THE STUDY OF HUMUS CHANGES IN SURFACE AND SUB-SURFACE LAYERS OF DESERTIFIED LANDS IN KHODABANDEH, IRAN

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Abstract

Soil organic matters are considered as the animal and plant residues and active components of soils. The cultivation practices will cause the quick removal of organic matters in soils even in those which are not affected by erosion. This study was carried out to assess the level of soil humus in the pilot area, to investigate the positive or negative effect of humus level on soil and to introduce the most appropriate farming systemThe area is 12409 hectare located on the eastern north of Khodabandeh city. In order to identify land uses, aerial photos and topographical maps were used and supported by field surveys. Four stages were followed in Khodabandeh in order to investigate on humus status in the regions. The results were compared using MSTAT statistical soft wares. In order to compare treatments, Duncan test was applied.

The results obtained from the studying surface and sub-surface layers of the area show that rangelands which have not been disturbed by anthropogenic activities are classified between irrigated and drylands. It can be said that the irrigated farming, especially alfalfa farming, enhances soil humus content due to nitrogen fixation done in the roots. But, the drylands especially those with high slope cause degradation of soil organic matters, fertility and production yield and also increase soil erodability.

Key words: *Iran, humus, desertified lands, Khodabandeh*

Introduction

Soil organic matters are considered as the animal and plant residues and active components of soils (Franzluebberes, 2002). The organic matter constitutes nitrogen and provides a part of soil phosphorus and sulfate. It protects soil against erosion and enhances water and air movement in the soil (Jafari, 2000).

Reapplication of crop residues to soil provides stability and improves soil structure. The organic matters play pivotal role in soils and provide nutrients necessary for plants. Thus, any research on these matters is of important concern (Malakouti and Homaee, 1994). The cultivation practices will cause the quick removal of organic matters in soils even in those which are not affected by erosion (Biederback et

al, 1994). In 1870, some researchers studied the vegetation status in a research field. They removed vegetation cover for a certain period and observed that the amount of organic matters declined from %4.2 to %1.4 during this 100 years (Broadbent, 1957).

The provision and improvement of soil organic matter of a cultivated soil is usually expensive and difficult. Thus, retaining the organic matter level more than the necessary level in order to yield a favorite production is not advised (Kayyand and Bygaart, 2002). On the other hand, a limited, not huge, amount of organic matter must be added to the soil (Zarinkafsh, 1992). In agricultural systems, it should care not to be encountered to the shortage of organic matter in soil and therefore, the recognition of soil organic matters in arable lands is inevitable (Malakooti & Hamedanian, 1991).

This study was carried out to assess the level of soil humus in the pilot area, to investigate the positive or negative effect of humus level on soil and to introduce the most appropriate farming system.

Materials and Methods

The studied area

The studied basin is a part of Khorroad river basin which leads to salty lake. The area is 12409 hectare located on the eastern north of Khodabandeh city. The maximum and minimum attitude of the region is 2035 and 1760 m, respectively. The annual mean temperature is 9.49 centigrade degree. The mean temperature of warmest (August) and the coldest (February) month is 22.67 and -3.29 centigrade degree, respectively. The annual precipitation, based on 34-year statistics, reaches to 336.72 mm.

Topographically, the studied area is located on the highland plains and upper terraces in which soils are categorized as Inceptisol including six soil series. The most part of the region slope is as 1-5% covering 65.01% of the whole area and slopes over 12% are seen rarely.

Geologically, the studied area is considered as a small part of Kavand-Dotapeh of the fourth geological Era. Regarding to the vegetation status, some plant species such as *Astragalus, Acantholimon* and *Festuca* are prominent. Moreover, other plant species such as *Huthemia persica, Cartannus oxycanta, Euphorbia* etc can be found.

In order to identify land uses, aerial photos and topographical maps were used and supported by field surveys. Four land use types including arable lands, orchards, rangelands and villages were identified. The most area is allocated for arable lands, especially dry farming lands, which is irrigated by the annual precipitation (Amiri, 2003).

Research method

In order to investigate on humus status in the regions, four stages were followed in Khodabandeh:

1. Preparation and gathering information and existing data. Both soil layers (0-30 and 30-60 Cm depths) were assessed to study changes. The randomized complete block design was used in this research. In each

block, five treatments were considered as follows:

- Dry lands with slope more than 8%
- Dry lands with slope less than 8%
- Irrigated mono-cropping lands
- Irrigated multi-cropping lands
- Barren lands

2. Field survey. In this stage, soil samples were harvested. Samples points were displayed on topographic map using ArcInfo and Idrisi soft wares.

