بسم ا   الرحمن الرحيم

EFFECT OF THREE TILLAGE IMPLEMENTS ON SOME CHEMICAL PROPERTIES OF SOIL IN SHAMBAT

By

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Thank to Allah, at the start, the end and for ever my thanks and gratitude to my supervisor: Dr Fawzi Hamad Alneel Masoud, for his interest, assistance advice and guidance during the period of this study.

Dedication

To My Mother , Family ,

Friends

With Love

The Effect of Three Tillage Implements on Some Chemical Properties of Soil in Shambat

(M.Sc Thesis Agric. Eng.)

Mohamed Abd Alazeem Mahjoub Algizoly

Abstract: The study was carried out to investigate the effect of three tillage implements on some soil chemical properties at Shambat Demonstration Farm during March (2009).The chemical properties were: Mg, Ph, EC, Na, Ca, K, and O.M.

The tillage implements used were, chisel plow, disc plow, disc harrowes.

The complete randomized block design (CRBD) was used to domenstrate the effect of the mentioned treatments.

The results showed that there was a significant difference at ($p<0.05$) in soil (PH) among treatments, where chisel plow recorded the highest value (7. 5) while the lowest value was recorded by disc harrows (6.94).The results also revealed that there is a significant difference at ($p<0.05$) in soil (Mg) among treatments. The control recorded highest value (2.05 me/l) while disc harrows recorded the lowest one (1.73 me/l).

There was no significant difference at ($p<0.05$) in the other soil chemical properties measurements (EC,Na, Ca ,K, and O.M).

بسم الله الرحمن الرحيم

تاثير ثلاثه الات حراثه على بعض الخواص الكيميائيه للتربه فى شمبات

(أطروحه ماجستير- هندسه زراعيه)

محمد عبد العظيم محجوب الجزولي

الخلاصه:

اجريت تجربه حقليه لموسم (2009) مارس بمزرعه جامعه الخرطوم التجريبيه لدراسه تاثير ثلاثه الات حراثه علي بعض الخواص الكيميائيه للتربه وشملت الخصائص التاليه :المغنيزيوم , الاس الهيدروجيني , الموصليه الكهربيه , الصوديوم , الكالسيوم , البوتاسيوم , والماده العضويه .

الالات المستخدمه في التجربه شملت المحراث الحفار, المحراث القرصي , الامشاط القرصيه استخدم في تنفيز التجربه تصميم المربعات العشوائيه الكامله لمعرفه الفروقات المعنويه للمعاملات المزكوره .

اوضحت النتائج ان استخدام المحراث الحفار ادى الى زياده معنويه في الاس الهيدروجيني بلغت (7.5) كما ادي استخدام الامشاط القرصيه الي اقل قيمه (6.94).

كما اوضحت النتائج ايضا ان هناك اختلافات معنويه فى المغنزيوم حيث سجل الشاهد اعلي قيمه بالنسبه للمغنيزيوم(2.04) كما سجلت الامشاط القرصيه اقل قيمه (1.73)

كما اوضحت النتائج ان ليس هنالك فروقات معنويه في الخصائص الكيميائيه الاخري والتي تشمل (الموصليه الكهربيه, الصوديوم, الكالسيوم, البوتاسيوم والماده العضويه).

CHAPTER ONE

INTRODUCTION

The soil can be defined as an essential natural resource that provide medium for plant growth, regulates and partition water flow in the environment and serves as an environmental buffer in the formation and degradation of natural compounds (Larson and Pierce, 1991).

Soil management can have a substantial effect on the vertical stratification of soil profile quality indices. Higher concentrations of P, Ca and Mg occur near the soil surface with conservation tillage thanwith tilled soils (Baur *et al*.2000). On the other hand, Rhoton *et al*. (1993) reported no differences in nutrient distribution near the soil surfaces subjected to zero or conservation tillage. This indicates that soil sampling depth in tillage experiments requires more attention (Crozier *et al.* 1999).

The soil quality concept has recognized soil organic matter as an important attribute that controls many key soil function (Doran *et al* 1994). Prolonged application of conventional tillage systems, commonly, deteriorates some of the inherent physico – chemical properties of the soil,unless appropriate management practices are observed. For example, conventional tillage decreases both soil C and N compared to no tillage by about 47% (Cebel *et al*.2000).

Tillage indirectly reduces Soil cation exchange capacity (CEC) through reducing soil organic matter (Fraser1994).

Stratification ratios of soil organic C and total N provide to be promising indicators of soil quality (Franzluebbers 2002), especially in the warm and dry regions where C sequestered in soil may be quite small (Potter *et al*.1998). Accordingly, under native vegetation, a stratification ratio (OC and TN) for the plough layer was found to be more than two, wich means a degree of soil inversion by tillage. Therefore, this is useful in evaluation of the impact of tillage on soil quality. In addition to OC and TN, there is a need to include ratios of other soil property parameters to be tested on a wide range of soil types in different agro-ecological zones. However in Sudan, all studies on the effect of tillage on soil properties did not include chemical properties as a reference. The main objective of this study was to show the effects of three tillage implements ; namely, the disc plow ,the disc harrow ,the chisel plow, on some chemical properties of soil in Shambat.

CHAPTER TWO

LTERATURE REVIEW

2.1 Definition of tillage

Tillage was defined by Hillel (1969) and Culpin (1976) as the mechanical manipulation of the soil to improve soil conditions affecting crop production; where as, Krause *et al* (1984) made an emphasis on the influence of tillage on the biological and chemical characteristics. On the other hand, Mills *et al.* (1991) defined tillage as the operation, which includes all practices necessary for land preparation, planting, cultivation and residue management.

2.2 Types of tillage

Bland *et al.* (1971) recommended plowing immediately after harvesting the preceding crop with shallow depth in order to make advantage of residual soil moisture, and to improve seedling emergence which would subsequently increase crop yield. However, Hillel *et al*. (1969) differentiated between two types of tillage practices:

a) Primery tillage which would break the soil mass into a loose system of clods of mixed sizes.
b) Secondary tillage, which would further pulverize, repack, and smooth the soil surface.On the other hand, some tillage practices, such as deep plowing, chiseling, ripping and sub soiling have been applied in various ways (Schwab *et al.,* 1966).

2.3 Objectives of tillage

The objectives of tillage are summarized in the following points:

1- Manage soil water, both wetting and drying.

2- To insure proper seedbed preparation

3- Control weeds.

4- Control or destroy insects, their eggs, larvae and breeding places.

5- Reduce wind and water erosion by leaving a rough surface.

6- Mixed incorporate soil amendments such as lime-based fertilizers (Kepner *et al.*, 1978).

2.4. The main tillage implements

A tillage tool is defined as an individual soil- working element, such as a plough bottom ,a disc blade, cultivator and shovel. A tillage implement consists of a single tool, or a group of tools, together with associate frame, wheels and protection devices (Bainer *et al.*, 1991). Tillage implements are divided into two groups, the first is a primary tillage implements, where is used for deep tillage, such as, mold board plow, disc plow, chisel plow and sub soil plow. The second is the secondary tillage implements, where it is used for, shallow tillage, such as disc harrow, ridger and scraper.

