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Research Paper

The relation between the soil organic matter content and grassland quality in Çoruh Valley (Bayburt) natural grasslands

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Abstract: This study was conducted to determine the relationship between grassland quality and soil organic matter content, OMC in natural grasslands of Demirözü and Aydıntepe Districts of Bayburt Province in Çoruh River Valley of Türkiye in 2003. Vegetation studies were performed in 40 zones using modified loop method. As a result, 8 key species were determined for the natural grasslands of this valley. In determination of the key species, Integrated System for Plant Dynamics (ISPD) software package was used. Subsequently, grassland quality degrees and condition classes were determined through Resource and Enviromental Data Interpretation System (REDIS) package software. Grasslands condition classes were dealth with in 4 classes, i.e. poor, medium, good and very good. Soil samples were collected from 0-20 cm depth in each of grassland zones studied to determine OMC of the grassland soils. Study results revealed that 20%, 52% and 28% of the grasslands studied were poor, medium and good quality respectively. OMC of the grassland soils, on the other hand, varied between 0,72% and 11,3%. In general, majority of the soils fell within medium and good classes regarding OMC. Correlation analysis suggested that there was a positive and significant relationship between grassland quality and OMC (R2=0,51). It means the higher the OMC the higher the grassland quality.

Keywords: soil organic matter, Çoruh Valley, natural grasslands

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Introduction

Rangelands are very important wealth components for the nations since they constitute one of the largest renewable natural resources and genetic material. Permanent ranges and pastures constitute around 26.5% of total surface area of Türkiye in which 7 distinctive climatic zones prevail. Because of over and early grazing, rangelands have severely been degraded. A number of studies report that Turkish rangelands were mainly in poor and moderate class, and degradation was too severe at lower altitudes as range quality increases with higher elevations (Koç 1995). According to Herbel & Pieper (1991), more than a life time is needed for the recovery of original vegetation in degraded rangelands in secondary succession in arid and semi-arid regions. Regarding erosion, threshold level goes up when the surface cover drops below 30%, (Marshall 1973). Studies on alfalfa crop rotation (Ekwue 1992; Franzluebbers 2001) showed that the higher the soil cover the less the soil erosion rates.

Surface cover in Turkish rangelands varies from 10 to 35%, but in general it is below 20% (Koç 1995). There is a worldwide tendency to heavy grazing above the carrying capacity of rangelands. Overgrazing destroys the most palatable and useful species in the biomass and reduces the density of the plant cover, in turn, increases the erosion threat and reduces the nutritive value and the carrying capacity of the rangelands (Anonymous 2005).

On the other hand, soil organic matter (OM) is the material produced originally by living organisms (plant or animal) which returns to the soil and goes through the decomposition process (Anonymous 2005). Many soil properties have an effect on soil quality, but OM deserves special attention. Because OM enhances water and nutrient holding capacity and improves soil structure, soil carbon management can enhance productivity and environmental quality, and can reduce the severity and costs of natural disasters, such as drought, flood, and diseases. In addition, higher OM levels can reduce atmospheric CO2 which causes climate changes (Anonymous 2003). OM provides soil to function well. It affects soil structure (aggregation), drainage, aeration (gas exchange properties), water holding capacity (WHC), pH, compaction and overall plant growth (Koenig 2003).

So, it was aimed to determine the relationship between grassland quality and soil organic matter content in order to provide information so as to enlighten the future rangeland improvement and management studies.

MATERIAL AND METHOD

Study Area

Study was conducted in Bayburt Province, Türkiye in 2004. It is located between 40o 37ı N & 40 o 45ı N; 39o 52ı S & 39o37ıW. Of all study area 27% is arable, 2% is meadow, 3% is forest, 49% is pasture and rangelend and 19% is rocky and steppe. Soil samples were collected from 40 pastoral soils. Soil Sub-samples were taken from randomly selected locations in the field. The sub-samples were thoroughly mixed to obtain a representative sample.

Soil Sampling

Samples were taken from about 20 cm or effective rooting depth. Visible dung and urine patches were excluded from samples. They were air-dried at room temperature for three days. Smith-Weldon Method was employed in determination of OM.

Vegetation Studies

Based on the species, plant cover area, frequency, botanic composition and quality degree were determined in the study. All major features of the species were collected as long as possible ie. fruit and/or flower. Species unable to be identified were recorded to the nearest possible family or genera for a subsequent identification by botanists after field work. The species found in the field were noted on forms with site codes.

Key species were determined through Integrated System for Plant Dynamics (ISPD) as Resource and Environmental Data Interpretation System (REDIS) has been used to determine Grassland Quality Degrees (GQD). Correlation and regression analyses were employed for determination of OM content and GQD relationship using JUMP 5.0.1 statistical software package.

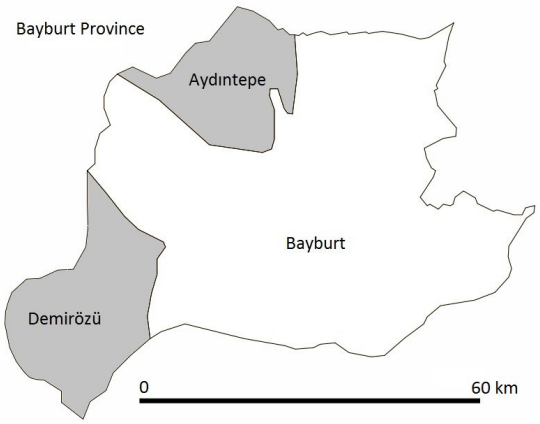

Figure 1. Study area

RESULTS AND DISCUSSION

Eighth key species (bareground, thorny astragalus species, artemisia species, Festuca ovina, thymus species, palatable legumes, palatable grasses and shrub species) were determined for the study area (Figure 2).