3. Laboratory tests. In order to identify soil organic matters, 60 soil samples were tested. Then, the amount of organic matters was determined using following formula:

percentage of dry organic matter = organic Carbon * 1.72

4. Analysis. The results were compared using MSTAT statistical soft wares. In order to compare treatments, Duncan test was applied.

Results and Discussion

A) Identifying normalization of data:

The mentioned parameter was computed in both soil layers after soil sampling and tests. As mentioned before, MSTAT was used to assess normalization of data. The normalization test was done using Skewness coefficient. The results showed the symmetry pattern and normalization of data. The surface soils of the studied area had low to medium humus level.

B) Surface soil

The most important parameter which affects soil fertility is organic matter. It is necessary for soil stability and structure as a colloid. It also provides nutrients for plants. Hence, this parameter was analyzed and F value was computed as 9.5202. The assessment of F table shows that the value for treatment number 4 at 1% is 4.43. Since the computed F value is higher than F table, so there are significant differences among treatments at probability 99% (Table 1).

Table 1: The ANOVA for humus content in soil surface layer

Probability	Computed F value	Mean squares	Sum of squares	df	Error sources
	0.6702	0.086	0.428	5	block
0.0002	9.5202	1.217	4.868	4	Treatment
		0.128	2.557	20	Error
			7.854	29	Total

The investigation on humus content in soil sub-surface layer showed that the humus had the same condition. In order to prove this matter, the amount of humus content in soil sub-surface layer was determined. The results showed that the computed F value in this layer was 5.5426 which was more than F table value at probability 99% (Table 2).

Table 2: The ANOVA for humus content in soil sub-surface layer

Probability	Computed F value	Mean squares	Sum of squares	df	Error sources
	2.1688	0.197	0.987	5	block
0.0036	5.5426	0.504	2.017	4	Treatment
		0.091	1.82	20	Error
			4.824	29	Total

The Comparison of mean of treatments using Duncan test

In this stage, the means of treatments which had significant difference, were compared to each other. The results are as follows:

Surface layer

Based on ANOVA results, it was cleared that there are significant differences among treatments at probability 99%. However, the mean of data related to humus in different treatments was calculated by Duncan test.

The value of error and the least significant ranges (LSR) were 0.1468 and 0.5877, respectively. The differences among treatments were compared to LSR. The treatments with differences more than LSR value, have been illustrated with symbols (Table 3).

Table 3: The values of means of humus for different treatments of surface layer

Row	Treatment	Mean	symbols
1	Irrigated mono-cropping lands	1.831	A
2	Barren lands	1.669	AB
3	Irrigated multi-cropping lands	1.296	ABC
4	Drylands with low slope	1.101	BC
5	Drylands with high slope	0.7039	C

Conclusion

The results obtained from the studying surface and sub-surface layers of the area show that rangelands which have not been disturbed by anthropogenic activities are classified between irrigated and drylands. It can be said that the irrigated farming, especially alfalfa farming, enhances soil humus content due to nitrogen fixation done in the roots. But, the drylands especially those with high slope cause degradation of soil organic matters, fertility and production yield and also increase soil erodability.

Therefore, it is suggested to pay more attention to the soil surface of barren lands in order to prevent land degradation and retain soil structure.

On the other hand, the organic matter situation of surface layer in barren lands is such that they have no vegetation cover and so, they are classified as the worst amongst the other treatments.

It is clear that cultivation has positive effect on humus content in soil sub-surface layer and may increase soil fertility and protect soil against erosion.

Finally, it is concluded that cultivation not only doesn't lead to the depletion of soil organic matter but also improves its content.

In soil surface layer of drylands, green manures and crop residues can be applied.

References

1. Amiri B (2003). The study of agricultural effects on land degradation. MSc dissertation, faculty of Natural resources, University of Tehran.

2. Basiri A (1998). Statistical designs in agriculture. Shiraz University Publication.

3. Jafari M (2000). Salty soils in natural resources. University of Tehran Press.

4. Koochaki E and A Alizadeh (1989). The principles of agronomy in arid lands. Astan Ghods Razavi Publication.

5. Mahmoodi S and M Hakimian (1984). The fundamentals of pedology. University of Tehran Press.

6. Malakooti M J and M Homaee (1994). The fertilization of soils in arid lands. University of Tarbiat Moddarres Publication.

7. Malakooti M J and S A Riazi Hamedani (1991). The fertilizers and soil fertilization. Markaz Nashr Publication.