2.4.1 Disc plow

Bainer *et al.* (1991) reported that, the standard disc plow consists of series of individually mounted, inclined disc blades on a frame supported by wheels, It is most suitable for conditions under which the moldboard plow does not work satisfactorily. A disc plow generally has from one to seven concave disc blades, spaced to cut from 17.78 to 30.48 cm (7 to 12) per disc. On some models one or more discs can be removed, and in some cases the disc spacing along the frame can be changed.

Kepner *et al*. 1978) stated that, disc implements, can cut through crop residues, roll over roots and other obstructions and can operate in non-scouring soil, by using scrapers. They do not provide complete converge of trash.

2.4.2Offset disc harrows

Hunt (1979) reported that, offset disc harrows receive their name because of tendency to trail to one side of the tractor hitch point. These discs were originally used for cultivating work under low branches of orchard trees; the heavy construction of these discs has made them popular for field seedbed preparation. These harrows are capable of pulverizing and firming plow furrows to their full depth. The draft of disc harrows increases and penetration decreases with speed.

Culpin (1976) reported that, the offset disc harrow has two gangs, set in opposite direction and working in tandem. Such an implement can operate in a considerably offset position with the hitch central on the tractor.

2.4.3 Chisel plow

A chisel plow is an implement designed for primary tillage at depths from 15 to 46 cm. The soil engaging tools are shanks equipped with replaceable points or shovels .They shatter, mix, and aerate the soil with little soil inversion They leave a rough soil surface with most of the plant residue remaining uncovered. This condition helps prevent wind and water erosion, while improving water penetration into the soil, and the plant residue on the soil surface improves traction (Ajit K.Srivastava *et al.*, 2006).

Chisel plows function most effectively when the soil is dry and firm because the tools can pass through wet soil with almost no shattering action. A chisel plow requires approximately one- half of the draft of a moldboard plow with the same working width and operating at the same tillage depth. However, farmers usually operate a chisel plow at a greater depth than a moldboard plow to break up the plow sole for improving water and root penetration. Under those conditions the draft requirement of a chisel plow increases. The plant residue left on the soil surface acts as an insulator and slows soil warming up and soil drying in the spring compared with soil left bare from moldboard plowing. Some researchers have found a need for increased chemical application rates because chisel plowing does not bury weed seeds and because plant residue may absorb some of the chemicals (Ajit K.Srivastava *et al.*, 2006).

Chisel plowing is usually completed in late summer or early fall and is followed by one or more secondary tillage operations during the following spring. Both the surface roughness and required draft increase with increased operating speed. Chisel plows are available with integral and drawn hitching configurations. The shanks are designed with spring-cushion, spring-reset, or spring-trip mountings to protect the tool and frame from the impacts with buried rocks.

Normally the chisel plow works up and down slopes, especially where the gradient is steep, though on shallow slopes work along the contours can save power requirements.

2.5 Impact of tillage on soil chemical properties

2.5.1 Soil pH

No-tillage management system had appositive effect on the capacity of the soil to faction with respect to its ability to provide source for plant nutrients (Those results from 1998 experiment) however, were less definitive. Bowman and Halverson (1998) found the soil pH levels near neutral or slight alkaline in the surface horizon with no tillage. Some studies showed no significant differences were observed between tillage treatments among soil chemical properties although soil pH values for treatments fell within the moderately acid range (Liebig *et al.*, 2004).

2.5.2 Soil organic carbon

Tillage affect on soil quality, indicators were limited to soil organic carbon, microbial biomass and bulk density. Some studies showed that particulate organic matter was greater under minimum tillage than no-tillage Liebig, M.A. *et al.* (2004) Rasmusen *et al*. (1998) concluded that, most of the soil organic carbon loss was due to high biological oxidation and absence of carbon in put the flowing year rather than resulting from erosion. Also, decreasing tillage intensity reduced soil organic matter loss but the effect was dramatic as eliminating summer-fallow. Crop management practices such as N fertilization increase residue production and improve C and N levels in soil influence of deferent tillage techniques on top soil (0-10 cm) organic mater content was studied by Riezebos and Loerts (1998). Their study showed that, the transition from forest to agricultural use had lead to significant decrease of organic matter in the top soil. Prior to deforestation soil organic matter was 2.09% and 2.42%, afterwards, it decreased to 1.59% when the soil was cultivated conventionally. Mechanically tilled fields appear to have a more rapid decline in organic matter than manually tilled field (1.59%VS.18.9%) resulting in more severe soil degradation. A transition from conventional tillage (using a heavy disk plough and harrow) to no-tillage leads initially to a lower organic matter content) 1.45%). After 10 years such a transition may appear to result in an increase in organic carbon content witch will be beneficial to the soil no-tillage has been proposed as an alternative to conventional cropping system for reducing soil degradation. It generally, leads to an increase of carbon in the top 5 to 10 cm of profile, relative to ploughed soil (Alvarez, 1998) with in the entire plough layer; however, organic carbon content under no-tillage may be higher Alvarez (1998) or lower Elliot (1992) than under plough tillage. Potter *et al.* (1998) found that no-tillage management resulted in an increased soil organic carbon concentration and mass in the surface 0.07 m in comparison to more incentive tillage management (e.g. sweep, chisel plough and mold board plough). Soil organic carbon or organic matter is generally important because it support all soil quality function (Fenton *et al.*, 1999). Carter and Serson (2001) reported that, conservation tillage significantly increased the concentration of organic carbon and microorganism carbon at the soil 0-8 cm depth, and significantly improved soil structure stability.

2.5.3 Soil EC

Crop production potential using particular irrigation water can range from 100 percent down to zero but there are often factors other than water quality which affect yield. The tolerance values of production potential when salinity is the only limiting factor. Such conditions, however, do not always exist. Other conditions may also limit production but the relative yield loss due to salinity will approximate salinity is the main limiting factor.

The soil salinity tolerances apply primarily to crops from late seedling stage to maturity. Tolerance during the germination and early seedling stage may be different and is only clearly defined for a few crops. Data for a few crops showing soil salinity that resulted in a 50 percent reduction in either yield or seedling emergence. In general, if the soil salinity in the surface soil (seeding area) is greater than 4 ds/m, it may inhibit or delay germination and early seedling growth. This slowed germination may then delay emergence, allowing soil crusting and disease problems to reduce the crop stand. Rainfall or pre-plant irrigations will often help to maintain low salinity, delay crusting and promote good emergence

A salinity problem exists if salt accumulates in the crop root zone to a concentration that causes a loss in yield. Salinity increases with depth and is greatest in lower part of root zone. As water salinity increase, greater care must be taken to leach salt out of root zone before their accumulation reaches a concentration which might affect yield (Ayers and Wescot, 1989). Haj *et al*. (1997) stated that about 25% reduction in the yield of some crop is attributed to soil salinity only.

The most influential water quality guideline on crop productivity is the water salinity hazard as measured by electrical conductivity (ECw). The primary effect of high ECw water on crop productivity is the inability of the plant to compete with ions in the soil solution for water (physiological drought). The higher the EC, the less water is available to plants, even though the soil may appear wet. Because plants can only transpire "pure" water, usable plant water in the soil solution decreases dramatically as EC increases.