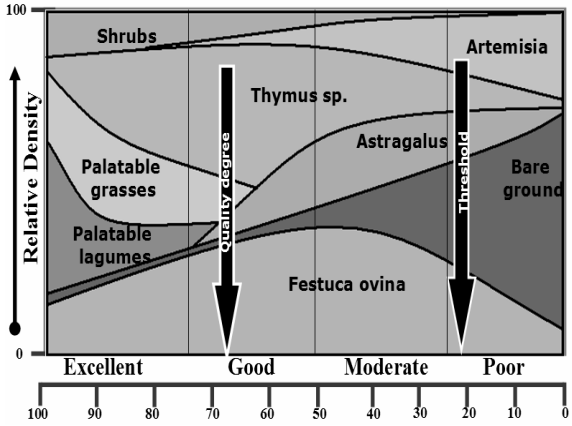

Figure 2. GQD determination model

It was revealed that 28%, 52% and 20% of the studied zones were in good, moderate and poor condition respectively (Table 1). None of the parts of the rangelands was in very good condition in the study area.

Table 1. Grassland quality classes

Grasland Quality Classes					
	Poor	Moderate	Good	Very Good	Total
Number	8	21	11	-	40
Percentage	20	52	28	-	100

In general, soil OM contents fall between medium and high condition classes in this study as it varied from 0.72% to 11.2% (Figure 3).

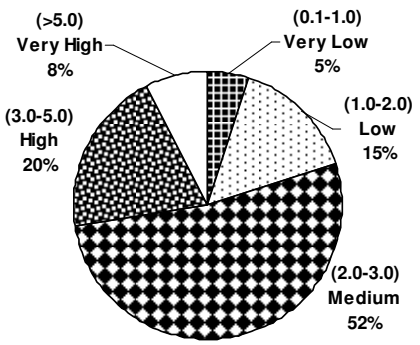

Figure 3. Organic matter content and soil sample classes

Statistical analysis of the data showed that there was a positive and quadratic relationship (R2=0,67) between OM content and GQD (Figure 4). This quadratic relationship implies that an increase in OM content of grassland soil to a degree positively contribute to the grassland quality with higher plant cover and percentage of palatable species in botanical composition since OM retains plant nutrients and prevents them from leaching to deeper soil layers (FAO 2005) by gluing soil particles together and ensuring favorable living conditions for soil organisms.

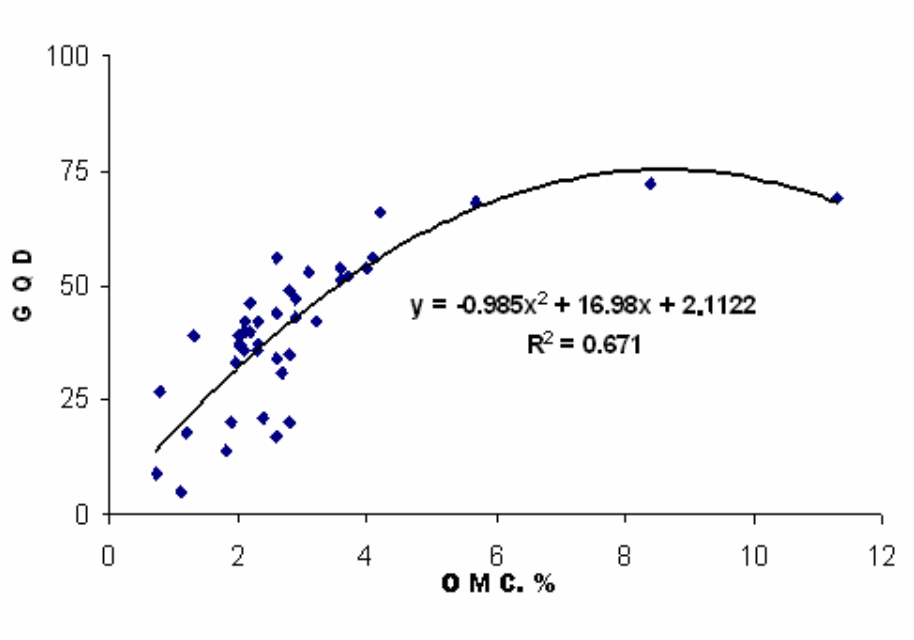

Figure 4. Regression curve and equation for GQD and OMC relationship

In this paper mineralization of organic matter was not investigated but it is a general opinion that OM increases soil fertility (Bell et al. 1998; Wolf & Snyder 2003) through its improving physical features of soil and decomposition providing utilizable nutrients to the plants.

Organic matter usually increases the WHC of the soil (Mapa & De Silva 1994). According to Hudson (1994) 1% of increase in OM content enhances WHC by 3.7 percent. This is of great importance for the areas having less precipitation with respect to sustainable feed supply for the animals throughout the grazing period.

CONCLUSION

Study revealed that OM content was of great importance for natural grasslands. OM positively affects the chemical and physical properties of the soil and its overall health. According to the results it can be concluded that the higher the OM content the higher the grassland quality.

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