

## **EFFECT OF AGRICULTURAL PRACTICES ON SOME PHYSICAL PROPERTIES OF SANDY SOIL .**

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### **ABSTRACT**

Some Physical and Chemical properties of sandy soil for defferent periods of cultivation were determined. The study include a non-cultivated, 1-year, 3-years, 6-years, of used to test for this influence such as hydraulic conductivity , water content , bulk density , and mean weight diameter . hydraulic conductivity and water content significantly increased from 0.20-0.42 cm.min-1 and from 19.80%-25.24% respectively as a result of 6 years of cultivation . Bulk density decreased from 1.61 mg.m-3 to 1.36 mg.m-3 for the first debth ( 0-15 ) cm of non-cultivated and 6 – years of cultivation, respectively. organic matter and electrical conductivity increased from 0.18% to 0.39% and from 2.0 ds . m-1 to 13.0 ds . m-1 for the non-cultivated and 6 years of cultivation, respectively Cumulative infiltration was also affected by the agricultural practices . kostiakov equation was used to describe the infiltration data .

### **INTRODUCTION**

physical properties for a particular soil condition do not remain stable during plant development (Trowse , 1971) . Johnson et al. (1942) pointed out that the size distribution of soil aggregates has been influenced by the cropping system . Jamison (1953) and Salter and Williams (1963) reported that soil structure is an important factor influencing the quantity of water held at low suction because the large pores are affected more by structural changes than are the smaller pores . There was a significant increase in aggregate stability as the number of previous crop cycles increased as reported by yaacob and Blair (1979) .

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They found also 26% increase in mean aggregate stability occurred over 3 years legume cropping period . similar results were reported by

Stoneman (1973) on a sandy soil from western Australia. The initial rate of water infiltration into the soil profile governed by structural stability of top soil and its organic matter (Othman and Blair , 1981) . Fahad et al . (1982) studied the effect of cropping sequences on some physical properties . they indicated that cropping sequences influenced cumulative infiltration, aggregate stability and water retention . Nedawi and Abdul Ressel 1988 reported that bulk density was reduced and hydraulic conductivity .water holding capacity and plant Dry matter were significantly increased. This study was done to determine the effect of agricultural practices on some physical properties of sandy soil as well as the effect of the period of practices on the physical properties . This type of study was not done before in the southern part of Iraq and particularly in sandy soils .

## MATERIALS AND METHODS

Soil samples were taken from Burjesiah Research Station near Zubair region, Basrah . The soil is a loamy sand (Hyper thermic ,Typic torripsamment ,calcareous, Mixed ) . Different crops were grown in the area including tomato, cucumber , onion, garlic and alfalfa . Five samples were collected from each location and for two depths of 0-15 cm and 15 – 30 cm . Samples were mixed to get a representative sample for each depth and location . Four different treatment were studied which are non-cultivated, cultivated for one year , cultivated for 3 years , and cultivated for 6 years . There was no crop rotation reported in the area . The field was received about four ton/ha of animal manure each year before growing season . moldboard plowing was used in spring before growing season each year up to 30 cm depth. Crop residues were mixed in soil. Trickle irrigation system was used with water quality of 10 ds/m. soil samples were air-dried and passed through 2mm screen for analysis. Soil physical and chemical analysis were determined for all hydraulic conductivity ( $K_{sa}$ ) according to Klute ( 1965 ) method and water infiltration by using glass tube of 4 cm in diameter and 40 cm length after packing the soil to desired bulk density which was similar to that in the field . Four replications were used for each measurement . Soil moisture content at field capacity was determined by saturated core samples of soil and covered for 24 hours and oven dried at 105 C .

Bulk density was determined by using core samples of soil and oven dried at 105 C . Soil aggregate stability was computed by wet sieving according to Yoder ( 1936 ) . Mean weight diameter was used as a parameter according to Youker and McGuinness ( 1957 ) . Kostiakov( 1932 ) equation was fitted the data in the form of  $I = a t^c$  where I is the cumulative infiltration ( cm of water ) , a is a constant , t is the time( min ) and C is a constant between zero and one . Electrical conductivity were determined according to Jackson ( 1958 ) . Organic matter content was determined according to Black ( 1965 ) . Duncan,s new multable range test (DNMRT) was used to explain the results (Steel and Torrie,1960 ) .