Maas and Hoffman (1977) and Maas (1984) stated that plant growth rate decreases linearly as salinity increases above a critical threshold salinity at which growth rate first begins to decrease. This linear decrease in yield is in good agreement with field data throughout the usual range of salinity. Deviations from the linear decrease occur at yields considerably less than 50 percent of potential, at which level yields are commercially unacceptable anyway.

The following equation (Maas and Hoffman 1977) expresses the straight line salinity effect on yield .

$$Y = 100 - b\ (ECe - a)$$

Where:

Y= relative crop yield (percent)

ECe = salinity of the soil saturation extract in ds/m

A = salinity threshold value

B = yield loss per unit increase in salinity

2.5.4 Sodium adsorption ratio

The tendency for sodium to increase its proportion on the cation exchange sites at the expense of calcium and magnesium is estimated by (SAR).

Richards (1957) reported that where concentration of the cations are expressed in mmole\L. the alkali hazard involved in the use of water for irrigation is determined by the absolute and relative concentrations of the cations. If the proportion of sodium is high, the alkali hazard is high; and conversely, if the calcium and magnesium predominate, the hazard is low.

Hamid and Mustafa (1975) stated that the quality of irrigation water is adversely affected by high sodium concentration, because sodium adsorbed onto the soil cation exchange sites, disperses the soil aggregates, reduce the macro-pores of the soil and hence its hydraulic conductivity.

2.5.5 Calcium

The effect of high concentrations of calcium ions in saline soil solutions varies with the species, such as guayule, are more tolerant o added calcium salts than of other neutral salts (Wadleigh and Gauch, 1944). Masaewa (1936), however, found added calcium chloride to be more toxic to soil cultures of flax than added sodium chloride. Wadleigh et al (1951) have reported specific toxicity of calcium salts added to soil cultures of orchard grass, and unpublished data by Ayers(1989).indicate similar relation for tall fescue. Both the calcium and chloride contents of the grasses from the calcium chloride treatments increased markedly; but since calcium nitride produced a toxic effect similar to that of calcium chloride, the toxicity was attributed to calcium accumulation rather than to chloride (Wadleigh et al, 1951). Modderate concentrations of calcium chloride are highly toxic to stone fruits in sand culture, and it appears that this toxicity is associated with an accumulation of chloride in the leaves. This chloride accumulation is more pronounced in the presence of excess calcium ions than when sodium occurs in excess (Brown et al (1953).

2.5.6 Magnesium

High concentrations of magnesium in the substrate are frequently more toxic to plants than osmotic concentrations of other neutral salts. This toxicity of magnesium may be alleviated by the presence of relatively high concentrations of calcium ions in the substrate.

2.5.7 Potassium

Although, the occurrence of high concentrations of potassium in the soil solution is rare, toxic effects of high potassium have been reported. There is evidence to indicate that toxicity of high potassium, like that of high magnesium, may be lessened when balanced by calcium concentrations High concentrations of potassium may also induce magnesium deficiency (Boynton and Burrell, 1944) and iron chlorosis (Walsh and Clarke, 1942).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Materials

3.1.1 Location

The experiment was conducted in the Demonstration Farm of the Faculty of Agriculture, University of Khartoum at Shambat, during December 2008 – March 2009. The total area of the experiment was 1800 m^2

3.1.2 Equipment and tools

1- An auger was used for soil sampling.
2- pH meter used to determine the potential hydrogen (pH) according to Franson (1985)
3- Conductivity meter used to measure EC according to Franson (1985).

3.1.3 Tillage implements

1- The tractor used in the experiment was CASE International English made its hourse power 75 Plate(3.1)
2- The disc plow used was GIAD, three units Plate (3.2).
3- The disc harrows used was GIAD two units Plate (3.3).
4- The chisel plow used was Massy forgson, five units Plate (3.4).

3.2 Methods

3.2.1 Soil sample analysis

An auger was used for soil analysis sampling from the depth (0-30 cm). The parameter measured included: sodium (Na) (by flame photometer) , potassium (K)(by flame photometer) , magnesium (Mg) (by titration).calcium (Ca)(by titration method) . Organic carbon.(O.C)% and organic matter% (OM)%. Also, the analysis included pH, Electerical conductivity (EC) ds/m.

pH was determined for all soil samples, according to the method described by Page *et al (ph meter)* . (1992).

EC dS/m: EC was measured using the method described by Page *et al*. (1992).

O.C Carbon OC%: it was measured following the method described Page *et al (titration method).* (1992).

3.2.2 Experimental design

The experiment was organized in Complete Randomized Block Design, where three blocks were used and each block was divided into four plots. As shown in Fig (3.1).

Block (1)	**block (2)**	**Block (3)**
control	Disc harrows	Disc plow
Chisel plow	Disc plow	control
Disc plow	Control	Chisel plow
Disc harrows	Chisel plow	Disc harrows

30 m

60 m

Fig. (3.1) the layout of experiment

Plate 3.1 Tractor

Plate 3.2 Disc plow

Plate 3.3 Chisel plow

Plate 3.4 Offset disc harrows

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Soil pH

Table 4.1 and appendix A and Fig(4.1) show that there is no significant difference among the treatments at ($P > 0.05$) They also revealed that there is a significant difference in pHs among treatments, where chisel plow recorded highest value (7.50) followed by disc plow (7.46), disc Harrows (7.02) and control (6.94),this result may be due to the fact that (Ph) increase with depth,and chisel plow expose the subsurface layer this result agrees with Liebig *et al* (2004).

4.2 Soil EC

As shown in table 4.1 and Appendix B and Fig(4.2) there is no significant difference at ($P > 0.05$). The Highest value recorded by chisel plow (1.38 ds/m) followed by Control (1.14 ds/m), Disc plow (1.13 ds/m) and Dissc Harrows (1.11 ds/m), this result agrees with Salih *et al* (1998).

4.3 Soil Ca

Table 4.1 and Appendix C and Fig (4.3) demonstrate that there is no significant difference at ($P > 0.05$). The Highest value recorded by chisel plow (3.6 me/l) followed by Control (3.46 me/l), Disc plow (3.0 me/l) and Disc Harrows (2.4 me/l), this result agrees with Rhoton *et al* (1993).

4.4 Soil mg

Table 4.1 and appendix D and Fig (4.4) demonstrate that there is significant difference at ($P > 0.05$).The Highest value recorded by chisel plow (1.86 me/l), Disc Harrows (1.73 me/l) and disc plow (1.13 me/l), this result agrees with Rhoton (1993).

4.5 Soil Na

Table 4.1 and Appendix E and Fig (4.5) demonstrate that there is no significant difference at (P>0.05).The Highest value recorded by chisel plow (7.82 me/l) followed by Disc plow (7.38 me/l), Disc Harrows (6.66 me/l) and Control (5.21 me/l) this result agrees with Rhoton *et al* (1993).

