THE SCRUTINY OF SOME SOIL DEGRADATION INDICATORS IN DRY FARMING AND GULLY LAND IN GHALEHGORG, SHOUSHTAR, IRAN

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Abstract-Iran's being located in the arid and semi-arid belt of the world as well as the occurrence of droughts and devastating floods on the one hand, and population increase and efforts to sustain food security on the other, have contributed in turning soil degradation into a major problem in the country. Land use change and the consequent land desertification combined with population increase would inevitably eternalize problems such as poverty and deprivation. Due to the significance of this subject, focused study of certain soil degradation indicators in two cases of Dry farming and Gully land was put on the agenda. Some experts believe parameters related to physical properties of soil including apparent soil bulk density and porosity, as well as chemical parameters, fertility, and organic matter play a role in soil degradation. The obtained results showed that as compared with ditches, agricultural land possessed higher amounts of organic carbon, and no significant difference was observed between agricultural and Gully land in terms of apparent soil bulk density or porosity.

Keywords: Land use change, Organic matter, Porosity, Soil bulk density.

INTRODUCTION

Hazy skies, muddy waters flowing in vast expanding fields, and fever-stricken deserts, all convey the same message: The imminent death of soil. Civilizations began with soil fertility and sustainability, and could end with soil degradation and erosion (Jafari and Tavili, 2009). Population increase as well as higher living standards leads to a growing demand for food, clothing, and housing. As the mainstream resources for food and clothing requirements, soil resources have a prominent place in the economy and food security of all the nations in the world.

Soil degradation resulting from such factors as improper use of agricultural land, land use change, rapid population growth, land utilizers' poor scientific/technical background, etc, has in turn lead to degradation of ecosystem followed by adverse changes in the physical and chemical properties of soil. The term "soil degradation" is defined as deterioration of soil quality resulting from improper use of soil by man. Soil degradation is the potential or actual loss of soil fertility. The two main types of soil degradation are:

Natural soil degradation due to action of soil-generating factors, Degradation as a result of human activity and Land-use change is classified in the latter category.

According to Zhao (2005), Gully land is defined as a canal with steep sloping sides and a sloped active erosion face resulting from erosion caused by alternate surface flows (usually during or after heavy rainfall).

METHODS AND MATTER

The Studied Area

The Ghalehgorg region forms a part of the great Shushtar Shahid Modarres catchment area covering an area of 56,327 ha. The geographical coordinates of this catchment area are longitude 316536-331131 east and latitude 3510331-3518672 north. The highest and lowest altitudes in the region are 570 and 35 meters from sea level respectively. The Ghalehgorg area comprises of two regions: a mountainous region consisting of hills and valleys, and a relatively flat area. Slope of land is greater than 30 percent in approximately 2%, 20-30 percent in 4.2%, and less than 8% in 84 percent of the area.
This study was conducted on that part of land with a natural potential for being utilized as pasture. Parts of this land was turned into dry farm land. At the downstream of agricultural lands, ditches have been formed which have consequently turned into badland in some parts.

Sampling and Analysis

Ten random soil samples (each sample weighing approx. 2 kg) were extracted from a depth of 0-30 cm from the natural pasture and dry farming lands. The samples were then air-dried, beaten, and sifted through the mesh 10 (2 mm diameter). Subsequently, in observance of expert recommendations in the field, we had the samples transferred to Maroun Khaksabz Laboratory in Behbahan, Khuzestan Province, so that certain characteristic parameters, i.e., apparent bulk density, porosity, and organic content of the soil samples could be measured prior to evaluating the status quo of soil degradation.

Statistical Analysis

Upon data gathering and recording in the Excel software environment, the SPSS was implemented for statistical analysis and running the independent t-test (5%). Accordingly, the mean iterations were derived for each characteristic corresponding to each land use and the results were subsequently compared based on the probability level of 5%.

Results and Discussion

The results shows the soil porosity variations resulting from changing land use from pasture to dry farming. Due to the relation that exists between apparent bulk density and porosity of soil, the above reasons are true for this index as well. In a report comparing the effects of cultivation on physical properties of soil, Gholami (2010) report that the conversion of pastures into agricultural land has reduced soil porosity from 57 to circa 45 percent. He cited the greatest reason for this as destruction/filling of large pores by the debris resulting from soil fragmentation.

