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Studying the Sensibility of Soil Particulate Organic Matters in Response to Changes of Prangos Uloptera DC Stands in Mountain Rangelands

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ABSTRACT

In evaluating of affecting the kind of Prangos uloptra on components of soil particulate organic matters and spreading of aggregates, mountain range lands were selected as Khangah- Sorkh of Urmia. Soil samples from 0-15 cm and 15-3 0 cm depth was analyzed. So, two adjacent places with Prangos Uloptra stands dominance were detected and in each place 4 key land were identified and soil samples were collected. Particulate organic matter C (POM-C) and (POM-N), macro and micro aggregates were analyzed. Variance analyze results had shown that all of the analyzed factors were increased in the effect of increasing attendant diversity with Prangos uloptra stands in the second sampling place expect for macro-aggregates percentages. (POM-C), (POM-N), C with macro-aggregates and micro-aggregates were affected significantly by high plant diversity with Prangos uloptra stands that were signed in the second sampling place. These results accented the early appearance of managing changes in the components of N and unstable C and augmented the sensibility of soil particulate aggregates in response to plant managing changes of covering. Accordingly, having the information based on time changes of soil particulate aggregates components and spreading of aggregates are useful for managing process of range lands ecosystems.

Keywords: aggregates, Prangos uloptra DC, particulate organic matter, rangeland ecosystem

INTRODUCTION

Prangos uloptra DC is from the Apiaceae family. The side hill spread of this kind of plant is about 1420-2200 m height and it has hemicriptophyt biological shape and is from multi-year gramineous plants. From the Prangos, there are 15 kinds of permanent plant in Iran which are frequently introduced as one of the most valuable feed, protective, medic, and industrial plants [1]. Native knowledge is putting this plant in the class of the best range lands plant in Iran, in that grin and rancher are aware of its quality changes. In Zagros Mountains, they are impeding the sheep from eating this plant in the first time of germination, but according to this knowledge, the dried form is the best plant for grin.

Prangos is one of the valuable kinds of trophics, especially with ambulant protein, this feature made it to be highly utilized in the handle nutrition. It is worthy to remember that the separation of its crown diagonal is reaches beyond one meter thus its huge leaves growing rapidly, so that it reduces the destruction effects of spring rain shower and impede the soil erosion [2]. The daily attention of ranchers toward this plant and excessive removal cause disorder in regeneration and destruction of its settlement. In order to protect of this crucial kind of plant and permanent utilization of it, it is necessary to know and perceive the connection of environmental settlement of this plant and heed the ecology aspects. Since the quality of soil is indicative of its statue and is different dependent on goal and need so we should investigate these indexes of soil that can show the work of plant and its type of

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management in those conditions. In addition it can tell the overall statue of soil system. In this relation we can infer features such as, organic matter C, percent of primitive ingredients, the overall amount of N, accessible water, electronic leadership, ph, fiber and soil structure and stable aggregates.

The soil Organic matter is consists of two humus parts and Labile amalgamation. The described stores of aggregate organic in this section are: Particulate Organic matter (POM), microbial accumulation biologic C, soluble C, mineral C and decoction C with various juicers [3], the farm studies has shown that management cause changes in aggregates organic condition. This change identified in labile stores faster than in organic C or total N [4]. For this, the soil C stores as a sensitive index are offered for observing the changes process in soil organic matter [5], particulate ingredient matters is part of organic matter that from the aspect of analysis amount is mediocre leftover of fresh plants and aggregates are as the temporal cache of organic matters. Although this part specialized trifle amount of soil however because of having the small return time and rich from any nutritional or C components is one of the most important soil quality indexes [3]. This research has shown that the relation of this part of organic matter with the mineral components is very little, so they are analyzed faster than organic matter that is related with mineral components [6]. So using this index for studying the effect of treatment and various sequences on soil quality indexes will be more appropriate [7].

We can separate the particular organic matter in 2 parts of soil: 1) light fraction (LF) and 2) sand size fraction (SSF). In total part with sand organic matter amount it consists of 20-45% from organic C and 13-40%from total soil N [8]. Until now, there have been little researches around the effect of Prangos Uloptra on importance of this kind from the aspect of medical, instrumental, gramineous this research has been done with the focus on studying the use of atomic matters and components as sensory factors to management for the assessing the effect of various systems of management on the features of soil.