4.6 Soil K

Table 4.1 and appendix F and Fig (4.6) demonstrate that there is no significant difference at (P>0.05). The Highest value recorded by chisel plow (0.21 me/l) followed by Control (0.20 me/l), Disc plow (0.19 me/l) and Disc Harrows (0.15 me/l) this result agrees with Rhoton *et al* (1993).

4.7 Soil OM%

Table 4.1 and appendix G demonstrate that there is no significant difference at (P>0.05). Highest value recorded by Disc plow (1.12 %) followed by Disc Harrows (1.09 %), Control (1.06 %) and chisel plow (0.98 %) this result could be due to the mixing effect of the disc plow, and this result may be due to the fact that.(O.M) is high at surface layer while Ec, Ph, Ca, Mg, Na, K. normaly increase with depth, this is true. Sinces chisel plow expose the subsurface layer while disc plow mix the serface layer, this results agrease with Potter et al (1998).

CHAPTER FIVE

CONCLOUSIONS AND RECOMMENDATIONS

5.1 Conclusions

From this study the flowing conclusions can be drawn:

1- The highest value of (PH) was recorded by the chisel plow followed by the disc plow, the disc harrows, respectively.

2- The chisel plow proved to be superior in its effect on increase the concentration of (MG) in the soil.

3- The different tillage implements namely,chisel plow,disc plow and disc harrow has no significant effects on (Ec, Na, Ca, k,and O.M) in the soil.

5.2 Recommendations

1- For increasing the soil (MG) the chisel plow is recommended.

2- Further investigation is needed to confirm the effects of disc plow, chisel plow, disc harrows on the chemical properties on different types of soils.

REFERENCES

Aburana, F.; Pearson, R.W.; and Elkins, C.B (1950). Quantitative evaluation of soil reaction and base status changes resulting from field application of residually acid forming fertilizer. Soil Sci. Amer. Proc., 22: 539

Ajit, K.; Srvistava, Michigan State University and Carrall, E. Gioring, (2006). Engineering Principle of Agricultural Machines. University of Illioois and Denins R. Bulk master, Pennsylvania University.

Alegre, J.C.; Cassel, D.K.; and Bandy, D.E. (1988). Effect of land cleaning method on chemical properties of Ultisol in the Amazon. Soil Sci. Soc. of Amer. J., 52: 1284.

Alvarez, R. Miguel, ERusso, Pabloprystupa, Javier, D. Sciener, and Wisblotta, (1998). Soil carbon pools under conventional and no-tillage system in the argentine Rolling Pampa Agronomy J., 90: 138-143.

Aolobi, (1980). Long-term effects of continues cultivation of a tropical ultisol in south western Nigeria Exp. 1 Agric., 25:207-215.

Ayers, A.D. (1950). Salt tolerance of avocado trees grown in culture solution. Calif. Avocado Soc. Yearbook, 1950:139-148, Illus.

Ayers, A.D. (1951). Sodium and Chloride injury of fuerte Avocado leaves. Calif. Avocado Soc. Yearbook ,1951: 174-178, Illus.

Bainer, R.; Kepner, R.A. and Bargers, E.L (1991). Principles of farm machinery. Published by John Willy and Sons, Inc, New York, London.

Bauer, P.J.; Fredderick, J.R.&Busscher,W.J(2000). Soil nutrients distribution as affected by surface and deep tillage on the southeast USA coastal plain. Proceedings of the 15th Conference of ISTRO, 2-7 July 2000. Fort Worth , Dallas, texas USA.

Bland, B.F(1971). Crop production: cereals and legumes. Academic press, London and New York.

Bower, and Turk, L.M. (1946). Calcium and magnesium deficiencies in alkali soils. Sci. Soc. Agron. J., 38: 723-727.

Bower, and Wadleigh, G.H. (1949). Growth and Cationic Accumulation by four species of plants as influenced by various Levels of exchangeable sodium. Soil Sci. Soc. Amer. Proc. (1948), 13: 218-223, Illus.

Boynton, D. and Burrell, A.B. (1944). Potassium –induced magnesium deficiency in the mcintosh apple tree. Soil Sci. Soc., 58: 441-454.

Bowman, R.A ., Halvorson, A.D., (1998). Soil chemical changes after nine years of differential N fertilization in a no-till dry land wheat-corn . Fallow rotation. Soil Sci. 163,241-247.

Bremer, E.; Janzen, H.H. and Jonson, A.M. (1994). Sensitivity of total, Light Fraction and mineralizable orgaicm after to management practices in alettibidge soil. Can. Soil Sci., 74: 131-138

Brown, J.W.; C.H. and Hay ward, H.E. (1953). Foliar Analyses of Stone Fruits and almond trees on saline substrates. Amer Soc. Hort. Sci .Proc., 61: 49-55.

Carter, M.R. (1986). Microbial biomass as an index for tillage induces changes in soil biological properties. Soil and Tillage Res., 7: 29-40.

Carter, M.R.; Grezoricg, E.G.; Argers, D.A.; Donald, R.G. and Bolinder, M.A. (1998). Organic C and N storage, and organic carpon Fraction, in adjacent cultivated and forested soils of eastern Canada. Soil and Tillage Research, 47(3-4): 261-269.

Cebel, N.; Mullen, M and Kirener, M. (2000). Comparison effect of conventional tillage and no tillage practices on some chemical, biochemical and microbial properties of erosion plots soils. Proceedings of international symposirum on desertification, 13-17 June 2000. Konya, turkey.

Crozier, C.R.; Naderman, G.C.; Tucker, M.R. and Sugg, R.E. (1999). Nutrient and PH stratification**s** with conventional and no tillage management. Communications in Soil Science and Plants analysis 30, 65-74.

Culpin, C. (1976). Farm Machinery, 9th edition. Fletcher and Son Ltd. Norwich. Great Britain.

Doran, J.W. and Parkin, T.B. (1994). Difining and assessing soil quality.pp 3-21. In :j.W Doran, D.C. Coleman, D.F. Bezdieck and B.A. Stewart (eds.) Defining Soil Quality for a Sustainable Environment. Soil Science society America, Agronomy, Madison, WI, U.S.A.

Drausman, L.R.; Whileny, D.A., Janssen, K.A.; and Long, J.H. (1991). Soil properties after 20 years of fertilization with different Soil after 20 years of fertilization with different nitrogen sources. Soil Sci. Soc of Amer. J., 55: 1097.

Elliot, L.F. and Wildung, R.E. (1992). Wheat biotechnology means for soil water conservation. J. of Soil and Water Conservation 47, No. I, Jan. Feb, 1992.

Fenton, T.E.; Brown, J.R. and Maubach, M.J (1999). Effects of Long –term cropping on organic matter content of soils: Implication for Soil Quality – Soil and Water Con. J., pp. 95-124.

Franzluebber, A.J. (2002). Soil organic matter stratification as an indicator of quality in crop land. Soil Organic matter stratification ratio as an indicator of soil quality. Soil and tillage research. 66,95-106.

Fraser, P.M. (1994). The impact of soil and crop management practices on soil macrofauna. In: C.E. Pankhurst, B.M. Double, V.V.S.R. Gupta and P.R. Grace (eds), Soil Biota: Management in Sustainable Farming Systems. CSIRO Australia, pp. 125-132.

