of the study area soil (60-90 cm)

Variables	CaCO3	O.M	pH	EC	Clay	sand
$CaCO_3$	**1**					
O.M	-0.137	**1**				
pH	0.439**	-0.413	**1**			
EC	0.520**	-0.093	0.331*	**1**		
Clay	0.300	0.088	0.027	0.433**	**1**	
sand	-0.416**	-0.116	-0.088	-0.477	-0.857	**1**
Silt	0.381*	0.100	0.129	0.322*	0.292*	-0.743

** Significant at P <0.01 level * Significant at P <0.05 level

As shown in Table 4.10, there is a negative correlation between sand content of organic matter content and P <0.01 significance level according to the results of correlation analysis between 60-90 cm depth of working area soil. The content of silt and clay content of P <0.01 significance level, while there is a positive relationship between the EC and pH scale in P <0.05 significance level was a positive correlation is concerned, between pH silt P <0.1 a negative correlation between 0.1 and sand significance level P <0.05 significance level, there are a negative relationship.

Table 4.11. Correlation analysis of the study area soil (90-120 cm)

Variables	CaCO3	O.M	pH	EC	Clay	sand
$CaCO_3$						
O.M	-0.125					
pH	0.531**	-0.289				
EC	0.393**	0.051	0.227*			
Clay	0.439**	0.062	0.210	0.458**		
sand	-0.408	-0.138	-0.285	-0.490	-0.889	
Silt	0.227*	0.190	0.285*	0.363*	0.436**	-0.799

** Significant at P <0.01 level * Significant at P <0.05 level

As shown in Table 4.11, there is a negative correlation between sand content of clay content and P <0.01 significance level according to the results of correlation analysis between 90-120 cm depth of study area soil. The content of silt and organic matter content of P <0.05 significance level P is a negative relationship between the lime content of the silt content is concerned, <0.01 significance level is a positive relationship in question. Between the EC and pH between lime P <0.01 significance level, while there is a positive relationship between the pH.

4.4.Physical and Chemical Analysis and Evaluation of Soil Sample Results

4.4.1. Soil Texture

Soil solid phase, clay, silt, and sand are regarded as ingredients in size. Quantities of these materials in a variety of dimensions in the earth mass, and their ratio with respect to each other refers to the soil texture. In other words the particles in the mass of earth texture indicating the relative condition shows the thinness or thickness of the solid material constituting the soil (Atalay at al., 2006).

Texture basic soil properties is bulk density, total porosity and pore size distribution, penetrometer (hardness) distribution, the soil is water-holding capacity and hydraulic conductivity affects many static and dynamic properties (Erşahin at al., 2001).

Sandy soils and soils covering more than 70% by weight of the sand fraction. Clay soils or soils consisting of 35 wt. %, mostly 40% clay fraction. A loam soil of sand, silt, and clay particles is a mixture of soil is defined as a textured, reflecting the characteristics of light and heavy textured soils evenly (Özhan at al., 2004). All the physical and chemical properties of loamy soil is suitable for plant growth from the pain. Food is good weather economies have a high water holding capacity. Sandy loam and loamy soils clay loam soils between the physical and chemical properties ideal care. This land provides an optimum development of the plant (Tanju at al., 1996).

Soil texture is the soil texture triangle is used to determine the class. But it is also possible to determine the soil texture by hand in the field. Accordingly, they form a generally smooth surface having clay soil sample structure and give a feeling s our hands also take very easy way. A silt soil sample having a structure leaves a feeling of work of our hands, having a soapy. Sandy and rough feeling can be felt easily through leaves and fingers according to the size of loamy soils with the rate structure because we have sand in them.

It has been found that clay content increases as the depth of the study area increases, while silt and sand contents decrease. In terms of land within the study area lands they differ in itself. Loamy soils they cover a large portion of the working drum. An equal amount of on-site sand, silt, and clay hosting. Have the desired physical properties for plant growth. Such water-holding capacity of the soil, the pore structure, water balance, ventilation, and structure are very good. The best soils for agricultural purposes and plant growth. When they receive excess water cost. Suddenly it does not harden when dry and easy pan revenues. Plows and other tools to adhere during tillage and soil release. If the chemical structure is good and sufficient level of efficiency if they carry very high nutrient soils.

The study area saturation with water in the soil (saturation mud) value ranges from 68.2% to 36%. The percentage of water saturation varies with the texture classes of soil (Kantarci at al., 2000).

4.4.2. Soil Reaction (pH)

Formed in the reaction of the soil solution or alkali earth is defined as the reaction. Soil pH reaction is expressed by the term. Potential abbreviation of the Latin phrase Hydronium pH Turkish equivalent is called the power of hydrogen (Kantarcı at al., 2000).

Soil reaction is to keep the soil a prominent place among the factors affecting the biological properties of the physical and chemical properties. Indeed due to microorganism activity in the soil and air and to this capacity, reception of nutrients, nitrification, plays an active role in the occurrence of the aluminum ions. Thus, plant development is directly or indirectly affected (Cepel at el., 1996).

Soil reaction class's soil with soil pH 7 neutral genetics, 7 under which values acid soils measured values above 7 indicate alkaline features. Soils that have a pH range of 3-4 are very strong acid, and those with a value between 10 and 11 are classified as very strong alkaline (Kantarci at el., 2000).

Table 4.12. Classification according to pH limit values (Ülgen and Yurtsever 1995)

Soil Reaction (pH) boundary values	
pH value	**Rating**
<4.5	Strong acidic
4.6-5.5	Moderately acidic
5.6-6.5	Slightly acidic
6.5-7.5	Neutral
7.5-8.5	Slightly alkaline
>8.5	Strongly alkaline
<4.5	Strong acidic

The study area soil pH values were evaluated according to Table 4.12 prepared according to (Ülgen and Yurt sever 1995). According to this, it is seen that the pH values at which the pH value of the working soil does not change depending on the depth change between 5.8 and 8.2. According to (Ülgen and Yurtsevere 995), neutral soil covering approximately slightly acidic of the land constitutes 5.8 of the total area. While slightly acidic soils constitute 7.5% of the total area, the medium soil constitutes 66.25% of the area and the acidic alkaline soil constitutes 26.25%of the area. The results revealed that the study area was the most suitable area for agricultural land in terms of pH.

Slightly acidic soil reaction-it said to be out of areas where cultivation is done on the field. Indeed under zero tillage plots measuring a pH value of 4.8, they measure the pH of 5.0 under conventional tillage plots (Erşahin at al., 2001). Acid-derived fertilizers used in soil fertilization cause acidification of the soil (Kantarcı at al., 2000)

4.4.3. Electrical Conductivity (EC (us/cm), Salt (%)

Table 4.13. Classification of salinity according to boundary values (Richards 1954)

Electrical conductivity (EC) boundary values	
EC value	**Rating**
0.00-0.15	Very Low
0.15-0.35	Low
0.35-0.65	Medium
>0.65	Very high

The study area was assessed according to Table 4.13, which was prepared according to EC values (Richards at al., 1954). The electrical conductivity (EC) value of the study area varies between 108.000 us/cm and 1507.000 us/cm, while the salt value of the soil varies between 0.002% and 0.02%. According to this analysis, it is concluded that all of the study area is unsalted and that there is no change in the amount of salt in the soil depending on the depth.

4.4.4. Carbonate (lime) (% $CaCO_3$)

The main sources of calcium in the soil calcareous parent materials are calcium containing minerals and organic matter.

Table 4.14. Classification according to lime limit values (Ülgen and Yurtsever 1995)

Lime ($CaCO_3$) boundary values (%)	
Limit value	**Rating**
0-1	Very Low
1-5	Low
5-15	Medium
15-25	High
>25	Very high

Most of the average annual rainfall of land because it is higher than in many countries in our region in the study area is less $CaCO_3$. The lime content of the study area soil varied between 0.467% and 30.628%, and the soil was evaluated according to Table 4.14 according to (Ulgen and Yurtsever 1995). Accordingly, 28.75% and 62.75% less calcareous soils of the medium lime 6.7% and highly 1.25% more calcareous soils. The study area is no problem with the 95% of lime soil. Analysis done to increase the amount of lime in the soil depth increases the minimum level has emerged as a result.

4.4.5. Organic Matter (%)

The study area was evaluated according to Table 4.15 prepared according to (Ulgen and Yurtsever .1995). Accordingly, the scope of the study area soil organic matter ranges from 0.418% and 5.81%. The amount of organic matter in the low 38.75% of the land within the study area, in the very low 8.75% is medium rate at 38.75% and high, very high was ranged between 10% to 3.75 in the soil A reduction in soil depth increases in the amount of organic matter and organic matter content of 0-30 cm of top soil analyzes made can be seen in part as a result has emerged.

Table 4.15. Classification according to organic matter limit values (Ülgen and Yurtsever 1995)

Organic Matter (O.M) boundary values (%)	
O.M%	Rating
0-1	Very Low
1-2	Low
2-3	Medium
3-4	High
>4	Very high

4.4.6. Total Nitrogen

The study area was evaluated according to Table 4.16 prepared according to (Kedir Abate Fentaw, 2015). Accordingly,(Bauer, A. And Black, A.L. 1994) they also found less amount of total nitrogen in the study area. They mentioned that the amount of total nitrogen correlated to the level of the area and, organic matter and topography (aspect .altitude and slope gradient, caver crop, Temperature, Run off these are these practical impact leaching and reduce total nitrogen. The total nitrogen level in this study was ranged between 0.001 % and 0.868 %, the mean value was 0.121 %. These numbers show a low range of variability in the soils .The amount of total nitrogen was classified based on different levels which were: very low 28.75%, low 62.5%, medium 6.7%, and very high 1.25% respectively, depth increases in the amount of total nitrogen content of 0-30 cm of top soil analyzes made can be seen in part as a result has emerged.

Table 4.16. Classification according to total nitrogen limit values (Kedir Abate Fentaw, 2015)

Total Nitrogen (TN) boundary values (%)	
Total nitrogen	**Rating**
<0.05	Very Low
0.05-0.12	Low
0.12-0.25	Medium
>0.25	Very high

4.4.7. 8

According to the results, there was a significant difference in the amount of sodium (ppm) which was determined based on (Rengasamy and Churchman .1999), they also found higher amount of sodium (ppm) in the study area. They mentioned that the amount of sodium (ppm) correlated to the level of the variable charge of clay minerals in the soil. And which was determined based on (Wondimagegne and Abere .2012), the also found amount of sodium (ppm) in the study. The amount of sodium (ppm) was classified based on different levels such as: low 65%, very low 17.5 %, medium 13.75 %, high 3.75%, the sodium (ppm) levels ranged between 26.220 (ppm) and 488.300 (ppm) the mean value was 190.468 (ppm) the numbers show medium range of variable in the soil. The amount of sodium (ppm) was classified based on different levels which were: very low 3.75%, low65 %, moderate13.75 %, high3.75% and respectively.

Table 4.17. Classification according to organic matter limit values (Kedir Abate Fentaw, 2015)

Sodium (Na) boundary values (ppm)	
Total sodium	Rating
<50	Very Low
50-100	Low
100-175	Medium
175-300	high
>300	Very high

4.4.8. Phosphorus (P_2O_5) (ppm)

Table 4.18. Classification of phosphorus (P_2O_5) according to limit values (Ülgen and Yurtsever 1995)

phosphorus (P_2O_5) boundary values (ppm)	
P_2O_5 value	**Rating**
0-3	Very Low
3-6	Low
6-9	Medium
9-12	High
>12	Very high

The study area was evaluated according to Table 4.16, where phosphorus (P_2O_5) values were prepared according to (Ülgen and Yurtsever 1995). Accordingly, the scope of work of soil phosphorus 1.650 (ppm) and 100 (ppm) shows the changes between. Low phosphorus ratio of 16.25% of land within the study area, good in 31.25 %, moderate in very low12.5 %, rate at very high 27.5 % and high 12.5%. Depth increases that reduced the amount of phosphorus in the soil and the analysis made in the best interest of soil phosphorus has emerged as a result of the 0-30 cm section.

4.4.9. Potassium (K_2O) (ppm)

The study area was evaluated according to the table prepared according to the values of potassium (K_2O) values of (Foth et al. 1990) and (Bolt et al., 1963). Accordingly, the scope of the work area potassium soil 26.22 (ppm) and (488.3) ppm shows the changes between. Potassium high ratio between 30% and 13.75% of the land within the study area than in just 3.75% and 11.25% are less than the 41.25%, rate in the middle. Depth has been a decrease in the amount of potassium in the soil increases the amount of potassium and best 0-30 cm soil analyzes made can be seen in part as a result has emerged.

Table 4.19. Classification of potassium (K_2O) according to limit values (Ülgen and Yurtsever 1995)

Potassium (K_2O) boundary values (ppm)	
Limit value	**Rating**
0-20	Very Low
20-30	Low
30-40	Medium
>40	High

4.5. Soil Management Map

GIS topographic map (1:25000) and satellite image as a resources location map of the in study area and land demarcation, was using. And soil management rating determines best soil management by soil quality assessment Erdemli Microcatchment status of the study area was mapped. The total of the study area in the soil management mapping is 838717 ha. From this total area, the area coverage of soil management the obtain from means soil layers examples (0-30) cm depth .The means of this research determination of best soil management practices by soil quality assessment of Erdemli Microcatchment in Bingöl Province Selected determine best soil management by quality parameter which were mapped are $CaCO_3$, O.M, PH, EC, total N, K, Na, available P, (figures maps 4.5,4.6,4.7 4.8, 4.9, 4.10,4.11,4.12,4.13,4.14and 4.15).Generally, the maps in the 839717 ha showed the amount of $CaCO_3$ was classified based on different levels. Which were very low 28.75%, low 62.5%, medium 6.7% and very high 1.25 limes in the study area. And the amount of organic matter was classified based on different levels. Which were very low 8.75%, low 38.75%, medium 38.75%, high 10% and very high 3.75% respectively in the study area. The PH was classified based on different levels this was slightly acidic7.5%, medium 66.25% and acidic alkaline 26.25% respectively in the soil reaction. Of the texture class was classified based on different levels. Which were Sand clay loam, Loam, Clay loam, Sandy clay, Loam sandy, Sandy loam, EC nusalinity of the study area, the amount of total nitrogen was classified based on different levels. which were very low 28.75%, low 62.5%, medium 6.7%, and very high 1.25%, respectively in the study area. Also the maps in the 839717 ha, showed the amount of potassium (ppm) was classified based on different levels. which were very low 3.75%, low 11.25%, moderate 41.25% , high 30%, and very high 13.75 % and the amount of sodium (ppm) was classified based on different levels. Which were very low 3.75%, low 65%, moderate 13.75% and high3.75%, and the amount of available phosphorus (ppm) was classified based on different levels. Which were very low 12.5%, low 16.25 %, moderate 31.25%, high12.5% and very high 27.5 % respectively in the soil.