MATERIALS AND METHODS

Sampling Procedures

In this research Khangah-sorkh range lands basin with the area about 2000 hectares is located with the geographical condition of eastern length 44057′4″ to 45o00′32″ and north width of 37o50′42″ to 37o46′18″ at the altitudinal range of 1400-2400 meters from the sea level which was chosen as the area of research in western Azerbaijan. The highest height is 1483 from the sea level. According to rainfall and temperature gradian, the average of annual rainfall and temperature of the studied zone was calculated consequently 393.9 mm and 9.87o. The continent of the studied zone with the use of Amberje technique consists of arid and semi stark area. Geology composers are sedimentary and belong to the Paleozoic to Cenozoic era. In this ways the composers of Jurassic and newgen era are the most composers of the geology of this zone. The soil fiber of the zone contained little changes; averagely the soil fiber is loamy, argil, and sandy. The soil structure is grainy and the apparent density is low [9].

Two adjacent places with dominance of Prangos Uloptra but different in attendant stands are found in the zone. Each sampling place contains different attendant stands. The percentage of the crown covering of the first sampling place was 61% and for second sampling place was 57% and slope was about 15-20%.

Sampling and examine of soil factors

The accidental-systematic technique was used for studying the variable plant coverings. Hereby, in each key places, 4 transect with the length of 100m and across each one, 10 plat of 1cm square (based on the spread of transmittance pattern of plant) were placed. In each plat it was placed the plant covering feature and the humus percent. Soil samples were removed from the depth of 0-15 and 15-30cm cross with the maximum growth of dominant stands. Also in each sampling place there were 100 M2 in regard to extant of the sampling places which were the same in topography and soil fiber and each of places 4 samples of soil from any depth were collected. Samples were dried in open air for 7 days. After breaking the clogs, removing roots, stone and other impurities, were milled and passed from 2m screen diameters [10]. For evaluating numerical diversity index, the expertise software Ecological Methodology, version 6/0 was used and Shanon winner Simpson was calculated.

Organic C was determined by the Walky black [11].

Particular organic matter was determined by physical fraction. Twenty-five grams of air-dried soil was dispersed with 100mL of 5g L-1of sodium hexametaphosphate. The soil solution mixture was shaken for 1 h at high speed on end-to-end shaker and poured over a 0.053 mm sieve with several deionized water rinses. The soil remaining on the sieve was back washed into a pre-weighed aluminum dish then dried at 60oC for 24 h, ground and analyzed for C and N [12]. Data was subjected to the analysis of variance (ANOVA) at the 5% of level of significance and done with the use of SPSS software version19.

RESULTS

Table 1. Physical fractionation of soil organic matter for C under tall fescue stands. POM-C is particulate organic

Fields	Total soil C(g kg-1)	POM-C(g kg-1)	Plant Diversity Index
Depth 0-15 cm			
Prangos uloptera1	0.36b	0.03b	0.06±1.958
Prangos uloptera2	0.95a	0.29a	0.05±1.987
Depth 15-30 cm			
Prangos uloptera1	0.36b	0.07b	
Prangos uloptera2	0.64a	0.15a	

The difference between two places was not significant, total C in second sampling place was more than first place but there was a significant effect of sampling depth on the total C at both stands ($p<0.05$). While sampling depth has not significant effect on the amount of soil C in the sampling places. Results of **Table 1** has shown that increasing the diversity plant stands with Prangos Uloptra stands caused 62% increase in total soil C in 0-15 cm depth and increase in available C in 15-30 depth. POM in second sampling place in comparison with 43% first sampling place had more amount, this amount in first depth was 89% in second place was 53% these amounts in the same position were more than those of first place.

Latin words in specified amounts, is not result in significant if they be common and is significant in specified amounts if they be uncommon. 1In this place (first sampling place) the stands attendant index includes (stipa barbata, astragalus microcephalus, and Artemisia aucheri) and 2in this place (second sampling place) the stands attendant index includes (Acanthophyllum microcephalum, Poa bulbosa, and Astragalus microcephalus).