Ghuman, B.S. and Lal, S. (1991). Tillage and residue management effects on soil properties and yield of rainfed maize and wheat in subhumid, subtropical climate. Soil and tillage Res. V., pp. 58(1-2): 1-10.

Greenland, D.J. and Ford, D.J. (1964). Separation of partially humidified organic materials from soils by ultrasonic disruption. Trans. Light Internal Congress Soil Sci., 3: 137-148.

Gupta, S.C.; Sharma, P.P. and Defranchi, S.A. (1989). Compaction effect on Soils Structure. Advances in Agronomy, 42: 311-338.

Hamel, J.E. (1969). Long-term tillage and crop rotation effects on bulk density and soil Impedance in northern Idaho. Soil Sci. Soc. Am. J., 53: 1515-1519.

Hamid, K.S. and Mustafa, A. (1975). Dispersion as an index of relative hydraulic Conductivity in salt affected. Soils of the Sudan. Geoderma, 14:107-114.

Holm, F.A. and Kikland, K.J. (1986). Annual broad leaved weed control in wheat in western Canada, in wheat production in Canada, Areview, Slinkard, A.E. and D.B. Fowter, (eds.)., University of Saskatchewan, Shskatoon, 1986-375.

Hunt, D.R. (1979). Farm Power and Machinery Management 4th ed. Second Printing. The Iowa State University Press.

Hunt, DR. (1995). Farm Power and Machinery Management. 7th ed. Second Printing. The Iowa State University Press.

Jenny, (1944). World IBSRAM proc 12(2) Bangkok, Thailand in Bourd soil Res, mgT.

Juo, A.S.; and Lal, R. (1977). The effect of fallow and continuous cultivation on the chemical and physical properties of an Alfisol in Western Nigeria. Plant and Soil .47:567.

Kepner, A.R.;Bainer, R, and Brger, L.E. (1978). Principles of Farm Machinery, 3rd Published by AVI Publishing Company, INC.

Krause, R.; Lorenz, F. and Hoogmoed, W. B. (1984). Soil Tillage in Tropics and Subtropics. Published by gtz.

Larson, and Pierce, F.J (1991). Conservationand enhancement of soil quality. In exalution for sustainable management in the developing.

Liebig, M.A. D. L. Tanaka. B.J. Wienhold (2004). Tillage and cropping effects on soil quality indicators in the northern Great plains.

Lilleland, O.; Brown, J.G., and Swanson, G. (1945). Research shows excess sodium may cause leaf tip burn. Almond Facts, 9(2): 1-5, Illus.

Masaewa, M. (1936). zur frace der chlorophobie der peflanzen. Bodenk u pflanzener 1:39-56.

Mass E.V. and Hoffman G.J. (1977). Crop Salt tolerance - current assessment. J. Irrigation and Drainage. Division, ASCE 103 (IRZ): 115-134. Proceeding Paper, 12993.

Mass, E.V. (1884). Crop salt-tolerance of plants in agriculture, salinity assessment and management. New York: American Society of Civil Engineering, pp. 262-304.

Matowet,; Peter, R.; Gary, M.; Pierznbki; Davidwhitney and Ray, E. Lamond, (1998). Soil chemical properties as influenced tillage and nitrogen source, place mint and rats after 10 years of continue sorghum. Soil and Tillage Research, 50(1):11-19.

Mills, B.G. and A. Strarasts (1991) Fallow Management In: Darling Downs-summer crop management Notes (1991-1992) p:175-182(QDPI).

Mubarak, A.R.; Bshamy, O.M.E. and Azhari, A. (2005). Long term soil and tillage research.

Page, A.L.; Miller, R.H. and Keeney, D.R. (1992). Methods of Soil analysis part 2.Second .Madison, Wisconsin, USA.

Pikul, J.L. and Allamarus, R.R. (1986). Physical and chemical properties of Haploxerall after fifty years of residues management. Soil Sci. Soc. of Amer. J., 50: 214-219.

Potter, K.N.; Torbert, H.A.; Matocha jr, J.E. and Unger, P.W. (1998). Distribution and amount of soil organic C in long-term management systems in Texas. Soil and Tillage Reasearch 47 (3-4), 309-321.

Rasmusen, P.E .; Albrech, SL. And Smily, R.W. (**1998).** Soil C and N changes under tillage and cropping system in semi-aired pacific North agriculture soil and tillage research, 47(3-4) :205-213.

Ratner, E.I. (1935). The influence of exchangeable sodium in the soil on its properties as a medium for plant growth. Soil Sci., 40: 459-471, Illus.

Ratner, E.I. (1944). Physiological effect of alkalinity of soils and the ameliorative role of plant root systems on solonetz (Alkali Soils). Poghvovedenie. (pedology): 205-227, Illus (in Russian. English summary), pp. 226-227.

Rhoton, F.E.; Bruce, R.R.; Buehring, N.W.; Elkins, G.B.; Langdale, C.W. and Tyler, D.D. (1993). Chemical and physical characteristics of four soil types under conventional and no-tillage systems. Soil and Tillage Reasearch, 28,51-61.

Richard, L D. (1957). Diagnosis and improvement of saline and alkali soils. Hand book 60.USDA.

Riezebos , H. and loets, A.C.(1998) . Influnce of land us changes and tillage practiceson soil organic mater in southern Brazil and eastern Paraguay. Soil and tillage reaserch, 49(3): 271-275.

Schwab, G. O.: R.K.Frevert; T. W.E. Dminster and K.K Bamas (1996) . Soil and water conservation engineering. 2th edn. John Wiley and sons, New York Copyright, 1955,1966.

Sharda, A.K. (1977). Influence of bulk density on horizontal water infiltration. Aust. J. of Soil Res., 15: 83-87.

Sharma, P.K.; De Datta, S.K. and Redulla, C.A. (1980). Tillage effects on soil physical properties and wet land rice. Agron J., 80(1): 34-40.

Wadleigh, and Gauch, H.G. (1944). The influence of high concentrations of sodium sulfate, sodium chloride, calcium chloride, and magnesium chloride on the growth of guayule in sand culture. Soil Sci. 58: 399-403, Illus.

Wadleigh,; Gauch, H.G. and Kolish, M. (1951). Mineral composition of orchard grss grown on pachappa loam salinized with various salts. Soil Sci., 72:275-282, Illus.

Walash, T. and Clarke, E.J. (1942). A chlorosis of tomatoes. (Abstract) Eier Dept. Agr. Jour., 39: 316-325, Illus.

Wood, A.W. (1985). Soil degradation and management under intensive sugarcane in North Queen Land. Soil use and Water, 1: 120-124.