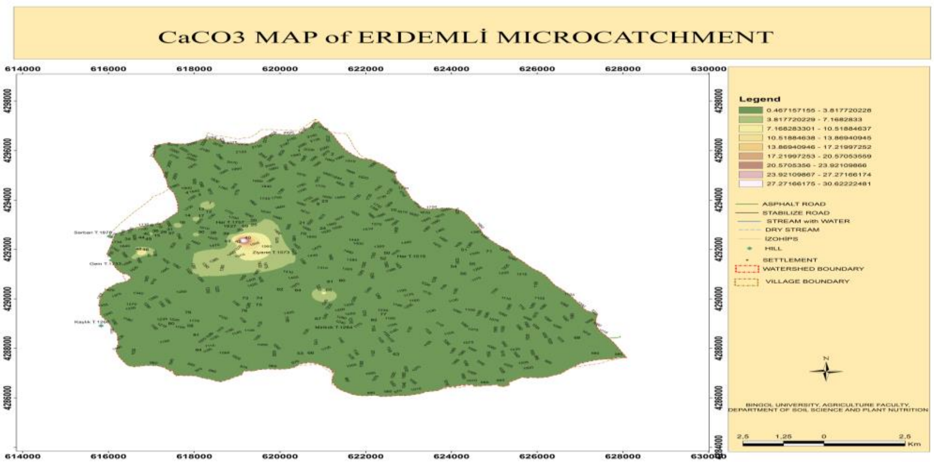

Figure 4.5. The Spatial Distribution range of soil $CaCO_3$ (%) in the soils of Erdemli Microcatchment

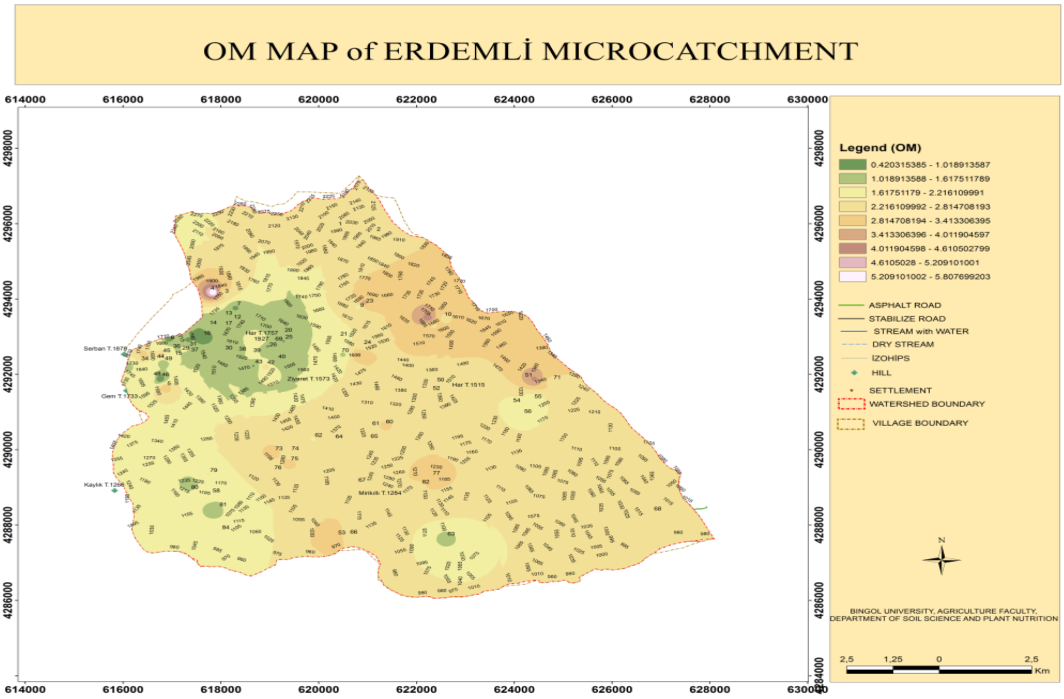

Figure 4.6. . Map Spatial Distribution of soil O.M (%) in the soils of Erdemli Microcatchment

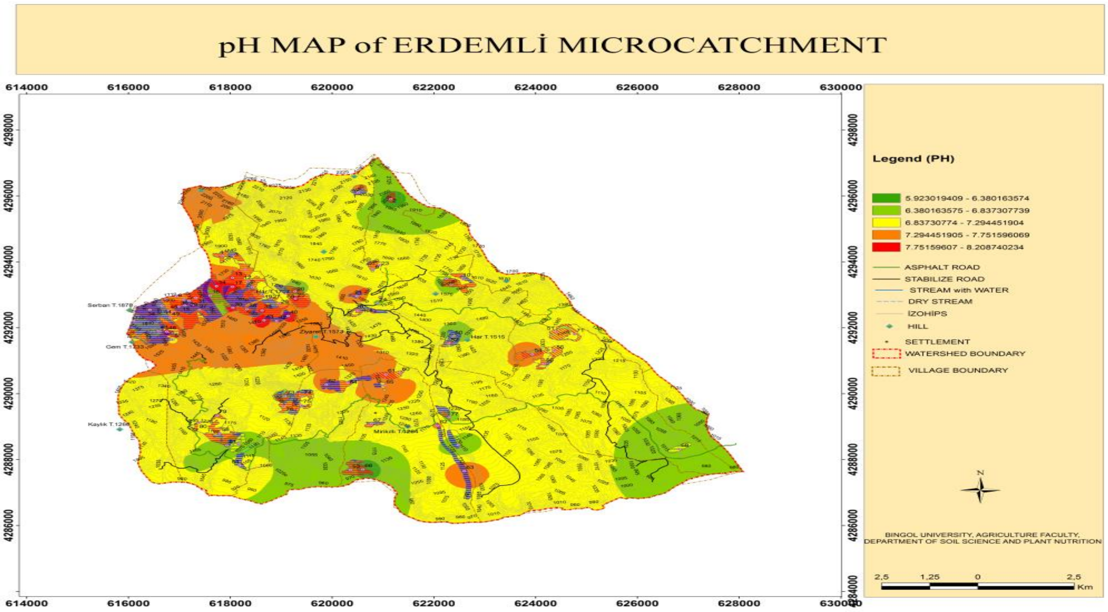

Figure 4.7. Map spatial Distribution of soil pH in the soils of Erdemli Microcatchment

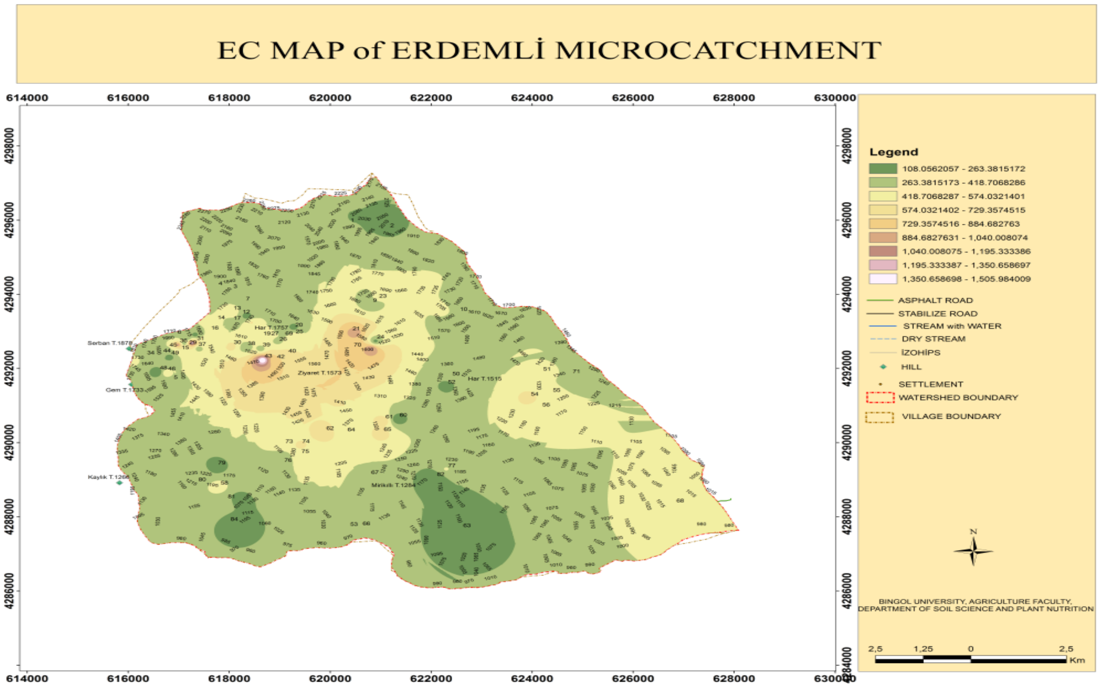

Figure 4.8. Map spatial Distribution of soil EC in the soils of Erdemli Microcatchment

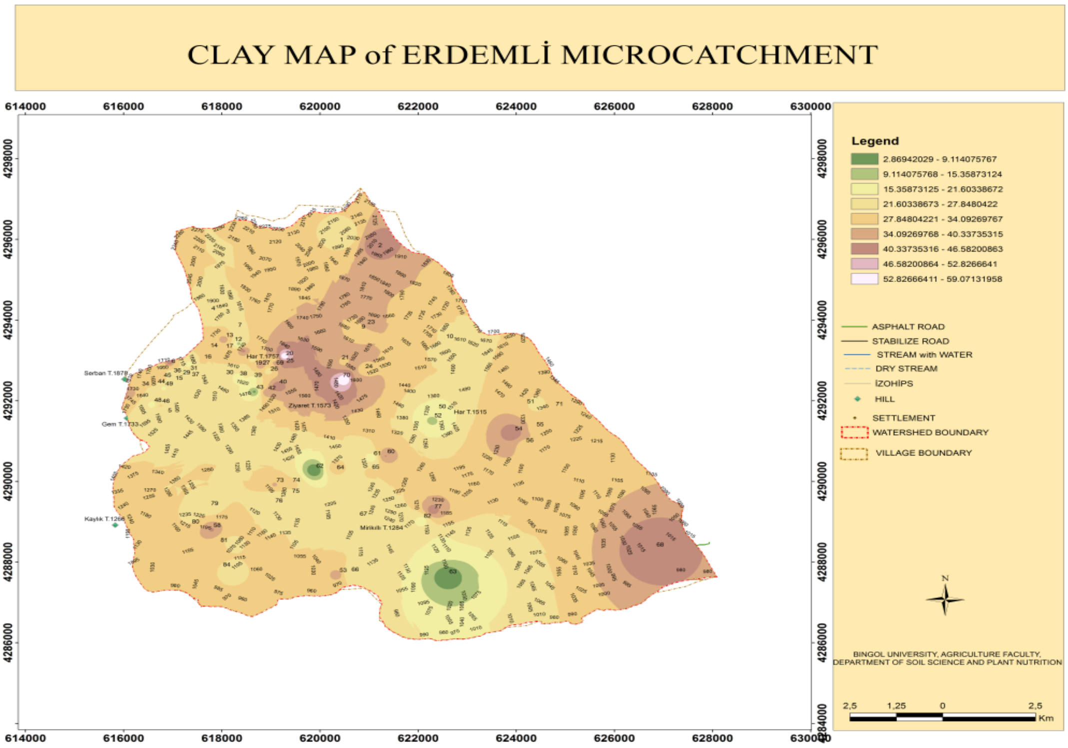

Figure 4.9. The Spatial Distribution of soil clay (%) in the soils of Erdemli Microcatchment

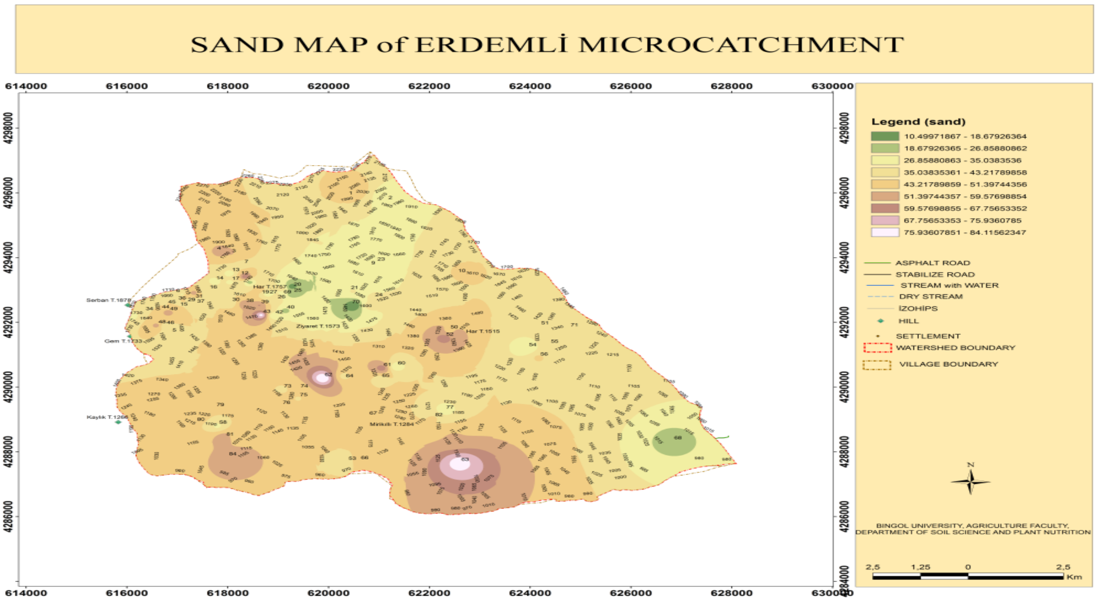

Figure 4.10. The Spatial Distribution of soil sand (%) in the soils of Erdemli Microcatchment