Table 2. Physical fractionation of soil organic matter for N under Prangos uloptera stands. POM-N indicates particulate organic matter N

Fields	Total N(g kg-1)	POM-N(g kg-1)	Plant Diversity Index
Depth 0-15 cm			
Prangos uloptera1	0.04b	0.01b	0.06±1.958
Prangos uloptera2	0.12a	0.04a	0.05±1.987
Depth 15-30 cm			
Prangos uloptera1	0.04b	0.011b	
Prangos uloptera2	0.10a	0.016a	

N and POM-N has shown positive reaction towards increasing of plant diversity attendant with Prangos Uloptra stands. As increasing diversity stands in second sampling place cause 66% increase in the first depth and 60% increase in second depth. Results of **Table 2** has shown that POM-N in first depth in second sampling place had 75% increase and in second depth 31%increase.although there was significant difference in 2 different depth in sampling places, but there was no significant difference between 2 depth of first sampling place of N and POM-N in first and second place.

Latin words in specified amounts, is not result in significant if they be common and is significant in specified amounts if they be uncommon. 1In this place (first sampling place) the stands attendant index includes (stipa barbata, astragalus microcephalus, and Artemisia aucheri) and 2in this place (second sampling place) the stands attendant index includes (Acanthophyllum microcephalum, Poa bulbosa, and Astragalus microcephalus).

Physical Analysis of aggregates has shown that macro aggregate in first sampling place had more amount than second place and micro aggregates had more amounts and among sampling places were observed significant difference of macro-micro aggregates. It seems that in regard to high crown covering percent in first sampling place, macro aggregates with crown percent were in direct connection and micro-macro with high diversity attendant Prangos Uloptra stands were in the same way (**Table 3**).

Table 3. Aggregate size distribution under Prangos uloptera stands

Fields	Macroaggregates of total soil (%)	Microaggregates of total soil (%)	Plant Diversity Index
Depth 0-15 cm			
Prangos uloptera1	42.24a	13.70b	0.06±1.958
Prangos uloptera2	24.59b	34.17a	0.05±1.987
Depth 15-30 cm			
Prangos uloptera1	53.65a	9.37b	
Prangos uloptera2	17.20b	32.86a	

Latin words in specified amounts, is not result in significant if they be common and is significant in specified amounts if they be uncommon. 1In this place (first sampling place) the stands attendant index includes (stipa barbata, astragalus microcephalus, and Artemisia aucheri) and 2in this place (second sampling place) the stands attendant index includes (Acanthophyllum microcephalum, Poa bulbosa, and Astragalus microcephalus).

Percent of available C in macro aggregates in any depth in the second sampling place was more than first sampling place, while available C within micro aggregates had the same rate but with difference in 15-30cm depth there was no significant difference between two places, while in the other cases it was reported that there were significant difference of C with macro-micro aggregates, available C in macro aggregates in first depth had 77% increased in second place and had 44% increased in available C within macro aggregates which had the 15-30 depth of second sampling place (**Table 4**).

Table 4. Soil C fractions associated with aggregate size under Prangos uloptera stands

Fields	C in Macroaggregates (%)	C in Microaggregates (%)	Plant Diversity Index
Depth 0-15 cm			
Prangos uloptera1	0.26b	0.86b	0.06±1.958
Prangos uloptera2	1.13a	1.54a	0.05±1.987
Depth 15-30 cm			
Prangos uloptera1	0.26b	9.37b	
Prangos uloptera2	0.50a	1.10a	

Latin words in specified amounts, is not result in significant if they be common and is significant in specified amounts if they be uncommon. 1In this place (first sampling place) the stands attendant index includes (stipa barbata, astragalus microcephalus, and Artemisia aucheri) and 2in this place (second sampling place) the stands attendant index includes (Acanthophyllum microcephalum, Poa bulbosa, and Astragalus microcephalus).

DISCUSSION

Other studies have shown that different grass species and varieties can change N accumulation in soil, probably due to variations in plant morphology and biomass [13]. The presence of attendant stands specially Lequminosae, in second sampling place Prangos Uloptra seems become proof of high N amount in the place. Addition of N significantly increased the amount of total N of second soil depth. Probably it is because of attendant stands (specially Lequminosae) [14].

Many studies have suggested that land management practices may have wide-ranging impacts on soil C. soil C may also be affected by climate, soil texture, nutrient statues and time since the land management was initiated [16] (Franzlubbers & Arshad, 1997).