APPENDICES

Appendix (A) Effect of tillage implements on soil ph*

Source	DF	SS	MS	F-cal	F-tab
Block	2	0.0698	0.0349	2.59	5.14
Treatment	3	0.4914	0.1638	12.16	4.76
Error	6	0.0808	0.0135	-	-
Total	11	0.6420	-	-	-

Appendix (B) Effect of tillage implements on soil Ec

Source	DF	SS	MS	F-cal	F-tab
Block	2	0.3939	0.1969	2.05	5.14
Treatment	3	0.1503	0.0501	0.52	4.76
Error	6	0.5777	0.0963	-	-
Total	11	1.1219	-	-	-

Appendix (C) Effect of tillage implements on soil Ca

Source	DF	SS	MS	F-cal	F-tab
Block	2	2.853	0.951	1.27	5.14
Treatment	3	1.307	0.653	0.87	4.76
Error	6	4.507	0.751	-	-
Total	11	8.667	-	-	-

Appendix (D) Effect of tillage implements on soil Mg*

Source	DF	SS	MS	F-cal	F-tab
Block	2	1.453	0.484	4.79	5.14
Treatment	3	1.260	0.630	6.23	4.76
Error	6	0.607	0.101	-	-
Total	11	3.320	-	-	-

Appendix (E) Effect of tillage implements on soil Na

Source	DF	SS	MS	F-cal	F-tab
Block	2	11.78	3.93	0.61	5.14
Treatment	3	20.29	10.15	1.57	4.76
Error	6	38.82	6.47	-	-
Total	11	70.89	-	-	-

Appendix (F) Effect of tillage implements on soil K

Source	DF	SS	MS	F-cal	F-tab
Block	2	0.0600	0.0200	0.57	5.14
Treatment	3	0.1041	0.0521	1.48	4.76
Error	6	0.2110	0.0352	-	-
Total	11	0.3752	-	-	-

Appendix (G) Effect of tillage implements on soil Om

Source	DF	SS	MS	F-cal	F-tab
Block	2	0.089	0.030	0.853	5.14
Treatment	3	0. 055	0.027	0.795	4.76
Error	6	0.687	0.114	-	-
Total	11	0.830	-	-	-

Appendix (I)

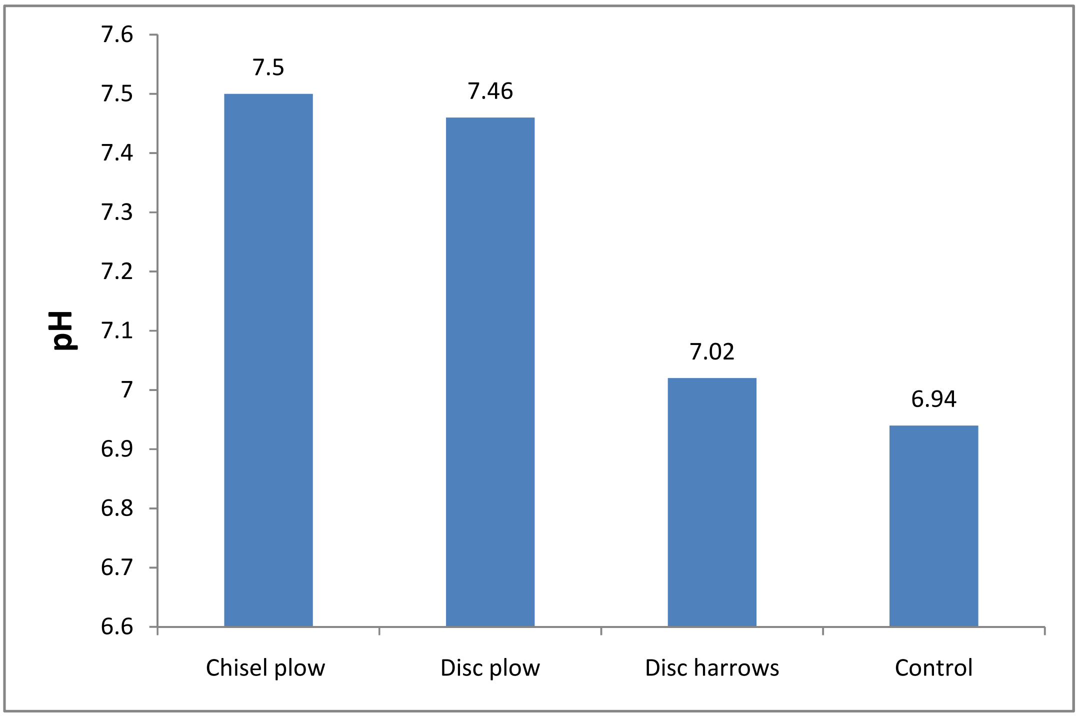

Fig 4.1 Soil Ph

Appendix (J)

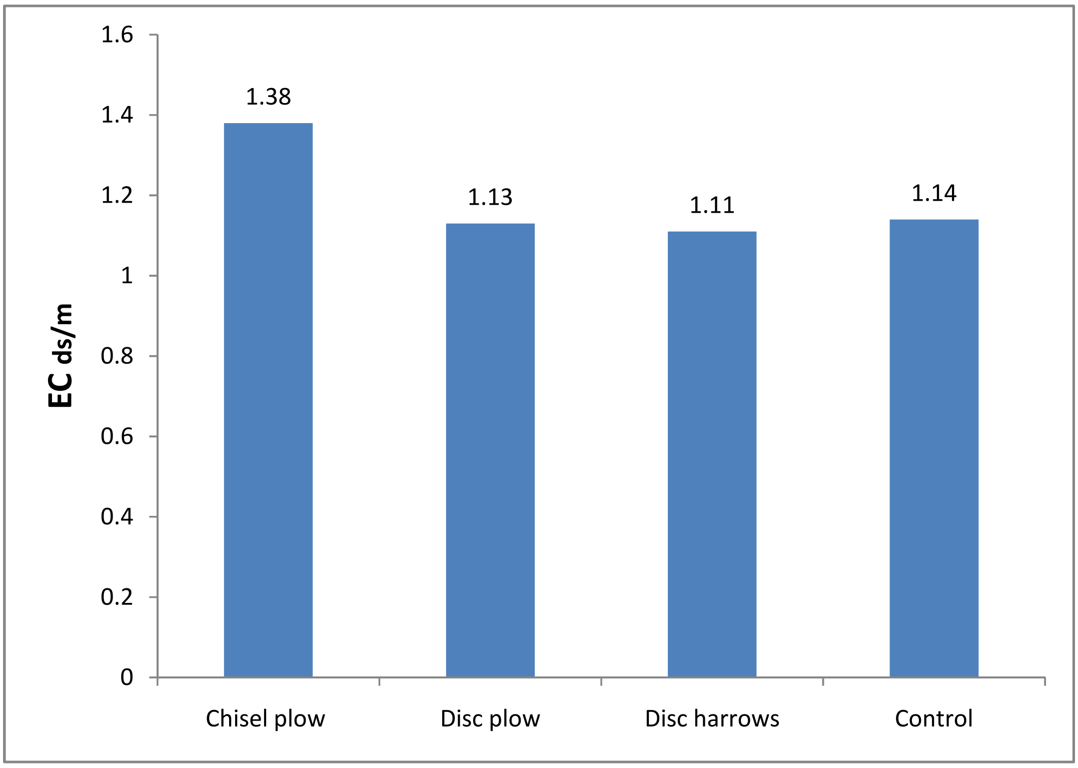

Fig 4.2 Soil EC

Appendix (K)