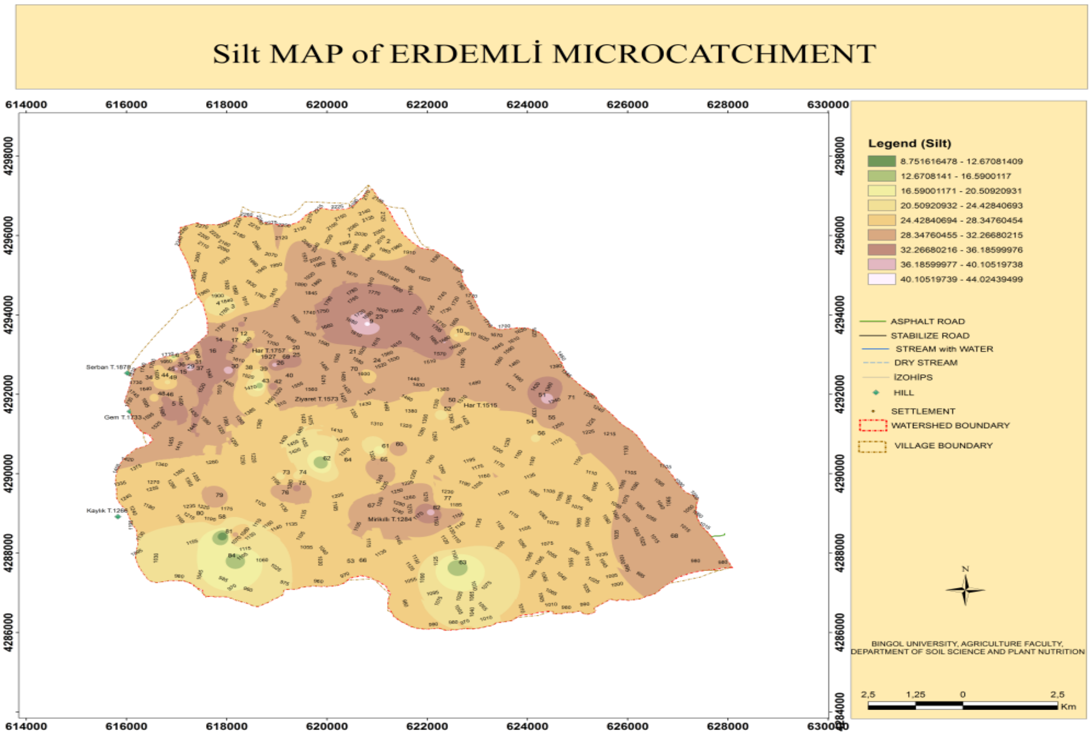

Figure 4.11.The Spatial Distribution of soil Silt (%) in the soils of Erdemli Microcatchment

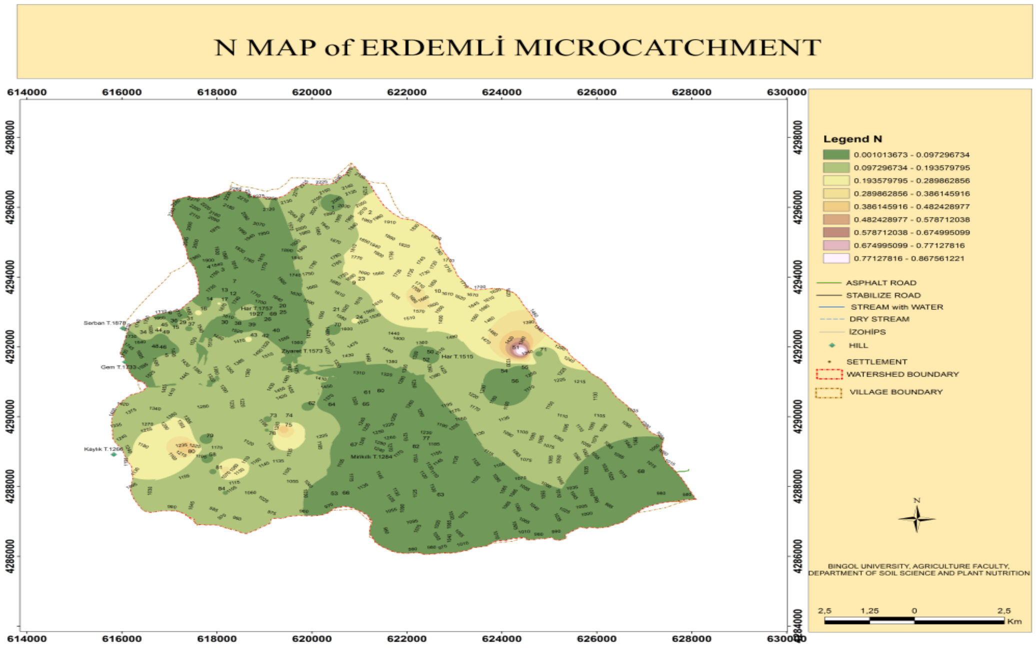

Figure 4.12. The Spatial Distribution of soil total Nitrogen (%) in the soils of Erdemli Microcatchment

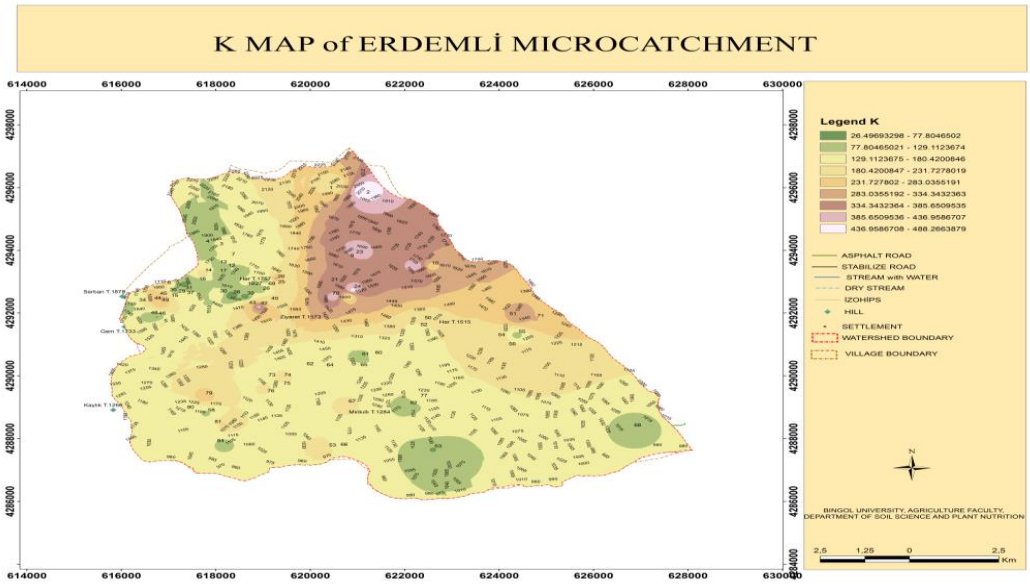

Figure 4.13. The Spatial Distribution of soil potassium (ppm) in the soils of Erdemli Microcatchment

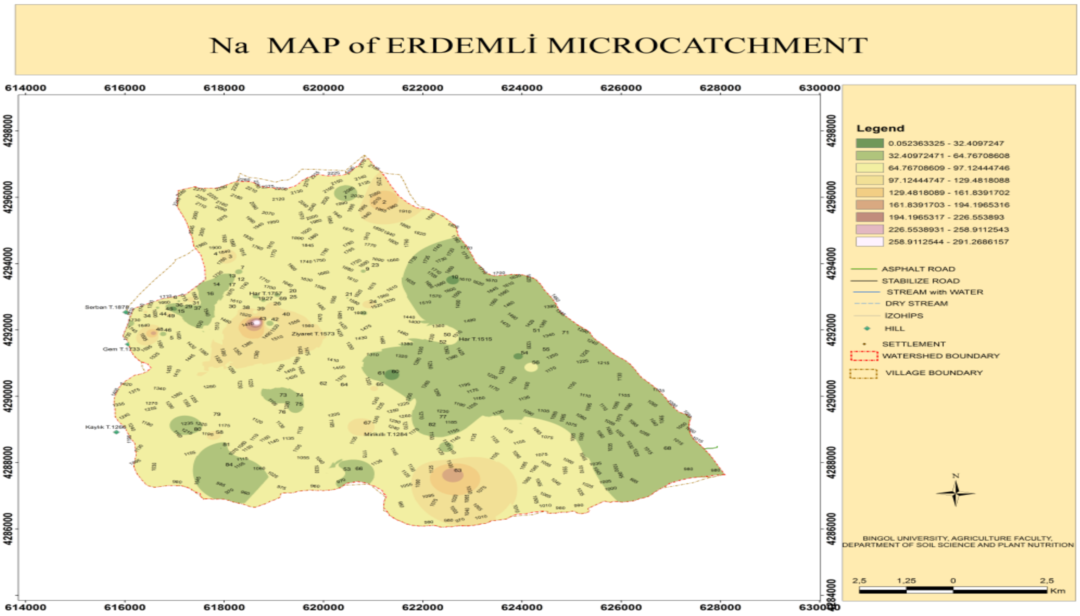

Figure 4.14. The Spatial Distribution of soil sodium (ppm) in the soils of Erdemli Microcatchment

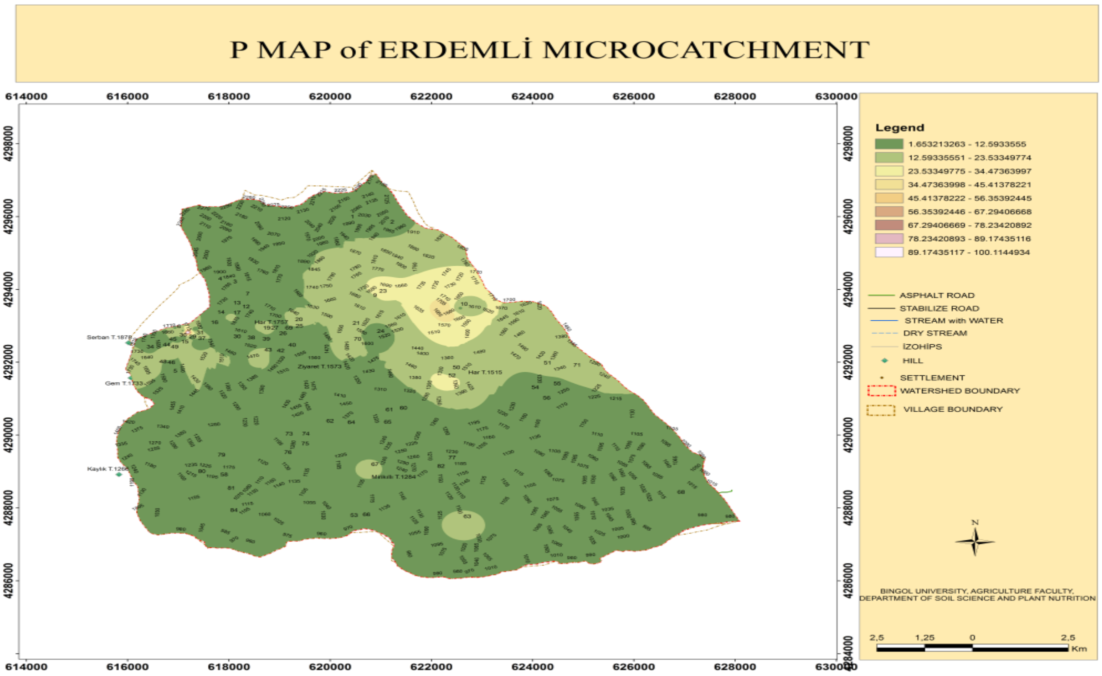

Figure 4.15. The Spatial Distribution of soil phosphorus (ppm) in the soils of Erdemli Microcatchment

5. CONCLUSIONS AND RECOMMENDATIONS

This study is made of Bingol province Slope Microcatchment to determine the watershed characteristics with some soil properties

Microcatchment slope is located west of the Young district and extends from the exit of the central district. The villages located within the boundaries of the Microcatchment study area; Bahçeli, Erdemli, Dışbudak, Erdemli, Gökdere, Kıran, Suvaran and Yumaklı. Are the villagers.

Mostly hot and dry summer in Bingol province shows a continental climate with harsh winters and cold. In spring and autumn rain, winter rains occur in the form of snow. The annual average rainfall is 1202.5 mm, 936.9 mm and annual evaporation sum. Write

Evaporation increases with increasing temperature and evaporation to reach the highest level of 262.7 mm in July.

The geological structure of the study area is composed of metamorphic bedrock. It made deep soils developed on the bedrock, sandy-loam, and a sandy-clay texture. In this land drainage problems unsalted although not shown, a majority of lime, a moderate amount of organic matter is determined to have a pH near neutral property. Analyses carried out where there is no limiting factor for plant growth were observed in the results.

Maximum footprint area of the work area when land use cases investigated. 2727.96 ha of land class VI. 1429.64 ha of land class II. 1325.18 ha of land class. class 1207.71 ha of land, trouble can be considered in terms of use of agricultural land of 2301.57 hectares, gently sloping, rocky terrain and the influence of moderate erosion was determined that covers 469.44 ha.Work area of 839717 hectares in the mild erosion, 3164.91 ha of moderate to severe erosion and severe erosion is observed in the area of 3939.95 hectares

Basin area has an adequate drainage network in general. Basin length of 16.51 km and the basin width of 9.93 km. While creek frequency value of 1.18 was detected in the measurements made of the drainage density is 3.25.