## RESULTS AND DISCUSSION

The bulk density , hydraulic conductivity , water content , soil separates and mean weight diameter (MWD) for two depths are shown in Table 1 . Bulk density(Mg . m<sup>-3</sup>) decreased significantly from 1.61 Mg. m<sup>-3</sup> for the non cultivated soil to 1.36 Mg.m<sup>-3</sup> for the 6-years of cultivation in the ( 0-15 ) cm depth and there was a little change in the depth (15-30) cm As the period of agricultural activities increased . The soil structure was improved as a result of increasing organic matter content which reduced the value of bulk density (Stoneman , 1973 ; Yaacob and Blair , 1981 ) .

Saturated hydraulic conductivity and soil water content at field capacity increased significantly as cultivation period increased . Hydraulic conductivity in the top soil increased from 0.20 to 0.42 cm /min as a result of 6 years of cultivation while a little Increase has beed shown in the depth of ( 15 – 30 ) cm. water content at field capacity for the first depth (0-15) cm increased from 19.80% to 25.24% and a little increase happened at the second depth (15-30) cm , because most of the agricultural practices were happened in the first depth of soil . These results are in agreement with the find of Nedawi and Abdul Ressel ( 1988 ) . Mean weight diameter for the ( 0-15 ) cm depth increased from 0.09 mm to 0.20 mm as a result of 6 years of cultivation and increasing of organic matter.

The changes in some chemical properties of soil was shown in Table 2 . organic matter increased significantly from 0.18% to 0.39% in the top soil and from 0.13% to 0.25% in the ( 15-30 )cm depth after 6 years of cultivations .

Electrical conductivity was changed from 2.0 ds/m to 13.0 ds/m in the ( 0-15 ) cm depth and from 5.2 to 38.0 ds/m in the ( 15-30 ) cm depth after 6 years of cultivation. Increase in salt accumulation in the cultivated soils is due to irrigation system and water quality . water of 10 ds/m was used with drip irrigation system. Most of the salt was leached to the second depth and accumulated their which increased the quantity of salt at ( 15-30 ) cm depth  $\text{CaCO}_3$  increased about 39% in the top soil and 50% in the depth of ( 15-30 ) cm as a result of 6 years of agricultural practices . Increase  $\text{CaCO}_3$  was through irrigation water quality which content high amount of ca ions . There was no significant change in soil PH.

Cumulative infiltration as a function of time was shown in Figure 1 . Soil of 6-years of cultivation has higher cumulative infiltration than the non-cultivated soil . Improvement of soil aggregation due to increasing in organic matter and crop residues increased macro-pores and consequently increased water infiltration (Jamsion , 1953 ; Salter and Williams , 1963 and Nedawi and Abdul Ressul ,1988 ). Kostakov equation was used to fit the data .

