Comparison of several properties between the soils under the natural grassland and the abandoned field in the Kherlen river basin, Mongolia

Aki Hoshino, Kenji Tamura, Maki Asano, Teruo Higashi
Graduate School of Life and Environmental Sciences, University of Tsukuba
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Introduction

In Kherlen Bayan Ulan (KBU), Mongolia, large areas had be already cultivated since 1960s, but most of these areas were abandoned in the 1990s. There are abandoned field of half-million hectare in Mongolia. *Chenopodium* spp. are dominated in these abandoned fields. On the other hand, several grasses (*Stipa*, *Krylovii*, *Care*x sp) are dominated in the natural grassland. The objective of this study was to survey effect of abandonment of cultivation on the physico-chemical properties of soil.

Materials and Method

1) Study sites

Study sites were the abandoned field(AF)and the natural grassland(NG)at KBU (47 ° 28'N, long. 108 ° 78'E) in north eastern Mongolia.

AF Feed crop were produced from 1962, then wheat were produced with irrigation from 1982 and abandoned in 1992.

NG Common natural grassland in Mongolia.

2) Field investigation

The survey on the vegetation and soil profiles were carried out as a field survey. The vegetation survey was done by quadrat method of 1m×1m. Five quadrates were set up each sites.

3) Soil sampling

Soils of each horizon were sampled for chemical analysis. Undisturbed core soils were sampled by cylindrical core (100ml) sampler for physical measurement.

4) Soil physico-chemical analysis

Three phase ratio and saturated hydraulic conductivity were determined by the core method. Particle size distribution was determined by the pipette method. Soil pH was determined by a glass electrode method. Soil EC was determined with a EC meter. Organic carbon contents and total nitrogen contents of soils were determined by dry combustion method using NC-analyzer. CEC was determined by schollenberger method. Exchangeable and water-soluble bases ware determined by atomic absorption method. Water-soluble anion was determined by ion chromatography.

Results

1) Results of field investigation

Table1. Results of vegetation survey

AF plant cover ratio: 60%

species	E-SDR$_2$
Chenopodium aristatum L.	100
Cleistogenes squarrosa (Trin.) Keng	42
Carex sp	28
Potentilla bifurca	25
Salsola collina Pall.	19

NG plant cover ratio: 70%

species	E-SDR$_2$
Stipa krylovii Roshev.	53
Carex sp	51
Cleistogenes squarrosa (Trin.) Keng	50
Allium polyrhizum	32
Haplophyllum dauricum (L.) G. Donf.	28
Salsola collina Pall.	18
Artemisia adamsii Bess.	16
Caragana stenophylla	16
Potentilla bifurca	15
Scorzonera austriaca	14
Convolvulus ammannii	13
Chenopodium aristatum L.	10
Artemisia frigida Willd.	8
Lappula redowskii (Horn.) Greene	6
non-identifable	6

(E-SDR$_2$: Extended Summed Dominance Ratio)

Soil profile and texture

Horizon (cm) (soil texture)

AF A: 0-13(SL), AB: 13-24(SL), Bw1: 24-38(SL), Bw2: 38-57(SL), Bw3: 57-80(SL), Ck: 80-100$^+$(L)

NG A: 0-11(SL), AB: 11-28(SL), Bw: 28-43(SL), C1: 43-73(S), C2: 73$^+$ (LS)

2) Results of soil physico-chemical analysis

Solid ratio of AF was 8% higher than NG in each A horizon. Macropore / capillary pore of NG was 1.8 times higher than AF in each A horizon (Fig. 1).

Saturated hydraulic conductivity of NG was 2.6 times higher than AF in each A horizon (Fig 2).

It was seemed that macropore was destruction by compression of a tractor, and the value of hydraulic conductivity and gas phase value decreased. Total carbon and CEC were decreased by cultivation and crop harvest.

pH values of NG and AF were 6.5 and 7.7 in each A horizon, respectively (Fig 3). There were not clearly differences about water-soluble cation in AF and NG. PO_4^{3-} of water-soluble anion was existence only in A and AB horizons of AF. It suggested that fertilizer was applicated in AF. Generally, cultivation with irrigation occur salinization of surface soil, but base saturation percentage of soil was low in AF. A horizon's CEC of AF and NG were 8.4 and 10.1cmol(+)kg^{-1},respectively. A horizon's total carbon of AF and NG were 10.8 and 13.6 gkg^{-1}, respectively.

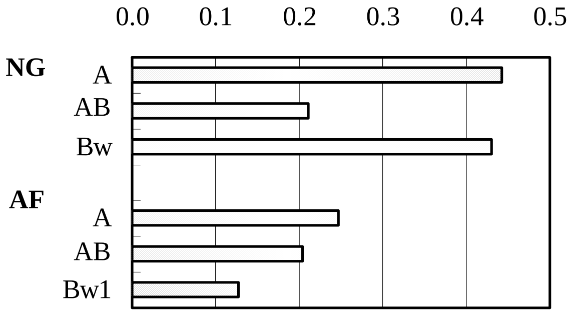

Fig1. Macropore/capillary pore ratio of soil core sample.

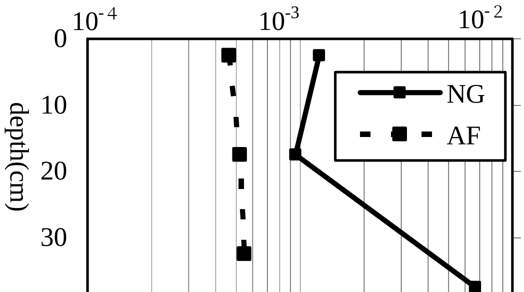

Fig2. Saturated hydraulic conductivity of soil core samples

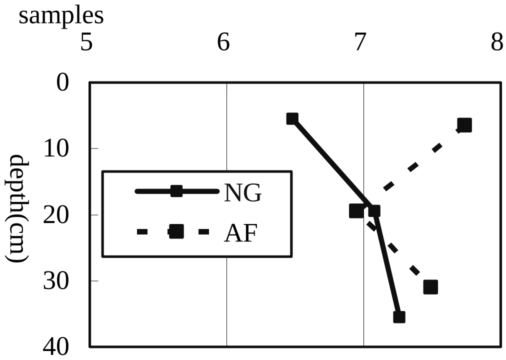

Fig3. pH(H_2O) of soil samples

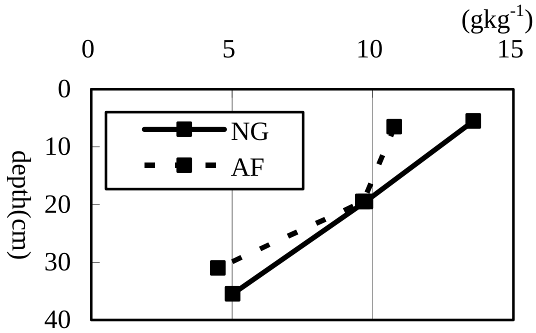

Fig4. Total carbon contents of soil samples

Conclusion

Macropores and permeability were relatively decreased by the destruction of soil structure caused by the cultivation on surface soil. pH values at AF site were higher than those at NG site. Total carbon contents were decreased in the surface soil at AF site. Thus, it seemed that soil structure was affected by the cultivation and its abandonment.

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