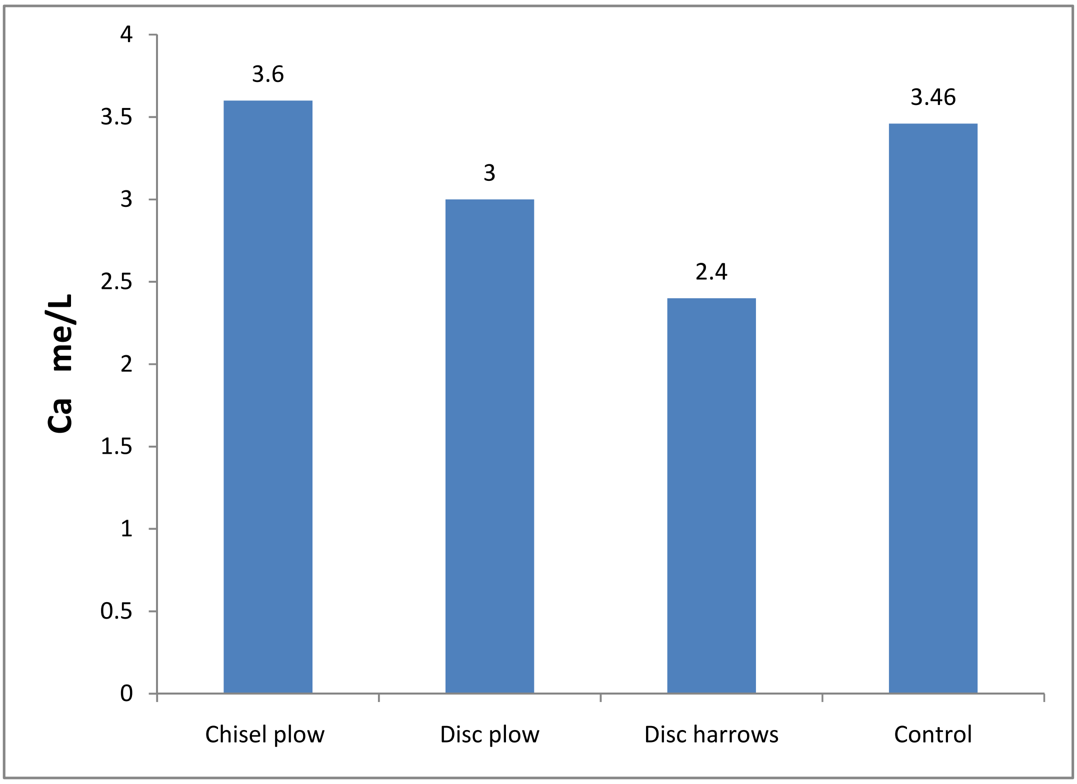

Fig 4.3 Soil Ca

Appendix (L)

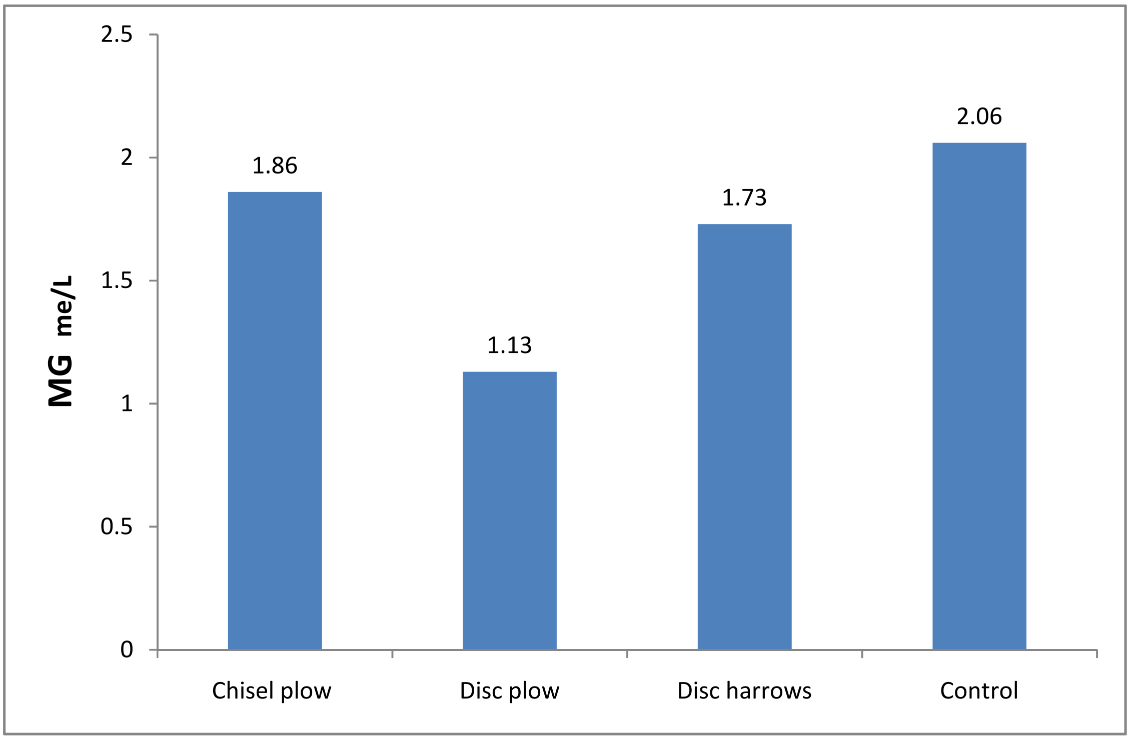

Fig 4.4 Soil Mg

Appendix (M)