Digitized map of the examination results obtained in the study area was determined to have 839717 hectares. The area around the basin 4171 m, 13108 m in length and width was calculated as the average altitude is 8855 m 1550 m. The average height of the average slope Microcatchment from Turkey (1130 m) is calculated higher

erosion control and gully rehabilitation, such as slope stabilization measures for the protection of soil cover, water holding capacity-building machine and made by workers earthmoving activities, forest trees and reforestation with fruit species, should be closed to grazing a certain period of pasture and grassland to improve the existing corrupt oak vegetation.

Rich water resources in the basin are available, but efficient use of water resources, and it was determined that this effectively used. Slope case of the use of these water resources in a rational manner in Microcatchment efficiency can be watered with it in a more efficient way of existing irrigation and rural development are also expected to increase.

Microcatchment slope of the village takes place earlier in soil conservation, erosion control and reforestation efforts were made. When considering the land's soil and climatic conditions and ecological conditions in the basin indicate that housing land and afforestation is possible. Bahçeli, Erdemli, Dışbudak, Erdemli, Gökdere, Kıran, Suvaran and Yumaklı, maintaining land in the hillside village land, erosion control and reforestation efforts should be made

In situated oak areas cuts down on your workspace made cuts situated to meet winter fuel needs of the villagers in a hand basin on the other hand basins were found to cause damage to people's illegal logging with oak living space outside. Also in the area it is usually made of small ruminants, including goats and oak to meet the winter needs of these animals feed

Benefit-leaf cutting the trees is done. Because of the vast majority of Microcatchment village forests have a low income is seen as a strong pressure on the elements.

It was determined that the people living in Microcatchment limited and inadequate to meet the needs of their own fruit and vegetables. Accordingly, the cover fruit and vegetables, there is no income-generating activity at the desired level due to lack of closure under vegetable cultivation and orchard plants. There remains the fruit and a vegetable are not available for the cold storage and marketing facilities and is gaining economic value.

Agricultural activities in the study area can be limited due to irrigation. It has also been determined that field cultivation and garden cultivation have been made unconsciously using classical methods. Because of the lack of the use of soil processing equipment, the loss of productivity in agricultural production is also a problem. It has been observed that there is a serious lack of knowledge and practice on basic issues such as fertilization, drip irrigation, maintenance, and trimming of fruit trees, application of plant protection techniques against diseases and pests, use of certified seeds and seedlings, which are important for agricultural activities. For all these reasons, it was observed that rural poverty was felt intensely in the micro basin. In addition, climate features in some areas of micro-basins limit agricultural activities. Cereals are not cultivated with forage plants (alfalfa, vetch, and Hungarian) that should be common in local conditions.

It is mandatory to meet the needs of livestock carried out in the basin, it is not considered to be income-generating activities, and especially in the winter months it is determined that adequate nutrition is because the efficiency is low. Feed plants planned and appropriate to local conditions, utilization of certified seed is the cause of the low yields.

In situated pastures in the study area upper elevation extreme and where the uncontrolled grazing, especially observed early due to grazing began in spring pasture vegetation is weak structure, so there is enough to feed failed to reach the animals grazing in the pastures have increased efficiency at the desired level.

Drinkers in the pastures, salt, etc. savant technical and auxiliary activities of the lack of pasture structure cannot be done in an intensive way.

In addition to the weak vegetation in pasture areas, it has been observed that the existing vegetation coverers were over-destructed in order to be used as fuel and animal feed. In particular, it has been determined that the places where the gatherers are gathered and cut are sloping, naked and at high altitudes, and with the destruction of the landowners who hold the land against erosion, the erosion in the pasture areas is severely reigning.

Bovine and small-headed livestock in the region are mainly made up of goats, and branch-leaf cuttings are used in oak trees to meet the need for winter feeds of these animals. Because of the vast majority of Microcatchment village forests have a low income is seen as a strong pressure on the elements.

Located within the study area with rehabilitation work to be done in oak forest areas damaged, the renewal of existing vegetation or complementary oak sowing with afforestation activities must be performed.

Oak rehabilitation will be held areas, as paint damage will reach their seedlings are eaten by animals or by rotating wire protected fence. Many of the oak trees for firewood, illegal logging, illegal grazing, animal feeding is inefficient and corrupt because of the illegal use leaves and branches should be translated into productive forest through the rehabilitation of degraded forests.

Agricultural activities in the work can be done in a limited way, depending on the forehead irrigation. In addition, cultivation of field crops and gardens was built here in an unconscious way using conventional methods. Due to the loss of efficiency of processing equipment used in agricultural production is concerned. Fertilization, which is important for agricultural activities, drip irrigation, fruit tree care and pruning, disease and the application of plant protection techniques against harmful use of certified seeds and seedlings were observed to have a strong knowledge and practice gaps in basic subjects like.

The study area villages, especially in terms of the technical aspects of the long winter incompatible, inefficient small and large animal production, animal shelters are becoming one of the most important factors that limit. This lack of ventilation in animal housing chimney, lighting, feeding and wetlands regulations, activities such as paint-spraying disinfectant and should be carried out with reasonable improvements such as whitewash.

According to Law No. 3402 in all the villages in the land cadaster is Microcatchment Forest cadastral work history has been made so far.

Soil texture of the soil of the study area generally there is no problem with the process is a sandy loam soil structure. Absolute and physiological soil depth is 120 cm above average.

The study area did not change the pH of the soil pH values depending on the depth of value seems to vary between 5.2 and 8.0.(Ülgen and Yurtsever 1995) , where in the neutral land covering approximately half of the lands constitute 47.5% of the entire area. Slightly acidic soils of the total area of the medium acidic soils areas accounted for 66.25%, 8.7% and the slightly alkaline soil in the area is up 26.25%,

The electrical conductivity (EC) value of the study area varies between 108.00% and 1507.000, while the salt value of the soil varies between 0.002% and 0.02%. According to this analysis, it is concluded that all of the study area is unsalted and that there is no change in the amount of salt in the soil depending on the depth

Lime scope of the study area ranged from 0.467% and 30.628% of the land, the land and the (Ülgen and Yurtsever 1995) was evaluated according to the table by 4:14. Accordingly, 28.75% and 62.5 % less calcareous soils of the medium lime and 6.7% more highly calcareous soils. The study area is no problem with the 91.25% of lime soil. Analysis done to increase the amount of lime in the soil depth increases the minimum level has emerged as a result.

The scope of the study area soil organic matter ranges from 0.418% and 5.810%. The amount of organic matter in the low 38.75% of the land within the study area, in the very low 8,75% is good rate at 1.2% and 6.2% medium in the soil and the study area medium rate 38.75%.Depth increases in soil organic matter and reduction in the amount that best organic ingredient. The amount of soil in the 0-30 cm part of the analysis has come to the end.

The sodium (ppm) levels ranged between 26.220 (ppm) 488.300 (ppm) and the mean value was 190.468(ppm) the numbers show medium range of variable in the soil. The amount of sodium (ppm) was classified based on different levels. Which were very low 3.75%, low65 %, moderate 13.75%, high 3.75%,

The scope of the study area soil phosphorus 1.650 (ppm) and 100 (ppm) shows the changes between. High-phosphorus ratio of 12.5% of land within the study area, good in 31.25%, moderate in very low 12.5% and rate at low 162.5%,very high 27.5%. Depth increases that reduced the amount of phosphorus in the soil and the analysis made in the best interest of soil phosphorus has emerged as a result of the 0-30 cm section.

The potassium content of the study area varies between 26.220 (ppm) and 488.300 (ppm). Potassium high ratio in 30% and very high 13.75% of the land within the study area than in just 11.25% and 3.75% are less than the 41.25% rate in the medium. Depth has been a decrease in the amount of potassium in the soil increases the amount of potassium and best 0-30 cm soil analyzes made can be seen in part as a result has emerged.

The results in the show the amount of total nitrogen in the soil depth between 0-30 cm. According to the results, there was a significant difference in the amount of total nitrogen. Which was determined based on (Bauer and Black, A.L. 1994) them also the found least amount of total nitrogen in the study area. They mentioned that the amount of total nitrogen correlated to the level of the area and, organic matter and topography (aspect .altitude and slope gradient. cover crop. Temperature. Run off. these are these practical impact leaching and reduce total nitrogen. The total nitrogen level in this study was ranged between 0.001 % and 0.868 %, and the mean value was 0.121 %. These numbers show a low range of variability in the soils.

REFERENCE

Abbasi, MK., Zafar. M., and Khan.SR. “Influence of different land-cover types on thechanges of selected soil properties in the mountain region of Rawalakot,” Azad, Jammuand Kashmir, Nutrient Cycling in Agroecosystems, 78: 97-110, 2007.

Ahnen, Robert S., Bresalier, Gail McKeown-Eyssen et al., “Folic acid for the prevention of colorectal adenomas: a randomized clinical trial,” Jama, 297(21): 2351-2359, 2007.

Ajiboye, GA., and Ogunwale, JA. “Potassium Distribution in the Sand, Silt and Clay separates of Soils Developed over Talc at Ejiba,” Kogi State, Nigeria. World Journal of Agricultural Sciences, 4 (6): 709-716, 2008.

Allison, LE., MOODİE CD., “Carbonate In Black Ed. Methods of Soil Analysis Agronomy no,” ASA.SSSA. WI. USA. Part, 2(9): 1379–1400, 1965.

Altieri, Miguel A., “Sustainable agricultural development in Latin America: exploring the possibilities,” Agriculture, ecosystems, environment, 39(1-2): 1-21, 1991.

Andrews, Susan S., Douglas L., Karlen, and Cynthia A., Cambardella, “The soil management assessment framework,” Soil Science Society of America Journal, 6(68): 1945-1962, 2004.

Angima, SD., Thomas A., Terry, Alexander Dobkowski, Steve Campbell, Jeffrey D., Grizzel, Robert B. Harrison, Ronald L. Heninger et al., “Best management practices for maintaining soil productivity in the Douglas. fir region,” Corvallis, Or Extension Service. Oregon State University, 2011.

Anonymous, “Soil Survey Manual,”USDA. Handbook, No.18: 1993.

Anonymous, extension.plants.crops.soil-management, http. psu.edu. 2016

Ashenafi, Worku, and Bobe Bedadi., “Assessment and Mapping of Fertility Status of Salt Affected soil Amibara Area. Central Rift Valley of Ethiopia,” PhD diss., Haramaya Unive.

Atalay, İ., “Toprak Oluşumu, Sınıflandırılması ve Coğrafyası”, T.C. Çevre ve Orman Bakanlığı, Ağaçlandırma ve Erozyon Kontrolü Genel Müdürlüğü Yayını, 3.Baskı, Ankara, 2006.

Auletta, AE. Dearfield, KL. & Camino, MC.,“ Mutagenicity test schemes and guidelines: US EPA office of pollution prevention and toxics and office of pesticide programs. Environmental and molecular mutagenesis,” 21(1):38-45,1 9.

Ayana, BT., “Assessment of rainwater management practices for sustainable development and rural livelihood improvement in Andode.Meja micro watershed. Jeldu district Oromia region Ethiopia,” Ph.D, diss. Ambo University, 2011.

Bauer, Armand, and AL., Black,“ Quantification of the effect of soil organic matter content on soil productivity,” Soil Science Society of America Journal.58(1):185-193, 1994.

Belliturk, KC., Saglam, B., Akdemir, CB., Sisman,“Determination of Spatial Variability in Olive Production Part I-Soil,” Bulgarian Journal of Agricultural Sciences, Bulgaria, 16(4): 468-475, 2010.

Le Bissonnais, YLE.,“ Aggregate stability and assessment of soil crustability and erodibility I. Theory and methodology,” European Journal of soil science, 47(4):425-437, 1998.

Black, Charles Allen, DD., Evans, RC., Dinauer. Methods of soil analysis. Vol. 9. Madison, WI: American Society of Agronomy, 1965.

Bouyoucos, George John.,“ Directions for making mechanical analyses of soils by the hydrometer method,”Soil Science, 42(3):225-230, 1936.

Bouyoucos, George John.,“ Hydrometer method improved for making particle size analyses of soils,” Agronomy Journal, 54(5):464-465, 1962.

Brady, Leo., Andrzej M., Brzozowski, Zygmunt, S., Derewenda, Eleanor Dodson, Guy Dodson, Shirley Tolley, Johan P. Turkenburg, Lars Christiansen, Birgitte Huge-Jensen, and Leif Norskov., “A serine protease triad forms the catalytic canter of a triacylglycerol lipase,” Nature ,343(6260):767-770,1990.

Bremner, JM., Nitrogen Total. in DL.,Sparks (Eds) Methods of Soil Analysis, Part 3, Chemical Methods, SSSA Book Series Number 5, SSSA., Madison, WI,:1085–112,1996.

Burdock,George A., “Fenaroli's handbook of flavor ingredients,” CRC press, 2016.

Carmona, Felipe d., Campos, Ibanor Anghinoni, Marquel Jonas Holzschuh, and Marcelo Hoerbe Andrighetti., “Cation dynamics in soils with different salinity levels growing irrigated rice Revista Brasileira de Ciência do solo,” 34:61851-1863, 201.

Çepel, N., "Toprak İlmi, Orman Topraklarının Karakteristikleri, Toprakların Oluşu, Özellikleri ve Ekolojik Bakımdan Değerlendirilmesi", İstanbul Üniversitesi, Toprak İlmi ve Ekoloji Anabilim dalı, Üniversite Yayın No: 3945, Orman Fakültesi Yayın No: 438, -X, İstanbul ISBN, (975):404-421,1996.

Chapman, H.D., "Action exchange capacity by ammonium saturation in Black, C.A. (ed.). Methods of Soil Analysis. Agronomy part II. American society of agronomy. Madison," WI., USA, No. (9): pp.891-901.1965 .

Chekol, Wondimagegne, and Abere Mnalku.,"Selected Physical and Chemical Characteristics of Soils of the Middle Awash Irrigated Farm Lands, Ethiopia," Ethiopia Journal of Agricultural Science, 22:127-14, 2012.

Cole, Bernard F., John A., Baron, Robert S., Sandler, Robert, W., Haile, Dennis J., Cornelius, Cody D., and Kevin W. Bradley, "Carryover of Common Corn and Soybean Herbicides to Various Cover Crop Species," Weed Technology, 2016.