Labile fraction of SOMs is important, because they are a part of nutrient cycling [17]. Particulate organic matter C (POM-C and N (POM-N) have suggested as labile fractions of SOM and as indicates of impacts from management practices (e.g, Tillage, crop rotation, vegetation, fertilization) on soil [18,19]. The ranges of POM-C and POM-N values were 1.92 to 4.02g kg-1 and 0.28 to 0.96g kg-1, respectively. These values are in the ranges as reported by Gupta et al. [20] (POM-C: 2.8 to 5.10 g kg-1, POM-N: 0.13 to 0.29 g kg-1) and Franzluebbers et al. [15] (POM-C: 3 to12 g kg-1). But lower than that observed by Koutika et al. [21] (POM-C: 15 to 22 g kg-1) and higher than that reported by Oedraogo et al. [22] (POM-N: 0.11 to 0.27 g kg-1). In both fields, about 9 to 19% of total organic C and 32 to 48% of total organic N was comprised of particulate organic matter. These values are considered low compared to the results from Feller et al. [23] in West African sandy soil (47-51%). Garwood et al. [24] found that particulate organic matter under various grasses accounted for about 10% of the total soil organic C and this variation was related to root biomass. Under long-term pastures in the Southern Piedmont USA, organic accumulation was partitioned 57% into particulate organic C [25]. It has been suggested that the POM fraction is preferentially lost when grasslands or forests are cultivated but increased when cropped soils are converted to grasslands [12]. It is important to note that the increase of POM can transitory; therefore, the tall fescue poly stands should be maintained for a long period to increase the slow and passive pools of SOM. This result is supported by many works that have found sensivity of the proportion of POM in SOM to soil management practices [19,26,27].

Generally, the composition of particulate organic matter consists mainly of root fragments [12,24]. Thus, different levels of POM-C and POM-N between two fields in this study would suggest differences in root biomass were a major factor in soil aggregation [28]. According to Handayani et al. [29], root turnover improves POM content in soil even with low aboveground biomass amounts. Introducing legumes in tall fescue stands likely promotes more decomposition and root regeneration due to additional N, which may increases root contributions to particulate organic matter [30]. It is likely that in tall fescue poly stands, plant organic inputs are higher because plant density and root biomass are higher on those sites. Earlier studies have shown that mixed and weeds produced 3 to 5 times more biomass than mono vegetation (grass only or trees only), mainly because below-ground biomass inputs are higher [14].

High stands diversity of second sampling place caused significant difference among sampling places; however micro aggregates has shown direct relation towards increasing plant diversity with Prangos Uloptra stands.

In this study, significant difference of macro aggregates with micro aggregates in searching types maybe due to affect of macro roots and dense of lequminosae and other attendant stands in soil system that enfolds soil ingredients like a trap and increase permanent aggregates in water. Probably in this study, the second place stands had little strong roots than the first place, so that it cause decrease in macro aggregates. The reduction of macro-aggregates in soils under cropping systems has been early documented by previous works [31]. Long-term cultivation decreased the length and mass of fine roots and SOM resulting in a reduction of macro-aggregates.

Tisdall and Oades [31] observed that after few years, grassland provide more roots, hypha and soil organic matter and caused an increase in macro aggregation. Data driven from this study has shown that available C in micro aggregates being influenced under the Prangos Uloptra stands. Data shows that C in micro-aggregates [32]. Carbon associated with macro-aggregates increased with more grasses and legumes in the tall fescue stands, but the proportion of small aggregates decreased. Tisdall and Oades [31] found that organic matter content associated with 0.02 to 0.25mm size aggregates was considerably less than that of aggregates greater than 0.25mm in soil from a wide array of cropping histories, including native grasslands. Previous studies indicate that roots and hypha may be responsible for building macro-aggregates together [31] (Oades, 1984). Organic C is important in controlling soil stabilization [32,33]. Dormaar [34] reported that organic matter associated with macro-aggregates is more readily mineralized than organic matter associated with micro-aggregates. Thus, the C in macro-aggregates is more likely to be labile and less processed than C associated with micro-aggregates [31].

Previous studies indicated that the increase of total organic matter following three years of forage establishment indicates better soil structure because organic matter is likely to be humified binding agents for soil aggregation [13,29,33,35]. In addition, long-term forages reduce the susceptibility of aggregates to slaking [13]. Results from earlier study [29] indicated that the higher macro-aggregates, the faster the rate of soil structural movement.

CONCLUSION

The results show that physical components and soil POM obviously the changes derived from Prangos Uloptra stands on quality and quantity of POM. Stands diversity of second sampling place, Prangos Uloptra cause significant increase of N, C, POM, micro aggregates percent of available C in macro aggregates. Thus, available C in micro aggregates has shown more reaction to the changes of attendant plant diversity with Prangos Uloptra than C in macro aggregates.

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