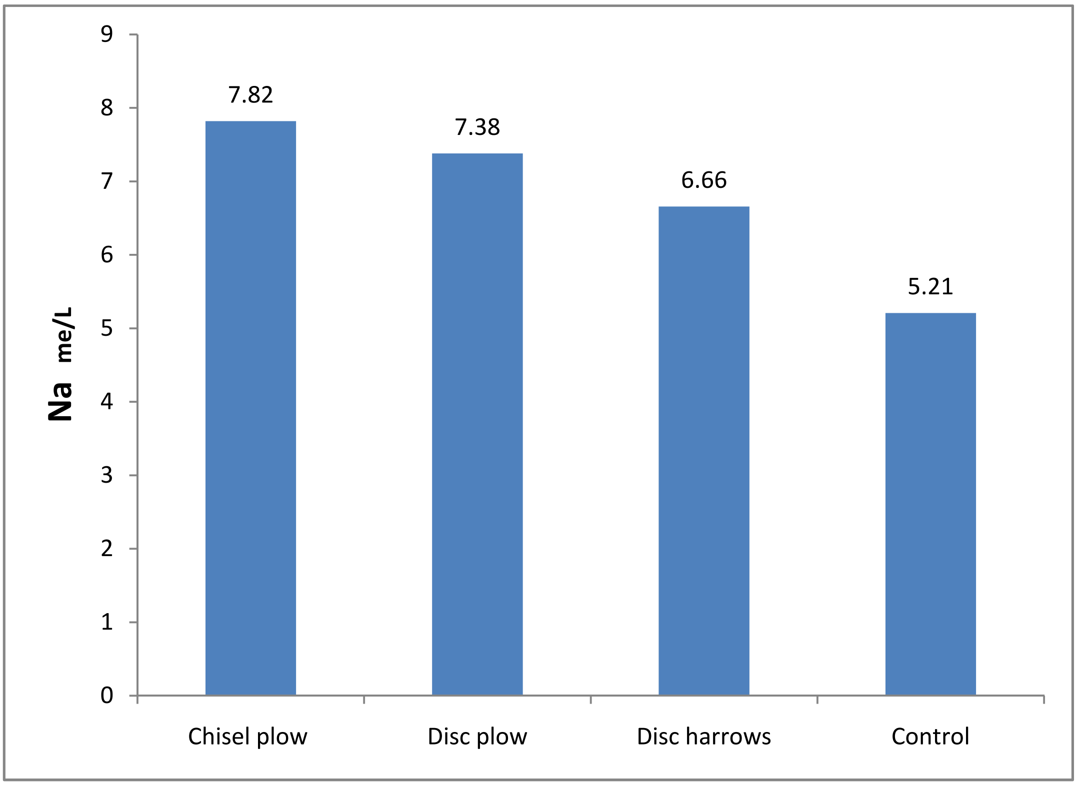

Fig 4.5 Soil Na

Appendix (N)

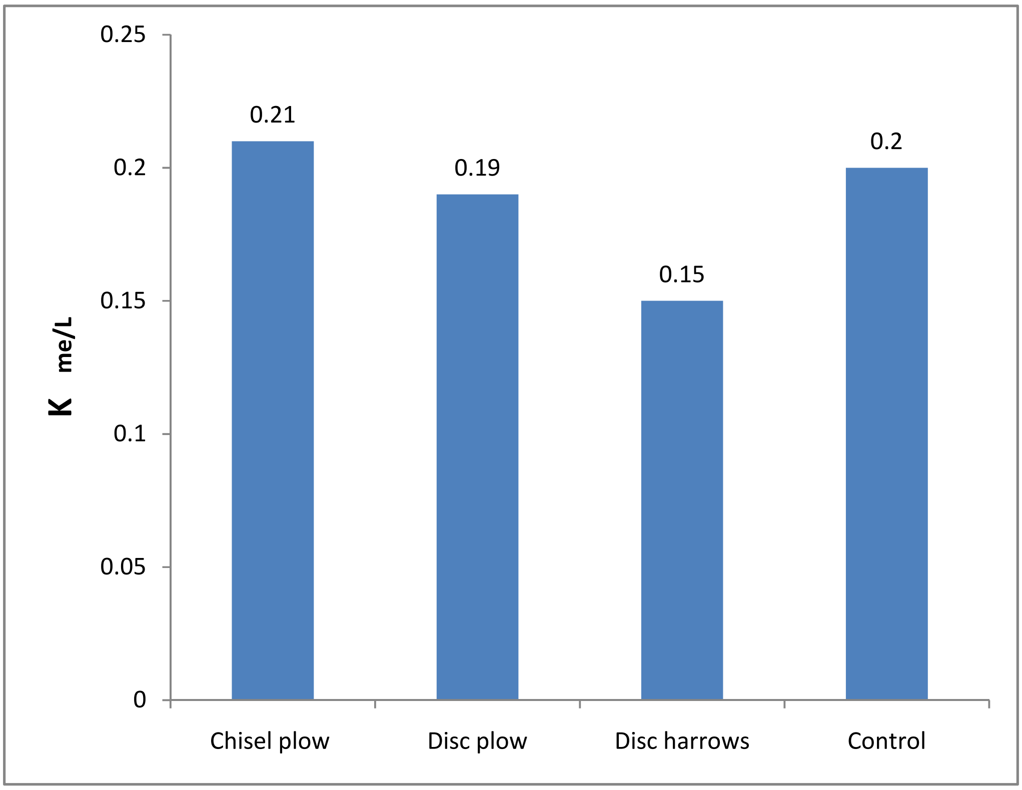

Fig 4.6 Soil K

Appendix (O)

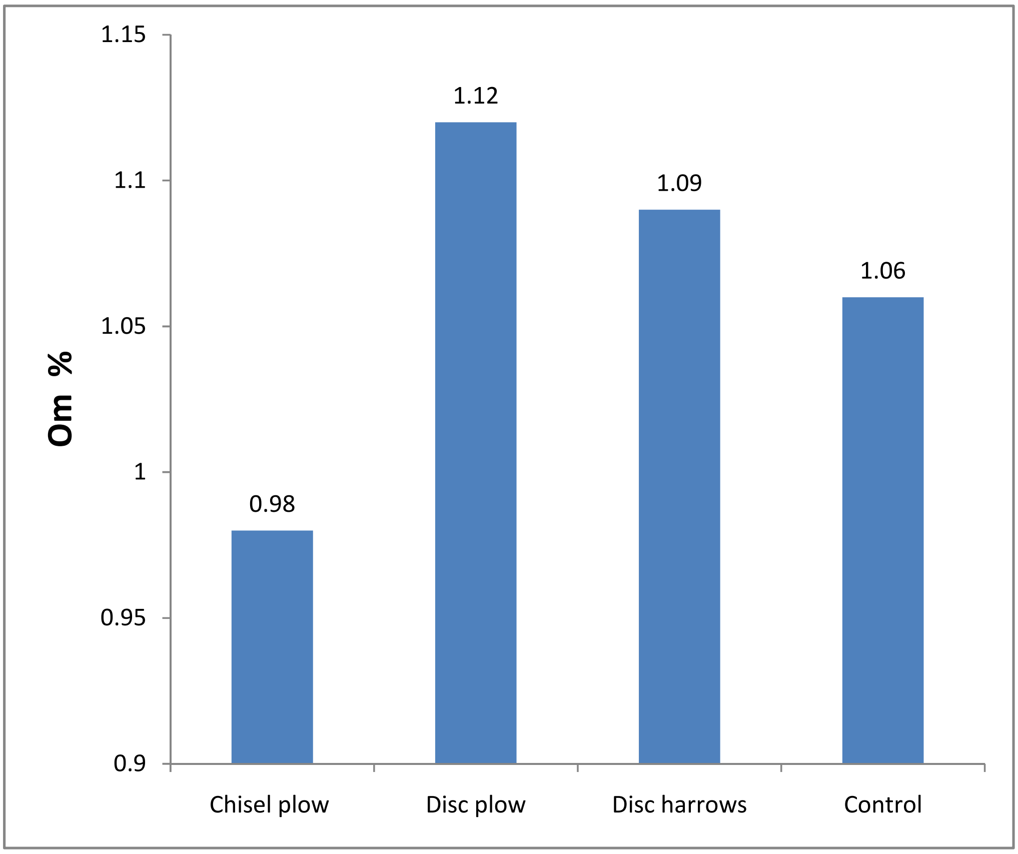

Fig 4.7 Soil OM%