Daily, Gretchen. "Nature's services societal dependence on natural ecosystems," Island Press, 1997.

De la Rosa, DJA., Moreno, F., Mayol, and Tomás Bonsón., "Assessment of soil erosion vulnerability in western Europe and potential impact on crop productivity due to loss of soil depth using the ImpelERO model," Agriculture, ecosystems, & environment, 81(3) : 179-190, 2000.

Demir, Y., Doğan Demir, A., Meral., R., Yüksel, A., "Bingöl Ovası İklim Tipinin Thornthwaite ve Erinç İndisine Göre Belirlenmesi," Türk Tarım ve Doğa Bilimleri Dergisi 2(4):332–337, 2015.

Dengiz, Orhan, Hesna Ozcan, E., Selim Koksal, Oguz Baskan, and Yakup Kosker., "Sustainable natural resource management and environmental assessment in the Salt Lake (Tuz Golu) Specially Protected Area," Environmental monitoring and assessment, 161(1-4):327-342, 2010.

Dengiz, Orhan, Mustafa Saglam, and Ferhat Türkmen., "Effects of soil types and land use-land cover on soil organic carbon density at Madenderewatershed," Eurasian Journal of Soil Science, 4(2): 82, 2015.

Doran, JW., Parkin, TB., Jones, AJ., "Quantitative indicators of soil quality: a minimum data set. Methods for assessing soil quality," 25-37, 1996.

Edelman, Van der Voorde, CH., PK J.," Important characteristics of alluvial soils in the tropics," Soil Science,(95):258-263, 1963.

Erşahin, S., “Toprak Amenajmanı, Tarımda Sürdürülebilirlik ve Çevre Kalitesi”, Gaziosmanpaşa Üniversitesi, Ziraat Fakültesi Yayınları, Yayın No: 56, Ders Notları Serisi No: 21, Tokat, 2001.

FAO (Food and Agricultural Organization)., Harmonized world soil database FAO.Rome ItalyVersion1(2):2012.

FAO., (Food and Agricultural Organization), “ Plant nutrition for food security Aguidefor integrated nutrient management. Fertilizer and Plant Nutrition Bulletin,”FAO, Rome, 16. 2006a.

FAO., “Food and Agriculture Organization Guidelines for soil description edition,”FAO of the United Nations. Rome,(539): 478-493, 2006b.

Fentaw, Kedir Abate, and Heluf Geberekidan., “Soil Fertility Assessment and Mapping of Amaregenda-Abajarso Sub-Watershed in Dessie Zuria District North Eastern Ethiopia,” Ph.D. diss., Univ. Haramaya, 2015.

Foth, HD., “Fundamentals of Soil Science,” 8th Edition. John Wiley and Sons, Inc, New York. USA, 1990.

Gay, Stephan, Geertrui Louwagie, Frank Sammeth, Tomas Ratinger, Brechje Marechal, Paolo Prosperi, Ezio Rusco et al., Final Report on the Projec., “Sustainable Agriculture and Soil Conservation SoCo,” Institute for Prospective and Technological Studies, Joint Research Centre, (JRC):51775, 2009.

Gülçur, F., Topragın Fiziksel, Kimyasal Analiz Metodları, İstanbulÜniversitesi Orman Fakültesi Yayınları, İÜ., Yayın, OF., Yayın.Kutulmuş Matbaası, İstanbul No: 201.1974, 1970.

Gumbs, FA., “Tillage methods, and soil and water conservation methods in the Caribbean,” Soil and Tillage Research, 27(1):341-354, 1993.

Guzmán, Gema, Marta Sáenz de Rodrigáñez, Karl Vanderlinden Tom Vanwalleghem, Ana Laguna, and Juan Vicente Giráldez. “Impacts of soil management on physical soil quality,”2015.

Gardiner, DT., Miller, RW., “Soils in Our Environment,” tenth ed. Pearson Education, Inc., Upper Saddle River, New Jersey. 07458, 2004.

U.S. “Salinity Laboratory Staff, Diagnosis Improvement of Saline and Alkaline Soils”. Agri. Handbook, No:60, USDA, 1954.

Ingram, Julie, and Carol Morris., “The knowledge challenge within the transition towards sustainable soil management: an analysis of agricultural advisors in England,” Land Use Policy, 24(1):100-117, 2007.

Jianqiang., “Best management practice development with the CERES. Maize model for sweet corn production in North Florida,” Ph.D diss., University of Florida, 2008.

Kacar, DJ., ,And Kacar, CR., Kacar David, J., and Kacar Cynthia R., “Automobile pet seat and cargo carrier,” US, Patent , (4):pp.943_05, 1990 .

Kantarcı, M.D., “Toprak İlmi”, I.Ü. Orman Fakültesi Yayınları, I.Ü. Yayın No:4261, Orman Fak. Yayın No: 462, Çantay Matbaası, İstanbul, 2000.

Karlen, Douglas, L., Susan, S., Andrews Brian J., Wienhold, and Ted M., Zobeck. , “Soil quality Khattak, Asif Khan., “SOIL MANAGEMENT IN ORGANIC AGRICULTURE A CASE STUDY OF DENMARK., Ph.D. diss. Roskilde University. Denmark, 2008.

Khodadoust, Kazem, Mohammadreza Ardalan, Reza Pourabbas, Majid Abdolrahimi., “Dental and oral diseases in Medieval Persia, lessons from Hedayat Akhawayni,” Journal of medical ethics and history of medicine, no: 6, 2013.

Kingston, Jamaica. “Best Management Practices for Agricultural Non-Point Sources of Pollution,”

Le Bissonnais, Y., “LAggregate stability and assessment of soil crustability and erodibility I. Theory and methodology,” European Journal of Soil Science, 47: 425-437, 1996.

Lee, R., “Forest Hydrology”, Columbia University Pres, New York, 1980.

Lewis Publishers “is an imprint of CRC press,” New York, PPt: 151-169, 2001.

Lilly, J., Paul, “Best management practices for agricultural nutrients,” AG-North Carolina Agricultural Extension Service,” North Carolina State University. USA, 1991.

Marten,Gerald,G.,Patma,Vityakon.,“Soilmanagementintraditionalagriculture,” Traditiona l agriculture in Southeast Asia, A human ecology perspective, 199-225,1986.

Medeiros,João,AS.,“Managementalternatives for urea use in corn and wheat production,” Ph.D diss. University of Missouri,Columbia, 2006.

Megersa, Tolera, “Assessing the role of traditional land management practices in improving cropland productivity,” The case of Diga Woreda.Oromia. PhD diss. Ambo University, 2011.

Mesfin, Abebe., "Nature and management of Ethiopian soils," Alemaya University agriculture, Ethiopia,1998.

Miller, Marian AL., "Protecting the Marine Environment of the Wider Caribbean Region the Challenge of Institution-Building," Green Globe Yearbook,37-46, 1996.

Ministry of Agriculture,"Soil and water conservation," Guide line for Ethiopia, 2011.

Molendijk, LG., Ruysschaert, L., Bechini, C., Costamagna, HP.,Haslmayr, T., Lehtinen, A., Baumgarten et al., "Impacts of soil management practices on crop productivity, on indicators for climate change mitigation, and on the chemical, physical and biological quality of soil," 2014.

Muhammad, lawal, AO., & Ayinde, A., "Analysis of Soil Management Practices in Cereal Based Production Systems among Small-Scale Farmers in Kwara State," Nafzger, D., Jagadamma, Sindhu, Rattan, Lal., Robert, G., Hoeft, Emerson and Eric A., Adee., "Nitrogen fertilization and cropping systems effects on soil organic carbon and total nitrogen pools under chisel-plow tillage in Illinois," Soil and Tillage Research, 95(1): 348-356, 2007.

Nega Emir, Heluf Gebrekidan., "Effect of land use changes and soil depth on soil organic matter, total nitrogen and available phosphorus contents of soils in SenbatWatershed," Western Ethiopia. ARPN Journal of Agricultural and Biological Science, 8(3):206, 2013.

Nelson, DW., Sommers, LE., Total Carbon, Organic Carbon, and Organic Matter. in DL., Sparks (Ed) Methods of Soil Analysis, Part 3, Chemical Methods, SSSA Book Series Number 5, SSSA., Madison,WI,P:961 -1011, 1996.

North Carolina State University 1984, "Best Management Practices for Agricultural Nonpoint Source Control: IV. Pesticides. North Carolina State University, National Water Quality Evaluation Project," Raleigh, NC. Cited in USEPA,1993.

Oloyede, A., OA., Muhammad-Lawal, OE., Ayinde, and KF., Omotesho., "Analysis of Soil Management Practices in Cereal Based Production Systems among Small-Scale Farmers in Kwara State," 1(10):164-174, 2014.

Olsen, SR., Cole, CV., Watanabe, FS., Dean, LA., " Estimation of Available Phosphorus in Soils by Extraction with Sodium Bicarbonate," U.S.D.A. Circular Number 939, U.S. Government Printing Office, Washington, D.C,1954.

Ongley, Edwin D., "Control of water pollution from agriculture," Food, Agriculture Org, pp: 55, 1996.

Özhan, S., "Havza Amenajmanı", İstanbul Üniversitesi Orman Fakültesi Havza Amenajmanı Anabilim Dalı, İ.Ü. Rektörlük Yayın No:4510, Orman Fakültesi Yayın İstanbul No: 481: ISBN: 975-404-739-1 2004.

Pecio, Alicja, and Zuzanna Jarosz. , “Long-term effects of soil management practices on selected indicators of chemical soil quality,” Acta Agrobotanica, 2(69): 2016.

Peck, TR., and Soltanpour, “The principles of soil testing and plant analysis,” SSSA Book series, NO.3:1-9, 1990.

Prasad, R., Power, JF., “Soil Fertility Management for Sustainable Agriculture, Lewis Publishers is an imprint of CRC press,” 1997, New York, 151-169, 2001.

Pulakeshi, P., Patil, L., Dasog. S., Radder, BM., Bidari, BI., and Mansur, “Mapping of nutrients status by geographic information system (GIS) in Mantagani village under northern transition zone of Karnataka,” Karnataka Journal of Agricultural Science, 25(3): 332-335, 2012.

Purohit, Varua,ME J.,Ward. B., MaheshWari, S., Oza. R., and P., Chinnasamy. “Assisting community management of groundwater. Irrigator attitudes in two watersheds in Rajasthan and Gujarat, India,” Journal of Hydrology, 537.pp:171-186, 2016.

Rengasamy, P., and GJ., Churchman, “Cation exchange capacity, exchangeable cations and sodality,” Soil analysis: an interpretation manual, PP: 147-157, 1999.

Richards, LA., “Diagnosis and improvement saline and alkali soils,” United States Department of Agriculture, Agriculture Handbook. No: 60, 1954.

Sanders, David, “Soil conservation,” Land Use, Land Cover, and Soil Sciences edited by Willy H. Verheye, UNESCO,Eolss Publishers, Oxford, UK, Links, 2004.

Schoenholtz, “Forest ecology and management,” Stephen H., Helga Van Miegroet, and J A., Burger., “A review of chemical and physical properties as indicators of forest soil quality: challenges and opportunities,” 138(1):335-356, 2000.

Schoonover, Jon E., and Jackie F., Crim., “introduction to soil concepts and the role of soils in watershed management,” Journal of Contemporary Water Research & Education, 154(1): 21-47, 2015.

Schumm, Stanley A., “Evolution of drainage systems and slopes in badlands at Perth Amboy, New Jersey,” Geological society of America bulletin, 67(5):597-646, 1956.

Serdar, and Saime Seferoglu., “The seasonal changes of nutritional elements of chestnut (Castanea sativa). American Journal of Research Communication,” 1(5):1-8, 2013.

Ülgen, N., Yurtsever, N., “Türkiye Gübre ve Gübreleme Rehberi,” (4. Baskı), T.C. Başbakanlık Köy Hizmetleri Genel Müdürlüğü Toprak ve Gübre Araştırma Enstitüsü Müdürlüğü Yayınları, Genel Yayın No: 209, Teknik Yayınlar No: T.66, Ankara, 1995

Sitanggang, Masri, YS., Rao Nayan Ahmed,SK., Mahapatra, “Characterization and classification of soils in watershed area of Shikohpur, Gurgaon District, Haryana,” Journal of the Indian Society of Soil Science, 54(1):106-110,2006.

Soil Science Society of America. Glossary of soil science terms, ASA, CSSA, SSSA, 2008.

Sopher, CD., and Baird, JV., Soils and Soil Management. Edition. Prentice Hall Career and Technology,”Englewood Cliffs. New Jersy, 1982.

Sposito, G., “the Chemistry of Soils. Oxford Uni. Press,” New York, 226-245, 1989.

Sullivan, Preston., “Sustainable soil management,” National Sustainable Agriculture Information Service, 2004.

Tan, HK., “Soil sampling, preparation, and analysis Marcel Dekker,” New York, PP: 78 -209, 1996.

Tanju, Ö., “Toprak Genesisi ve Sınıflandırılması”, Ankara Üniversitesi Ziraat Fakültesi Toprak Bölümü, Ziraat Fakültesi Yayınları No:1472 Ders Kitabı, 1996.

Tekwa, IJ., Shehu. HE., and Maunde., “Soil nutrient status and productivity Potentials of lithosols in Mubi Area,” Northeastern Nigeria. Agriculture and Biology Journal of North America, 2(6): 887-896, 2011.

Torres, L., Yadav, OP., & Khan, E., “A review on risk assessment techniques for hydraulic fracturing water and produced water management implemented in onshore unconventional oil and gas production. Science of the Total Environment,” 2016.

Tüzüner, A., “Handbook of Soil and Water Analysis Laboratories. TC., Ministry of Agriculture Forestry and Villages Speed. Gene,” Director Ankara, 375s, 1990.

Van,reeuwijk, LP., “Procedures for Soil Analysis International Soil Reference And İnformation Centre, No: 9, 1999.