**Table 1 . Some physical properties of used soils**

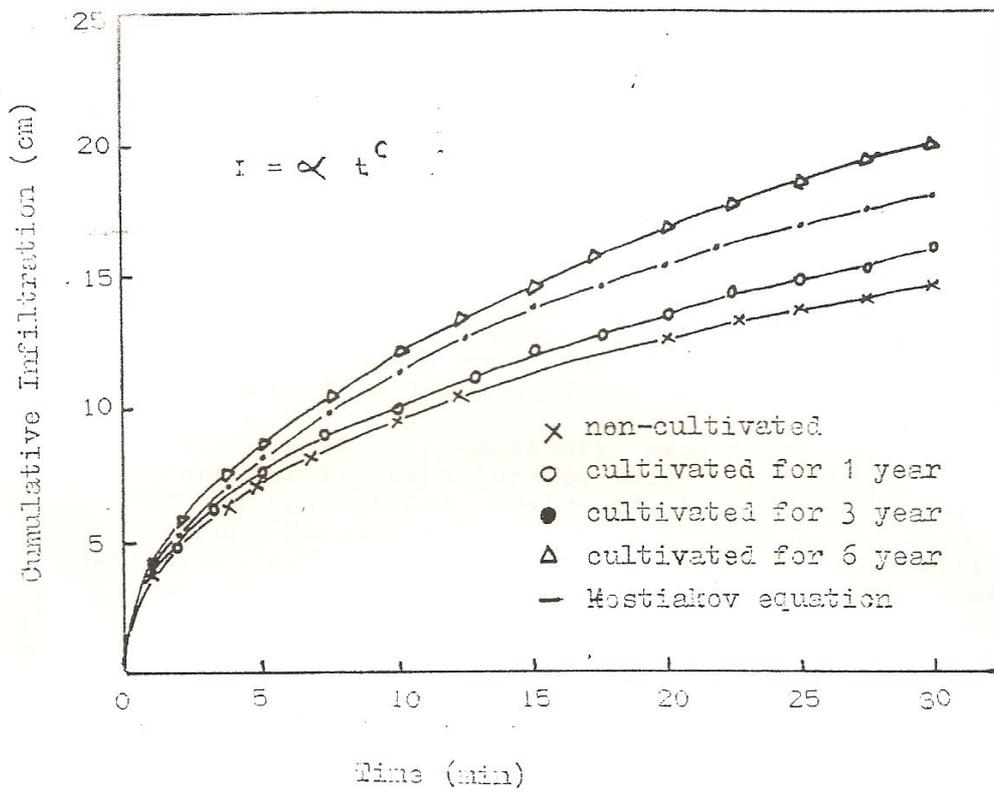
Soil Clay Treatment	Soil Depth (cm)	Soil Bluk density Mg.m <sup>-3</sup>	Hydraulic conductivity Cm.min <sup>-1</sup>	Water content at F.C %	MWD (mm)	Sand	Silt %
<b>Non- cultivated 5.20 soil 5.78</b>	<b>0-15</b>	<b>1.61d</b>	<b>0.20a</b>	<b>19.80b</b>	<b>0.09b</b>	<b>88.15</b>	<b>6.82</b>
	<b>15-30</b>	<b>1.65d</b>	<b>0.19a</b>	<b>18.68a</b>	<b>0.04a</b>	<b>86.80</b>	<b>7.04</b>
<b>cultivated 5.73 for 1 year 8.21</b>	<b>0-15</b>	<b>1.51b</b>	<b>0.25b</b>	<b>22.50d</b>	<b>0.12c</b>	<b>87.90</b>	<b>6.35</b>
	<b>15.30</b>	<b>1.60cd</b>	<b>0.20a</b>	<b>19.87b</b>	<b>0.06a</b>	<b>84.55</b>	<b>7.25</b>
<b>cultivated 7.32 for 3 year 8.80</b>	<b>0-15</b>	<b>1.40a</b>	<b>0.37c</b>	<b>22.94d</b>	<b>0.17d</b>	<b>87.15</b>	<b>5.52</b>
	<b>15-30</b>	<b>1.64d</b>	<b>0.18a</b>	<b>20.21b</b>	<b>0.09b</b>	<b>84.45</b>	<b>6.72</b>
<b>cultivated 7.55 for 6 year 10.88</b>	<b>0-15</b>	<b>1.36 a</b>	<b>0.42d</b>	<b>25.24e</b>	<b>0.20e</b>	<b>89.30</b>	<b>4.45</b>
	<b>15-30</b>	<b>1.55bc</b>	<b>0.23b</b>	<b>21.15c</b>	<b>0.13c</b>	<b>82.20</b>	<b>7.22</b>

means having different letters are significantly different at 0.01 level.