Table 1: Comparison of the Mean Soil Degradation Indicators for Different Types of Land Use in Region

Mean Index			Land Use
Organic Matters (%)	Porosity (%)	Apparent Bulk Density ($gr.cm^{-3}$)	
0.23^{a}	0.39^{a}	1.60^{a}*	Rain-Fed/Dry Farming
0.097^{b}	0.04^{a}	1.49^{a}	Gully land land

In each column, the figures designated with a similar letter of alphabet (a or b) did not show a statistically significant difference after t-testing at 5% probability. According to Table 1, there is no significant difference statistically between the values of apparent soil bulk density in different land uses. Hajabbassi et al. (2007) showed that soil structure disturbance as a result of tillage had decreased the organic content of the soil, leading to an increase in the apparent soil bulk density due to elimination of organic matter as well as fragmentation of soil aggregates resulting from tillage. The smaller particles from crushed soil fill out the pores in the soil, causing an initial decrease in the density of the plow layer. However, the density of this layer would later increase due to impact of raindrops as well as compression of soil with machinery. The 20-year activities for the purpose of turning pasture land into agricultural land have led to a 25% increase in the apparent bulk density of soil. Overall, tillage initially led to a reduction in the apparent soil bulk density, but as time passed, this reduced density was counterbalanced and at times soil density even increased to values greater than the initial values. The reason for this is soil fragmentation and consequent filling of larger soil pores with smaller particles/fragments (Azarabin et al., 2003).

According to table 1, more organic carbon was observed in agricultural land compared with Gully land. These results are similar to those obtained by Gholami (2010) who argued that change of land use from pasture to agricultural increased organic matter in soil, whereas in abandoned dry-farmed land, it reduced such matter. Further results showed that organic material increase more in dry farming as compared with irrigated farming. In another study conducted in Javanmardi Pain east of Lordegan, Hajabbassi (2002) obtained similar results and stated that whenever there are low levels of organic material in virgin soil, any action on the soil is equivalent to cultivation. In the course of similar research, Hajabbassi and Besalatpour (2007) concluded that minimum tillage or cultivation management, or no tillage at all would lead to preservation of organic carbon in soil. Zhao (2005) also reported that plant residues on surface soil are dramatically affected by the type of tillage implemented, and that no-tillage methods would increase the amount of these matter in soil.

CONCLUSION

Due to cultivation of agricultural land in the studied region, the soil organic carbon content has increased. No significant difference was observed between the apparent soil density in dry farmed and Gully land. The reason is attributed to the long duration of land cultivation. Overall, tillage would initially reduce apparent soil density, but restores it to its previous level as time goes by, at times even increasing it to values greater than the original ones. The reason for this is soil fragmentation as a result of which tiny soil particles fill out large pores (Zhao et al., 2005). No significant difference was obtained for soil porosity either. The same reasons mentioned for density also hold for porosity due to the relation that exists between soil porosity and soil density. Due to the particular soil and environmental, as well as ethnical conditions in the studied region, and in spite of the fact that ditches are highly abundant in the area, and have even turned into badland in certain places, no critical conditions were observed for certain soil degradation indexes, so that no hindrance was deemed to be necessary in the present study regarding cultivation through dry farming and tillage for obtaining minimum amounts of wheat and oat.

It is suggested that this study be extended to include soil quality, fertility, as well as degradation in this region, along with controlling physical and chemical properties as well as soil mineralogy in longer term. In this way, soil erosion and degradation can be eliminated through correct management.

REFERENCES

[1] ***Azarabin M., Jalalian A., Karimianeghbal M., 2003,*** *"An Investigation into the Effect of Land Use Change on certain Soil Characteristics in Kouhrang Reion,*

Charmahal-o Bakhtiari Province", Proceedings of the 8th Congress on Iran Soil Sciences, Rasht, pp. 884-5.

[2] ***Gholami A., 2010,*** *"A 40-Year Study into Land-Use Change and its Effects on Physical, Chemical, and Mineralogical Properties of Soil", Ph.D. Thesis in Agrology, Islamic Azad University Research Center, Tehran.*

[3] ***Hajabbassi M., 2002,*** *"A Case Study into certain Physical Characteristics, Fertility, and Soil Cultivation Index in Boroujen", Journal of Agriculture and Naturall Resources, Vol. 6, No. 1, pp. 149-161.*

[4] ***Hajabbassi M., Besalatpour A., 2007,*** *"Effect of Land Use Change on Soil Characteristics on Soil in South/Southeastern Regions of Isfahan", Journal of Agriculture and Naturall Resources, No. 42, pp. 525-534.*

[5] ***Jafari M., Tavili A., 2009,*** *"Soil and Land Degradation", Tehran University Publications in 294 pp.*

- ***Zhao, 2005,*** *Effect of Desertification on Soil and Crop Growth properties in Horqin sandy cropland of Inner Mongolia, North China. Soil and tillage. Vol 87.175-185.*
- ***Zhao, W.Z., H.L. Xiao, Z.M. Liu and J. Li. 2005****. Soil Degradation and Restoration as affected by Land Use Change in the Semiarid Bashang Area, northern China. Catena, 59: 173-186.*

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