Wildemeersch, Dirk., “ Intrauterine contraceptives that do not fit well contribute to early discontinuation.,” The European Journal of Contraception & Reproductive Health Care 16(2): 135-141,2011

Walkley, AA., Critical Examination of a Rapid Method for Determining Organic Carbon in Soils Sci, (63): 251-263, 1946.

Weakley, Aldous, and I. Armstrong Black., “An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method,” Soil science, 37(1): pp.29-38.1934. .

APPENDIX

Appendix 6.1. The soil color and color name of soil samples depth (0 – 30) cm

Profile	Depth (cm)	Soil Color	Color Names	Profile	Depth (cm)	Soil Color	Color Names
p1	0-30	Brown	10YR5/3	p41	0-30	light brown	7.5YR6/4
p2	0-30	Brown	7.5YR5/2	p42	0-30	dark brown	10YR3/3
p3	0-30	Brown	7.5YR4/4	p43	0-30	light brown	7.5YR6/4
p4	0-30	Brown	10YR4/3	p44	0-30	brown	105/3
p5	0-30	Brown	7.5YR5/4	p45	0-30	dark brown	7.5YR3/4
p6	0-30	Brown	7.5YR5/4	p46	0-30	dark brown	7.5YR3/4
p7	0-30	Brown	10YR5/3	p47	0-30	dark brown	7.5YR3/4
p9	0-30	Brown	7.5YR4/2	p48	0-30	brown	10RY5/3
p10	0-30	Brown	7.5YR5/4	p49	0-30	brown	7.5YR5/4
p11	0-30	Brown	7.5YR5/2	p50	0-30	dark brown	10YR3/3
p12	0-30	Brown	7.5YR5/4	p51	0-30	dark brown	7.5YR3/4
p13	0-30	Brown	10YR5/3	p52	0-30	dark brown	10YR3/3
p14	0-30	Brown	7.5YR4/4	p53	0-30	dark brown	7.5YR3/4
p15	0-30	Brown	10YR4/3	p54	0-30	dark brown	10YR3/3
p16	0-30	Brown	7.5YR5/4	p55	0-30	dark brown	7.5YR3/4
p17	0-30	Brown	10YR5/3	p56	0-30	dark brown	10YR3/3
p18	0-30	Brown	7.5YR5/4	p58	0-30	light brown	7.5YR6/4
p19	0-30	Brown	7.5YR5/4	p60	0-30	dark brown	10YR3/3
p20	0-30	Brown	10YR4/3	p61	0-30	dark brown	7.5YR3/4
p21	0-30	Brown	10YR4/3	p62	0-30	Brown	10YR4/3
p22	0-30	Brown	7.5YR4/4	p63	0-30	Brown	7.5YR5/4
p32	0-30	Brown	7.5YR5/2	p64	0-30	brown	7.5YR5/4
p24	0-30	light brown	7.5YR6/4	p65	0-30	dark brown	7.5YR3/4
p25	0-30	Brown	10YR5/3	p66	0-30	dark brown	7.5YR3/4
p26	0-30	Brown	7.5YR4/2	p67	0-30	Brown	7.5YR5/4
p27	0-30	Brown	7.5YR5/4	p86	0-30	dark brown	10YR3/3
p28	0-30	Brown	10YR4/3	p69	0-30	brown	7.5YR5/4
p29	0-30	Brown	7.5YR5/4	p70	0-30	Brown	10YR4/3
p30	0-30	Brown	7.5YR5/4	p71	0-30	dark brown	7.5YR3/4
p31	0-30	light brown	7.5YR6/4	p73	0-30	dark brown	7.5YR3/4
p32	0-30	Brown	7.5YR5/4	p74	0-30	dark brown	10YR3/3
p33	0-30	Brown	7.5YR5/2	p75	0-30	dark brown	7.5YR3/4
p34	0-30	Brown	10YR4/3	p76	0-30	dark brown	10YR3/3
p35	0-30	dark brown	7.5YR3/4	p77	0-30	Brown	7.5YR5/4
p36	0-30	light brown	7.5YR6/4	p78	0-30	light brown	7.5YR6/4
p37	0-30	light brown	7.5YR6/4	p79	0-30	dark brown	7.5YR3/4
p38	0-30	dark brown	10YR3/3	p80	0-30	Brown	10YR4/3
p39	0-30	light brown	7.5YR6/4	p81	0-30	Brown	7.5YR5/4
p40	0-30	light brown	7.5YR6/4	p83	0-30	Brown	7.5YR5/4

Appendix 6. 2. The soil color and color name of soil samples depth (30 – 60 cm)

Profile	Depth (cm)	Soil Color	Color Names	Profile	Depth (cm)	Soil Color	Color Names
P1	30-60	brown	7.5YR 5/4	p42	30-60	Light brown	Light brown
P2	30-60	brown	7.5YR 5/2	p43	30-60	Dark brown	7.5YR3/4
P3	30-60	Light brown	Light brown	p44	30-60	brown	7.5YR 5/4
P4	30-60	Light brown	Light brown	p45	30-60	Light brown	Light brown
P5	30-60	brown	7.5YR 5/2	p46	30-60	Dark brown	7.5YR3/4
P6	30-60	Light brown	7.5YR6/4	p47	30-60	brown	7.5YR 5/4
P7	30-60	Light brown	7.5YR6/4	p48	30-60	Light brown	Light brown
P9	30-60	Light brown	7.5YR6/4	p49	30-60	brown	7.5YR 5/2
P10	30-60	Light brown	7.5YR6/4	p50	30-60	brown	7.5YR 5/4
P11	30-60	Light brown	7.5YR6/4	p51	30-60	brown	7.5YR 5/2
P12	30-60	Light brown	7.5YR6/4	p52	30-60	brown	7.5YR 5/2
P13	30-60	Light brown	7.5YR6/4	p53	30-60	brown	7.5YR 5/4
P14	30-60	Light brown	7.5YR6/4	p54	30-60	brown	7.5YR 5/4
P15	30-60	Light brown	7.5YR6/4	p55	30-60	brown	7.5YR 5/2
P16	30-60	Light brown	7.5YR6/4	p56	30-60	brown	7.5YR 5/2
P17	30-60	brown	7.5YR 5/2	p57	30-60	brown	7.5YR 5/4
P18	30-60	Light brown	7.5YR 5/2	p58	30-60	brown	7.5YR 5/4
P19	30-60	Light brown	7.5YR6/4	p60	30-60	brown	7.5YR 5/2
P20	30-60	Light brown	7.5YR6/4	p61	30-60	brown	7.5YR 5/4
P21	30-60	Light brown	7.5YR6/4	p62	30-60	brown	7.5YR 5/4
P22	30-60	Light brown	7.5YR6/4	p63	30-60	brown	7.5YR 5/2
P23	30-60	Light brown	7.5YR6/4	p64	30-60	Light brown	7.5YR6/4
P24	30-60	Light brown	7.5YR6/4	p65	30-60	Light brown	7.5YR6/4
P25	30-60	Light brown	7.5YR6/4	p66	30-60	Light brown	7.5YR6/4
P26	30-60	Light brown	7.5YR6/4	p67	30-60	Dark brown	7.5YR6/4
P27	30-60	Light brown	7.5YR6/4	p68	30-60	Light brown	7.5YR6/4
P29	30-60	Light brown	7.5YR6/4	p69	30-60	brown	7.5YR 5/4
P30	30-60	Light brown	7.5YR 5/2	p70	30-60	brown	7.5YR 5/2
P31	30-60	Light brown	7.5YR6/4	p71	30-60	Light brown	7.5YR6/4
P32	30-60	Light brown	7.5YR6/4	p73	30-60	brown	7.5YR 5/2
P33	30-60	Light brown	7.5YR6/4	p74	30-60	brown	7.5YR 5/4
P34	30-60	Light brown	7.5YR6/4	p75	30-60	Dark brown	7.5YR3/4
P35	30-60	Light brown	7.5YR6/4	p76	30-60	Light brown	7.5YR6/4
P36	30-60	Light brown	7.5YR6/4	p77	30-60	Light brown	7.5YR6/4
P37	30-60	Light brown	7.5YR6/4	p78	30-60	Light brown	7.5YR6/4
P38	30-60	Light brown	7.5YR6/4	p79	30-60	Dark brown	7.5YR3/4
P39	30-60	Light brown	7.5YR6/4	p80	30-60	Light brown	7.5YR6/4
P40	30-60	Light brown	7.5YR6/4	p81	30-60	Light brown	7.5YR6/4
p41	30-60	brown reddish	2.5YR 6/4				

Appendix 6.3. The soil color and color name of soil samples depth (60 – 90 cm)

Profile	Depth (cm)	Soil Color	Color Names	Profile	Depth (cm)	Soil Color	Color Names
p1	60-90	brown	7.5YR 5/4	p41	60-90	brown reddish	2.5YR 6/4
p2	60-90	brown	7.5YR 5/2	p42	60-90	Light brown	7.5YR 5/2
p3	60-90	Light brown	7.5YR 5/2	p43	60-90	Dark brown	7.5YR3/4
p4	60-90	Light brown	7.5YR 5/2	p44	60-90	brown	7.5YR 5/4
p5	60-90	brown	7.5YR 5/2	p45	60-90	Light brown	7.5YR 5/2
p6	60-90	Light brown	7.5YR6/4	p46	60-90	Dark brown	7.5YR3/4
p7	60-90	Light brown	7.5YR6/4	p47	60-90	brown	7.5YR 5/4
p9	60-90	Light brown	7.5YR6/4	p48	60-90	Light brown	7.5YR 5/2
p10	60-90	Light brown	7.5YR6/4	p49	60-90	brown	7.5YR 5/2
p11	60-90	Light brown	7.5YR6/4	p50	60-90	brown	7.5YR 5/4
p12	60-90	Light brown	7.5YR6/4	p51	60-90	brown	7.5YR 5/2
p13	60-90	Light brown	7.5YR6/4	p52	60-90	brown	7.5YR 5/2
p14	60-90	Light brown	7.5YR6/4	p53	60-90	brown	7.5YR 5/4
p15	60-90	Light brown	7.5YR6/4	p54	60-90	brown	7.5YR 5/4
p16	60-90	Light brown	7.5YR6/4	p55	60-90	brown	7.5YR 5/2
p17	60-90	brown	7.5YR 5/2	p56	60-90	brown	7.5YR 5/2
p18	60-90	Light brown	7.5YR 5/2	p57	60-90	brown	7.5YR 5/4
p19	60-90	Light brown	7.5YR6/4	p58	60-90	brown	7.5YR 5/4
p20	60-90	Light brown	7.5YR6/4	p60	60-90	brown	7.5YR 5/2
p21	60-90	Light brown	7.5YR6/4	p61	60-90	brown	7.5YR 5/4
p22	60-90	Light brown	7.5YR6/4	p62	60-90	brown	7.5YR 5/4
p23	60-90	Light brown	7.5YR6/4	p63	60-90	brown	7.5YR 5/2
p24	60-90	Light brown	7.5YR6/4	p64	60-90	Light brown	7.5YR6/4
p25	60-90	Light brown	7.5YR6/4	p65	60-90	Light brown	7.5YR6/4
p26	60-90	Light brown	7.5YR6/4	p66	60-90	Light brown	7.5YR6/4
p27	60-90	Light brown	7.5YR6/4	p67	60-90	Dark brown	7.5YR6/4
p28	60-90	Light brown	7.5YR6/4	p68	60-90	Light brown	7.5YR6/4
p29	60-90	Light brown	7.5YR 5/2	p69	60-90	brown	7.5YR 5/4
p30	60-90	Light brown	7.5YR6/4	p70	60-90	brown	7.5YR 5/2
p31	60-90	Light brown	7.5YR6/4	p71	60-90	Light brown	7.5YR6/4
p32	60-90	Light brown	7.5YR6/4	p73	60-90	brown	7.5YR 5/2
p33	60-90	Light brown	7.5YR6/4	p74	60-90	brown	7.5YR 5/4
p34	60-90	Light brown	7.5YR6/4	p75	60-90	Dark brown	7.5YR3/4
p35	60-90	Light brown	7.5YR6/4	p76	60-90	Light brown	7.5YR6/4
p36	60-90	Light brown	7.5YR6/4	p77	60-90	Light brown	7.5YR6/4
p37	60-90	Light brown	7.5YR6/4	p78	60-90	Light brown	7.5YR6/4
p38	60-90	Light brown	7.5YR6/4	p79	60-90	Dark brown	7.5YR3/4
p39	60-90	Light brown	7.5YR6/4	p80	60-90	Light brown	7.5YR6/4
p40	60-90	Light brown	7.5YR6/4	p81	60-90	Light brown	7.5YR6/4

Appendix 6. 4. The soil color and color name of soil samples depth (90 – 120 cm)