**Table 2 .** *Some chemical properties of used soils .*

Soil Treatment	Soil Depth cm	PH 1:2.5	CaCo3 %	EC ds /m	Organic matter %
non-cultivated	0 – 15	7.9	10.12 a	2.0 a	0.18 c
Soil	15 – 30	7.8	12.09b	5.2 c	0.13a
Cultivated for	0 – 15	8.2	12.52 b	3.6 b	0.29e
1 year	15 -30	7.6	14.02d	12.8 e	0.16bc
Cultivated for	0 – 15	7.9	13.50 c	8.0 d	0.34 f
3 years	15 – 30	7.4	14.80 e	16.4 f	0.23 d
Cultivated for	0 – 15	7.9	14.10 d	13.0 e	0.39 g
6 years	15 – 30	7.7	18.09 f	38.0 g	0.25 d

Means having different letters are significantly different at 0.01 level .



**Figure 1.** *The relationship between infiltration and time.*

In general ,We conclude from this study that cultivation practices in sandy soil may improve some physical properties of soil due to improvement of soil aggregation and organic matter. Farther study need to be done in sandy soil including crop sequences ,different amount of crop residues and water application and their effect on soil physical ,chemical ,and biological properties.

**REFERENCES**

- Black, C. A., D. D. Evans and J.L. White .1965 .Methods of soil analysis . Part 1. Agronomy No. 9 P:210-221 .
- Fahad , A . A . , L.N. Mielke ,A.D. Flowerday and D. Swartzendruber . 1982 . Soil physical properties as affected By soybean and other cropping sequences . soil Sci . Soc .Am.J., 46:377 – 381 .
- Jackson , M . L . 1958 . Soil Chemical analysis . prentice – Hall . Inc .
- Jamison , V . C . 1953 . Change in air-water relationship due to structural Improvement of soils . Soil Sci . , 76 : 143 – 151 .
- Johnson , J . R . G.M. Browning and M.B. Russel .1942 .  
The effect of Cropping practices on aggregation , Organic matter content and Loss of soil and water in the Marshall silt loam . Soil Sci. Soc . Am . Proc . , 7 : 105 – 107 .
- Klute , A . 1965. Laboratory measurement of hydraulic conductivity of Saturated soil . In Black , C . A . ( eds ) " Method of soil analysis " Am . Soc . Agron . Monograph 9 . P : 210 – 221 ,
- Kostiakov , A . N . 1932 . On the dynamic of the coefficient of water Percolation in soils and the necessity for studing it from a dynamic Point of view A . Purposes of amelioration . P . 17 – 21 , 6<sup>th</sup> Part A. Trans . Comm Int Soil Sci . Soc . Moscow .
- Nedawi , D . R . and I.A.Abdul Ressel . 1988. Effect of Organic residues on Some hydraulic Properties of Dirasat (Agricultural Science) 15 : 108 – 126 .

- Othman , Y . and G.J. Blair 1981. Effect of Legume cropping And Organic matter accumulation on the Granite Soil under a Simulated Tropical environment . Plant and Soil . 6 : 11 – 20 .
- Salter, P . J . and J.B. Williams 1963 . The effect of Farmyard manure on the moisture Characteristics of Sandy loam Soil . J . Soil Sci . , 14: 74-81.
- Stoneman , T . C . 1973. Soil Structure Change under Wheat belt farming system . J . Agric . West Aust . , 14 : 3 – 8 .
- Trouse , A . C . 1971. Soil conditions as they affected Plant establishment , root development and yield . In Compaction of Aricultural Soils ( Barnes K . K . ) Am . Soc . Agric . Eng . , St . Joseph Mich . P : 253 – 276
- Yaacob , O . and G.J. Blair 1979 . Effect of legume species and cropping intensity on the nitrogens status of a granite Soil under a simulated tropical environment . Plant and Soil , 52 : 85 – 97 .
- Yaacb , O . and G.J. Blair. Mineralization of N labelled lequme residues in Soils with different nitrogen contents and its uptake by Rhodes grass . Plant and Soil , 57 : 237 – 248 .
- Yoder , R.E. 1936 . A direct method of aggregate analysis of Soils and a study of physical nature of erosion losses. J. Am. Soc Agron. , 28: 337-351.