Profile	**Depth (cm)**	**Soil Color**	**Color Names**	**Profile**	**Depth (cm)**	**Soil Color**	**Color Names**
p1	90-120	Light brown	7.5YR6/4	p41	90-120	Light brown	7.5YR6/4
p2	90-120	Light brown	7.5YR6/4	p42	90-120	Light brown	7.5YR6/4
p3	90-120	Light brown	7.5YR6/4	p43	90-120	Light brown	7.5YR6/4
p4	90-120	Light brown	7.5YR6/4	p44	90-120	Light brown	7.5YR6/4
p5	90-120	Light brown	7.5YR6/4	p45	90-120	Light brown	7.5YR6/4
p6	90-120	Light brown	7.5YR6/4	p46	90-120	Light brown	7.5YR6/4
p7	90-120	Light brown	7.5YR6/4	p47	90-120	Light brown	7.5YR6/4
p9	90-120	Light brown	7.5YR6/4	p48	90-120	Light brown	7.5YR6/4
p10	90-120	Light brown	7.5YR6/4	p49	90-120	Light brown	7.5YR6/4
p11	90-120	Light brown	7.5YR6/4	p50	90-120	Light brown	7.5YR6/4
p12	90-120	Light brown	7.5YR6/4	p51	90-120	Light brown	7.5YR6/4
p13	90-120	Light brown	7.5YR6/4	p52	90-120	Light brown	7.5YR6/4
p14	90-120	Light brown	7.5YR6/4	p53	90-120	Light brown	7.5YR6/4
p15	90-120	Light brown	7.5YR6/4	p54	90-120	Dark brown	7.5YR6/4
p16	90-120	Light brown	7.5YR6/4	p55	90-120	Light brown	7.5YR6/4
p17	90-120	Light brown	7.5YR6/4	p56	90-120	Light brown	7.5YR6/4
p18	90-120	Light brown	7.5YR6/4	p57	90-120	Light brown	7.5YR6/4
p19	90-120	Light brown	7.5YR6/4	p58	90-120	Light brown	7.5YR6/4
p20	90-120	Light brown	7.5YR6/4	p59	90-120	Light brown	7.5YR6/4
p21	90-120	Light brown	7.5YR6/4	p60	90-120	Light brown	7.5YR6/4
p22	90-120	Light brown	7.5YR6/4	p61	90-120	Light brown	7.5YR6/4
p23	90-120	Light brown	7.5YR6/4	p62	90-120	Light brown	7.5YR6/4
p24	90-120	Light brown	7.5YR6/4	p63	90-120	Dark brown	7.5YR4/2
p25	90-120	Light brown	7.5YR6/4	p64	90-120	Light brown	7.5YR6/4
p26	90-120	Light brown	7.5YR6/4	p65	90-120	Brown	10YR5/3
p27	90-120	Light brown	7.5YR6/4	p66	90-120	Light brown	7.5YR6/4
p28	90-120	Light brown	7.5YR6/4	p67	90-120	Light brown	7.5YR6/4
p29	90-120	Light brown	7.5YR6/4	p68	90-120	Dark brown	10YR3/3
p30	90-120	Light brown	7.5YR6/4	p69	90-120	Light brown	7.5YR6/4
p31	90-120	Light brown	7.5YR6/4	p70	90-120	Light brown	7.5YR6/4
p32	90-120	Light brown	7.5YR6/4	p71	90-120	Light brown	7.5YR6/4
p33	90-120	Light brown	7.5YR6/4	p73	90-120	Light brown	7.5YR6/4
p34	90-120	Light brown	7.5YR6/4	p74	90-120	Light brown	7.5YR6/4
p35	90-120	Light brown	7.5YR6/4	p75	90-120	Light brown	7.5YR6/4
p36	90-120	Light brown	7.5YR6/4	p76	90-120	Dark brown	7.5TR3/4
p37	90-120	Light brown	7.5YR6/4	p77	90-120	Light brown	7.5YR6/4
p38	90-120	Light brown	7.5YR6/4	p78	90-120	Light brown	7.5YR6/4
p39	90-120	Light brown	7.5YR6/4	p79	90-120	Light brown	7.5YR6/4
p40	90-120	Light brown	7.5YR6/4	p80	90-120	Light brown	7.5YR6/4

Appendix 6. 5. The Structural types of soil samples depth (0 – 30 cm)

Profile	Depth (cm)	Structural	Profile	Depth (cm)	Structural
p1	0-30	Granular	p41	0-30	Granular
p2	0-30	Granular	p42	0-30	Granular
p3	0-30	Massive	p43	0-30	Granular
p4	0-30	Granular	p44	0-30	Medium Granular
p5	0-30	Granular	p45	0-30	Granular
p6	0-30	Granular	p46	0-30	Granular
p7	0-30	Granular	p47	0-30	Medium Granular
p9	0-30	prismed	p48	0-30	Weak Granular
p10	0-30	Granular	p49	0-30	Medium Granular
p11	0-30	Granular	p50	0-30	Granular
p12	0-30	Medium Granular	p51	0-30	Granular
p13	0-30	Medium Granular	p52	0-30	Massive
p14	0-30	Medium Granular	p53	0-30	Medium Granular
p15	0-30	Medium Granular	p54	0-30	Medium Granular
p16	0-30	Medium Granular	p55	0-30	Medium Granular
p17	0-30	Medium Granular	p56	0-30	Granular
p18	0-30	Medium Granular	p58	0-30	Granular
p19	0-30	Medium Granular	p60	0-30	Granular
p20	0-30	Massive	p61	0-30	Granular
p21	0-30	Medium Granular	p62	0-30	Granular
p22	0-30	Medium Granular	p63	0-30	Granular
p23	0-30	Medium Granular	p64	0-30	Granular
p24	0-30	Medium Granular	p65	0-30	Granular
p25	0-30	Medium Granular	p66	0-30	Granular
p26	0-30	Weak Granular	p67	0-30	Granular
p27	0-30	Medium Granular	p86	0-30	Granular
p28	0-30	Weak Granular	p69	0-30	Massive
p29	0-30	Medium Granular	p70	0-30	Granular
p30	0-30	Granular	p71	0-30	Granular
p31	0-30	Granular	p73	0-30	Granular
p32	0-30	Granular	p74	0-30	Medium Granular
p33	0-30	Granular	p75	0-30	Weak Granular
p34	0-30	Granular	p76	0-30	Medium Granular
p35	0-30	Granular	p77	0-30	Massive
p36	0-30	Medium Granular	p78	0-30	Weak Granular
p37	0-30	Granular	p79	0-30	Massive
p38	0-30	Medium Granular	p80	0-30	Weak Granular
p39	0-30	Medium Granular	p81	0-30	Weak Granular
p40	0-30	Medium Granular	p83	0-30	Weak Granular

Appendix6. 6. The Structural types of soil samples depth (30 – 60 cm)

Profile	Depth (cm)	Structural	Profile	Depth (cm)	Structural
p1	30-60	Block	p41	30-60	Granular
p2	30-60	Granular	p42	30-60	Granular
p3	30-60	Granular	p43	30-60	Granular
p4	30-60	Massive	p44	30-60	Angular Block
p5	30-60	Block	p45	30-60	Granular
p6	30-60	Granular	p46	30-60	Granular
p7	30-60	Granular	p47	30-60	Angular Block
p9	30-60	Granular	p48	30-60	Medium Granular
p10	30-60	Massive	p49	30-60	Granular
p11	30-60	Angular Block	p50	30-60	Medium Granular
p12	30-60	Block	p51	30-60	Granular
p13	30-60	Granular	p52	30-60	Massive
p14	30-60	Block	p53	30-60	Medium Granular
p15	30-60	Granular	p54	30-60	Medium Granular
p16	30-60	Granular	p55	30-60	Angular Block
p17	30-60	Angular Block	p56	30-60	Medium Granular
p18	30-60	Granular	p58	30-60	Medium Granular
p19	30-60	Block	p60	30-60	Massive
p20	30-60	Medium Granular	p61	30-60	Massive
p21	30-60	Medium Granular	p62	30-60	Massive
p22	30-60	Block	p63	30-60	Angular Block
p23	30-60	Block	p64	30-60	Angular Block
p24	30-60	Block	p65	30-60	Granular
p25	30-60	Medium Granular	p66	30-60	Granular
p26	30-60	Granular	p67	30-60	Granular
p27	30-60	Angular Block	p86	30-60	Massive
p28	30-60	Granular	p69	30-60	Granular
p29	30-60	Medium Granular	p70	30-60	Massive
p30	30-60	Medium Granular	p71	30-60	Block
p31	30-60	Angular Block	p73	30-60	Granular
p32	30-60	Massive	p74	30-60	Angular Block
p33	30-60	Massive	p75	30-60	Granular
p34	30-60	Granular	p76	30-60	Medium Granular
p35	30-60	Block	p77	30-60	Granular
p36	30-60	Block	p78	30-60	Granular
p37	30-60	Angular Block	p79	30-60	Granular
p38	30-60	Medium Granular	p80	30-60	Granular
p39	30-60	Medium Granular	p81	30-60	Block
p40	30-60	Medium Granular	p83	30-60	Block

Appendix6. 7. The Structural types of soil samples depth (60 – 90 cm)

Profile	**Depth (cm)**	**Structural**	**Profile**	**Depth (cm)**	**Structural**
p1	60-90	Massive	p41	60-90	Massive
p2	60-90	Angular Block	p42	60-90	Massive
p3	60-90	Angular Block	p43	60-90	Massive
p4	60-90	Massive	p44	60-90	Massive
p5	60-90	Massive	p45	60-90	Massive
p6	60-90	Granular	p46	60-90	Massive
p7	60-90	Massive	p47	60-90	Massive
p9	60-90	Massive	p48	60-90	Massive
p10	60-90	Block	p49	60-90	Massive
p11	60-90	Massive	p50	60-90	Massive
p12	60-90	Block	p51	60-90	Massive
p13	60-90	Massive	p52	60-90	Massive
p14	60-90	Massive	p53	60-90	Massive
p15	60-90	Massive	p54	60-90	Massive
p16	60-90	Massive	p55	60-90	Massive
p17	60-90	Massive	p56	60-90	Massive
p18	60-90	Block	p58	60-90	Massive
p19	60-90	Massive	p60	60-90	Massive
p20	60-90	Massive	p61	60-90	Massive
p21	60-90	Massive	p62	60-90	Massive
p22	60-90	Massive	p63	60-90	Massive
p23	60-90	Weak Granular	p64	60-90	Massive
p24	60-90	Massive	p65	60-90	Massive
p25	60-90	Block	p66	60-90	Massive
p26	60-90	Block	p67	60-90	Massive
p27	60-90	Massive	p86	60-90	Massive
p28	60-90	Massive	p69	60-90	Massive
p29	60-90	Massive	p70	60-90	Massive
p30	60-90	Massive	p71	60-90	Massive
p31	60-90	Massive	p73	60-90	Massive
p32	60-90	Massive	p74	60-90	Massive
p33	60-90	Massive	p75	60-90	Massive
p34	60-90	Massive	p76	60-90	Massive
p35	60-90	Massive	p77	60-90	Block
p36	60-90	Massive	p78	60-90	Massive
p37	60-90	Massive	p79	60-90	Massive
p38	60-90	Massive	p80	60-90	Massive
p39	60-90	Massive	p81	60-90	Massive
p40	60-90	Massive	p83	60-90	Block

Appendix 6. 8. The Structural types of soil samples depth (90 – 120)

Profile	Depth (cm)	Structural	Profile	Depth (cm)	Structural
p1	90-120	Massive	p41	90-120	Massive
p2	90-120	Massive	p42	90-120	Massive
p3	90-120	Massive	p43	90-120	Massive
p4	90-120	Massive	p44	90-120	Massive
p5	90-120	Massive	p45	90-120	Massive
p6	90-120	Massive	p46	90-120	Massive
p7	90-120	Massive	p47	90-120	Massive
p9	90-120	Massive	p48	90-120	Massive
p10	90-120	Massive	p49	90-120	Massive
p11	90-120	Massive	p50	90-120	Massive
p12	90-120	Massive	p51	90-120	Massive
p13	90-120	Massive	p52	90-120	Massive
p14	90-120	Massive	p53	90-120	Massive
p15	90-120	Massive	p54	90-120	Massive
p16	90-120	Massive	p55	90-120	Massive
p17	90-120	Massive	p56	90-120	Massive
p18	90-120	Massive	p58	90-120	Massive
p19	90-120	Massive	p60	90-120	Massive
p20	90-120	Massive	p61	90-120	Massive
p21	90-120	Massive	p62	90-120	Massive
p22	90-120	Massive	p63	90-120	Massive
p23	90-120	Massive	p64	90-120	Massive
p24	90-120	Massive	p65	90-120	Massive
p25	90-120	Massive	p66	90-120	Massive
p26	90-120	Massive	p67	90-120	Massive
p27	90-120	Massive	p86	90-120	Massive
p28	90-120	Massive	p69	90-120	Massive
p29	90-120	Massive	p70	90-120	Massive
p30	90-120	Massive	p71	90-120	Massive
p31	90-120	Massive	p73	90-120	Massive
p32	90-120	Massive	p74	90-120	Massive
p33	90-120	Massive	p75	90-120	Massive
p34	90-120	Massive	p76	90-120	Massive
p35	90-120	Massive	p77	90-120	Massive
p36	90-120	Massive	p78	90-120	Massive
p37	90-120	Massive	p79	90-120	Massive
p38	90-120	Massive	p80	90-120	Massive
p39	90-120	Massive	p81	90-120	Massive
p40	90-120	Massive	p83	90-120	Massive

Appendix6. 9. Some physical properties of soil samples depth (0 – 30 cm)

Profile	Depth (cm)	$CaCO_3$%	O.M%	PH	EC.
P1	0-30	0.89	2.68	7.15	261.5
P2	0-30	1.12	2.74	6.24	216.1
P3	0-30	1.82	2.59	6.86	284.4
P4	0-30	1.12	5.81	7.11	322
P5	0-30	1.31	3.29	7.23	380
P6	0-30	1.4	0.42	7.24	297
P7	0-30	5.88	0.92	7.23	380
P9	0-30	1.12	2.12	6.94	292.6
P10	0-30	1.31	2.67	6.99	366
P11	0-30	0.84	4.34	6.82	482
P12	0-30	1.12	1.08	7.07	160.7
P13	0-30	1.4	1.49	7.79	552
P14	0-30	1.21	1.08	7.91	474
P15	0-30	1.4	1.43	7.52	295
P16	0-30	4.86	0.5	8.2	422
P17	0-30	4.67	1.11	7.88	354
P18	0-30	1.31	1.37	7.24	589
P19	0-30	1.21	1.87	7.23	441
P20	0-30	1.4	1.19	5.92	204
P21	0-30	1.4	1.82	7.72	975
P22	0-30	0.84	2.68	6.75	261.5
P23	0-30	0.84	3.56	6.94	458
P24	0-30	1.03	2.67	6.72	231.1
P25	0-30	7.1	1	7.96	506
P26	0-30	1.68	0.95	7.04	357
P27	0-30	1.31	2.32	6.89	535
P28	0-30	1.4	2.01	7.94	1309
P29	0-30	1.68	1.57	7.77	281
P30	0-30	4.2	1.43	7.79	616
P31	0-30	1.4	0.86	7.36	177.9
P32	0-30	1.12	1.12	6.81	305
P33	0-30	5.7	1.77	7.2	331
P34	0-30	1.31	3.16	7.76	363
P35	0-30	0.84	2.18	7.23	380
P36	0-30	5.14	1.92	7.97	990
P37	0-30	1.49	1.19	7.25	341
P38	0-30	1.21	1.24	7.59	284.9
P39	0-30	1.49	1.9	7.81	341
P40	0-30	30.63	1.28	8.04	626

Appendix 6. 10. Some physical properties of soil samples depth (0 – 30 cm)

Profile	Depth (cm)	$CaCO_3$%	O.M%	PH	EC.
P40	0-30	30.63	1.28	8.04	626
P41	0-30	0.47	3.48	7.37	1072
P42	0-30	4.95	2.44	7.59	782
P43	0-30	1.49	0.98	7.97	1507
P44	0-30	1.59	1.95	7.29	412
P45	0-30	1.31	3.19	6.68	382
P46	0-30	12.14	0.43	8.21	517
P47	0-30	1.4	1.45	7.04	450
P48	0-30	1.21	2.06	6.88	115.9
P49	0-30	1.4	1.12	7.15	161.4
P50	0-30	0.93	2.52	6.6	269.4
P51	0-30	1.03	4.09	6.97	450
P52	0-30	1.17	2.64	7.06	241
P53	0-30	1.07	3.4	6.75	395
P54	0-30	2.43	2.1	7.76	641
P55	0-30	0.93	1.71	6.98	462
P56	0-30	0.93	2.09	7.09	471
P58	0-30	0.84	1.73	7.11	511
P60	0-30	0.84	2.93	7.18	146.1
P61	0-30	0.93	2.33	7.51	654
P62	0-30	0.47	2.2	7.49	661
P63	0-30	1.07	1.49	7.57	146.1
P64	0-30	0.65	2.53	7.23	462
P65	0-30	7.47	2.31	7.75	627
P66	0-30	0.93	2.31	6.04	288.4
P67	0-30	1.21	2.54	6.91	351
P68	0-30	0.93	2.68	6.48	540
P69	0-30	1.21	1.49	6.84	287.1
P70	0-30	1.4	1.54	7.01	839
P71	0-30	0.56	2.68	6.98	277.8
P73	0-30	0.93	3.06	6.71	493
P74	0-30	1.21	2.35	7.14	613
P75	0-30	0.93	2.95	6.95	445
P76	0-30	1.03	2.71	6.86	309
P77	0-30	0.84	3.3	6.72	425
P78	0-30	0.84	2.32	6.5	232
P79	0-30	1.17	2.22	7.05	185
P80	0-30	0.93	1.45	7.05	355.7

Appendix 6. 11. Some physical properties of soil samples depth (0 – 30 cm)

Profile	Depth (cm)	Clay%	Sand%	Silt%	Class
P1	0-30	22.4	50.06	27.54	SandyClayLoam
P2	0-30	45.81	28.5	25.69	SandyClayLoam
P3	0-30	24.43	52.26	23.31	clay loam
P4	0-30	25.12	54.33	20.55	sand clay
P5	0-30	27.63	37.25	35.11	clay
P6	0-30	45.29	41.55	13.16	clay loam
P7	0-30	25.56	41.42	33.03	SandyClayLoam
P9	0-30	29.15	30.1	40.75	clay loam
P10	0-30	24.84	51.09	24.07	sandy loam
P11	0-30	29.93	35.97	34.1	clay loam
P12	0-30	13.43	65.96	20.61	clay loam
P13	0-30	36.66	31.58	31.76	loam
P14	0-30	31.96	32.66	35.38	clay loam
P15	0-30	21.62	44.77	33.61	clay loam
P16	0-30	28.4	38.12	33.48	clay
P17	0-30	32.39	33.84	33.77	sand clay loam
P18	0-30	42.08	23.29	34.63	clay
P19	0-30	26.15	50.49	23.35	loam
P20	0-30	58.3	13.76	27.94	clay loam
P21	0-30	32.84	35.45	31.71	clay loam
P22	0-30	26.92	36.72	36.36	clay
P23	0-30	37.22	28.79	33.99	loam
P24	0-30	30.76	37.52	31.72	clay loam
P25	0-30	41.17	22.87	35.95	loam
P26	0-30	24.29	38.16	37.54	loam
P27	0-30	38.71	29.8	31.49	loam
P28	0-30	20.38	35.55	44.07	sandy loam
P29	0-30	20.58	51.21	28.21	clay loam
P30	0-30	24.85	36.74	38.41	loam
P31	0-30	19.45	55.66	24.89	clay loam
P32	0-30	31.66	33.3	35.04	clay loam
P33	0-30	26.96	40.88	32.16	loam
P34	0-30	29.82	40.1	30.07	clay loam
P35	0-30	32.38	40.13	27.5	sandy loam
P36	0-30	24.42	37.47	38.11	sandy loam
P37	0-30	27.48	38.94	33.58	clay
P38	0-30	18.98	56	25.02	clay loam
P39	0-30	19.06	59.95	21	sand clay
P40	0-30	45.69	24.32	29.99	sandy loam

Appendix 6. 12. Some physical properties of soil samples depth (0 – 30 cm) (Continued)

Profile	Depth (cm)	Clay%	Sand%	Silt%	Class
P41	0-30	35.51	38.63	25.86	clay loam
P42	0-30	37.56	27.41	35	sand clay
P43	0-30	8.28	78.16	13.57	sandy loam
P44	0-30	27.54	48.83	23.63	sand clay loam
P45	0-30	30.02	42.72	27.25	clay loam
P46	0-30	28.19	38.08	33.73	clay loam
P47	0-30	38.17	31.79	30.05	clay loam
P48	0-30	19.36	53.85	26.8	sandy loam
P49	0-30	20.13	56.72	23.15	sand clay loam
P50	0-30	20.25	50.2	29.55	loam
P51	0-30	26.43	35.79	37.78	sand clay loam
P52	0-30	13.95	62.84	23.21	sandy loam
P53	0-30	36.34	36.08	27.59	clay loam
P54	0-30	46.39	27.6	26.01	clay
P55	0-30	33.01	37.89	29.1	clay loam
P56	0-30	31.8	44.31	23.89	sand clay loam
P58	0-30	40.9	33.36	25.73	clay
P60	0-30	40.47	28.87	30.66	clay
P61	0-30	18.34	63.71	17.95	sandy loam
P62	0-30	2.86	84.12	13.01	loam sand
P63	0-30	4.92	80.1	14.98	loam sand
P64	0-30	31.07	41.11	27.82	clay loam
P65	0-30	28.41	39.31	32.28	clay loam
P66	0-30	22.46	49.93	27.61	sandy clay loam
P67	0-30	26.3	44.38	29.32	loam
P68	0-30	45.44	24.89	29.67	loam
P69	0-30	31.84	38.16	30	clay
P70	0-30	59.08	10.49	30.43	clay loam
P71	0-30	28.16	41.96	29.88	clay
P73	0-30	34.69	41.61	23.71	clay loam
P74	0-30	30.41	45.92	23.67	sandy clay loam
P75	0-30	23.63	42.71	33.66	loam
P76	0-30	23.92	46.21	29.86	loam
P77	0-30	43.26	30.85	25.88	clay
P78	0-30	20.33	52.1	27.57	sandy clay loam
P79	0-30	24.51	43.73	31.75	sandy clay loam
P80	0-30	26.61	47.92	25.48	sandy clay loam
P81	0-30	32.88	58.37	8.75	sandy loam
P82	0-30	19.29	43.73	36.98	sandy clay loam

Appendix 6. 13. Some Macronutrients measured of soil samples depth (0 – 30 cm) (Continued)

Profile	Depth (cm)	N%	K(ppm)	Na (ppm)	P(ppm)
P41	0-30	0.163	156.5	64.59	8.14
P42	0-30	0.187	154.2	64.53	8.1
P43	0-30	0.216	153.2	64.32	7.94
P44	0-30	0.16	151.3	63.47	7.92
P45	0-30	0.229	146.9	63.16	7.91
P46	0-30	0.01	145.8	62.67	7.88
P47	0-30	0.049	143.9	62.61	7.76
P48	0-30	0.091	143.8	61.96	7.63
P49	0-30	0.043	143.3	61.67	7.43
P50	0-30	0.056	142.8	61.45	7.25
P51	0-30	0.868	142	60.52	7.08
P52	0-30	0.117	140.5	60.39	6.95
P53	0-30	0.085	138.6	59.88	6.89
P54	0-30	0.063	137.9	59.73	6.85
P55	0-30	0.001	135.2	59.72	6.79
P56	0-30	0.05	130.3	59.71	6.75
P58	0-30	0.061	129.9	59.66	6.07
P60	0-30	0.025	128.9	59.48	6.04
P61	0-30	0.055	121.6	59.44	5.97
P62	0-30	0.091	119.5	59.33	5.09
P63	0-30	0.042	118.8	57.91	4.91
P64	0-30	0.092	113.8	56.28	4.7
P65	0-30	0.071	112.6	55.23	4.58
P66	0-30	0.044	108.7	53.49	4.43
P67	0-30	0.067	105.7	52.1	4.39
P68	0-30	0.051	105	50.99	4.34
P69	0-30	0.062	103.5	50.61	4.25
P70	0-30	0.067	103.2	48.61	4.15
P71	0-30	0.069	103.1	47.47	3.88
P73	0-30	0.082	100.1	47.04	3.75
P74	0-30	0.101	88.89	46.37	3.01
P75	0-30	0.474	88.82	45.41	2.97
P76	0-30	0.091	79.09	43.22	2.9
P77	0-30	0.064	77.56	42.31	2.78
P78	0-30	0.096	76.98	40.03	2.68
P79	0-30	0.056	76.4	37.88	2.58
P80	0-30	0.484	74.51	32.16	2.57
P81	0-30	0.074	64.83	31.42	1.95
P82	0-30	0.09	48.37	28.16	1.85

Appendix 6. 14. Some Macronutrients measured of soil samples depth (0 – 30 cm)

Profile	Depth (cm)	N%	K(ppm)	Na (ppm)	P(ppm)
P1	0-30	0.078	488.3	77,54	39.84
P2	0-30	0.239	447.7	291.5	31.37
P3	0-30	0.08	425.9	179.5	30.91
P4	0-30	0.025	425.2	176.8	22.09
P5	0-30	0.137	415.2	148.9	20.88
P6	0-30	0.074	409.5	125.8	20.31
P7	0-30	0.019	376.1	120.7	18.82
P9	0-30	0.102	366.1	118.6	18.54
P10	0-30	0.221	347.4	118.5	17.5
P11	0-30	0.322	333.9	116	17.43
P12	0-30	0.019	300.8	111.9	17.21
P13	0-30	0.065	295.8	110	17.14
P14	0-30	0.028	288	108.9	17.05
P15	0-30	0.065	283.9	101.4	16.94
P16	0-30	0.225	281.2	101.3	16.66
P17	0-30	0.203	278.4	99.9	15.79
P18	0-30	0.054	277.4	99.04	15.51
P19	0-30	0.191	268	98.32	15.47
P20	0-30	0.06	255.9	97.35	15.24
P21	0-30	0.177	253.7	94.82	14.99
P22	0-30	0.318	234.8	93.93	13.11
P23	0-30	0.287	233.8	93.7	12.2
P24	0-30	0.201	225.4	92.7	11.75
P25	0-30	0.017	225.4	91.63	11.54
P26	0-30	0.007	222.2	91.49	11.51
P27	0-30	0.102	214.9	89.42	11.05
P28	0-30	0.174	211.5	89	10.6
P29	0-30	0.055	209	86.02	10.3
P30	0-30	0.053	208.1	78.98	9.99
P31	0-30	0.083	199.9	77.64	9.89
P32	0-30	0.085	195.9	75.16	9.44
P33	0-30	0.09	192.8	74.85	9.25
P34	0-30	0.135	192.8	74.7	8.82
P35	0-30	0.106	186.2	74.56	8.77
P36	0-30	0.098	179.8	69.77	8.74
P37	0-30	0.088	175.1	67.58	8.58
P38	0-30	0.052	170.4	67.32	8.45
P39	0-30	0.073	169.4	67	8.28
P40	0-30	0.034	156.7	66.92	8.16

Appendix 6. 15. Some soil profiles' image in the study area

Profile No :1
coordinate X: 620512, Y: 4296098

Profile No :2
coordinate X: 621148, Y: 4295905

Profile No :3
coordinate X: 618042, Y: 4294165

Profile No :4
coordinate X: 617851, Y: 4294177

Profile No :5
coordinate X: 616862, Y: 4291645

Profile No :7
coordinate X: 618293, Y: 4293761

Appendix 6. 16. Some soil profiles image in the study area (Continued)

Profile No :46
coordinate X: 616750, Y: 4291880

Profile No :6
coordinate X: 616940, Y: 4292951

Profile No :79
coordinate X: 617741, Y: 4289341

Profile No :17
coordinate X: 618044, Y: 4293243

Profile No :19
coordinate X: 618632, Y: 4293014

Profile No :30
coordinate X: 618050, Y: 4292604

Appendix 6. 17.Some soil profile’s image in the study area (Continued)

Profile No :67
coordinate X: 620774, Y: 4289082

Profile No :45
coordinate: 616780, Y: 4292520

Profile No :49
coordinate X: 616817, Y: 4292310

Profile No :38
coordinate X: 618327, Y: 4292560

Profile No :65
coordinate X: 621022, Y: 4290245

Profile No :70
coordinate X: 620503, Y: 4292523

CURRICULUM VITAE

Personal Identity

Name, Surname	: Karwan Fatah Maarouf
Nationality	: Iraqi
Date and place of birth	: 12 June , 1982 Sulaimanya, Iraq
Marital Status	: Single
Telephone	: (+964)770 1583287
E-mail	: karwanmarf1@g mail .com

Educational Background

Degree	Place of Education	Date of Graduate
Bachelor's Degree	Sulaimanya University College of Agriculture Department of Soil and Water Sci.	2009

Language Skills

Language	Reading	writing	Speaking
Kurdish (Mother language)	Excellent	Excellent	Excellent
Arabic	Excellent	Excellent	Excellent
English	Very good	good	Good
Turkish	Minor	Minor	Minor