Tables

Table S 1: Assignment of soil types according to IUSS Working Group WRB (2014) to groups and soil types, respectively, used in the present study.

Group / Soil type	Plot	Soil type according to IUSS Working Group WRB (2014)
Kastanozem	I	Calcic Kastanozem (Loamic)
	II	Haplic Kastanozem (Arenic, Loamic)
	III	Haplic Kastanozem (Arenic, Loamic)
Non-sodic Solonchak	IV	Mollic Solonchak (Loamic)
	V	Mollic Solonchak (Loamic)
	VI	Mollic Solonchak (Alcalic, Loamic)
	VII	Haplic Solonchak (Alcalic, Loamic)
Sodic Solonchak	VIII	Gleyic Sodic Solonchak (Alcalic, Loamic)
	IX	Sodic Solonchak (Alcalic, Loamic, Humic)
	X	Sodic Solonchak (Alcalic, Loamic, Humic)

Table S 2: Organic carbon (OC), total nitrogen (TN), and C : N ratio of OM as function of soil type and horizon. Given are arithmetic means and the standard error of the mean in parentheses. Abbreviation: n = sample size.

Soil type	Horizon	n	OC		TN		C : N	
			mg g^{-1}		mg g^{-1}		-	
Kastanozem	Ah	3	9.28	(0.34)	0.96	(0.03)	9.8	(0.1)
	AC	3	5.33	(0.27)	0.63	(0.03)	8.2	(0.3)
	Ck	3	2.05	(0.28)	0.30	(0.06)	8.2	(0.7)
	C	2	1.27	(0.28)	0.25	(0.05)	5.7	(1.0)
Non-sodic Solonchak	Az	4	17.38	(2.90)	1.78	(0.31)	9.8	(0.1)
	B	4	4.04	(0.62)	0.52	(0.07)	7.7	(0.2)
	C	4	1.74	(0.13)	0.29	(0.01)	6.1	(0.4)
	Cl	4	1.10	(0.18)	0.24	(0.02)	4.8	(0.6)
Sodic Solonchak	Az	3	24.53	(2.34)	2.53	(0.24)	9.7	(0.2)
	ACz	3	11.07	(2.77)	1.10	(0.29)	10.0	(0.1)
	C	2	3.46	(1.04)	0.40	(0.10)	8.8	(0.4)
	Cl	3	1.34	(0.36)	0.24	(0.03)	6.0	(1.0)

Figures

Figure S 1: Concentration of water-soluble anions and cations (μmol$_c$ g^{-1} soil) for three soil types as a function of soil depth. For better visualization measured data are omitted and only the local polynomial regression fits (LOESS) are shown.

Figure S 2: Percentage contribution of arabinose to the total non-cellulosic neutral sugars of three soil types, separated for plants, light fraction (LF) and heavy fraction (HF).

Figure S 3: Percentage contribution of glucose to the total non-cellulosic neutral sugars of three soil types, separated for plants, light fraction (LF) and heavy fraction (HF).

Supplement S1 – Soil mineralogical composition

Material & Methods

X-ray diffractograms of ball-milled <2-mm fractions were recorded with an X'Pert PRO MPD Θ–Θ diffractometer (PANalytical, Almelo, Netherlands) equipped with a Cu anode producing Kα radiation. The powder samples were scanned from 2° to 85° 2Θ with a step size of 0.02° 2Θ and 3 s per step. A subset of samples was evaluated at the micro-scale using a Quanta 600 FEG environmental scanning electron microscope (ESEM; FEI Company, Hillsboro, USA) with an acceleration voltage of 20 keV. As the analysis was carried out in low-vacuum mode (0.6 mbar), sputtering of the samples with gold or carbon was not necessary. The microscope was equipped with an Apollo XL EDX detector (Ametek Inc., Berwyn, USA).

Clay mineralogical analyses were carried out for one representative soil profile of each soil type. Clay fractions (<2 µm) were obtained by pre-treating the soil with acetic acid (removal of carbonates), H_2O_2 (removal of OM), and dithionite-citrate (removal of iron oxides), subsequent separation by sedimentation (Stoke's law) and final Mg^{2+} saturation to cause flocculation and thus easier handling of samples. X-ray diffraction patterns were recorded using the same system and settings as for the powder analyses of bulk soil but with Co-Kα radiation generated at 40 kV and 40 mA. Oriented mounts were prepared on porous ceramic tiles to avoid segregation of fine particles during sedimentation (Dohrmann et al., 2009) and scanned from 2° to 35° 2Θ with a step size of 0.02° 2Θ and 4 s per step. Sample quantity allowed only for two treatments for qualitative analysis: (i) Mg^{2+}, (ii) Mg^{2+} + ethylene glycol. The ethylene glycol treatment was used as it detects expandable clay minerals like smectites, which strongly affect the physical properties of sodic soils.

Results

The three soil types had a quite homogenous mineralogical composition, dominated by quartz and feldspars as well as calcite and dolomite in the carbonate-rich horizons, whereas almost all samples showed small quantities of amphibole and muscovite (Figure S4). In the Solonchaks also gypsum was present. Calcite and dolomite XRD peaks were very broad. This peak broadening is related to very fine crystallite sizes. The clay fraction showed small amounts of illite, kaolinite, and chlorite, while smectites were partially present in the subsoil, and in the Sodic Solonchak also in the topsoil. In the smectite-rich horizons, the quantities of smectite and illite exceeded those of chlorite and kaolinite significantly (Figure S5). In the Solonchaks, the quantities of water-soluble salts were small when related to the bulk soil. Mass balance calculations (data not shown) and analyses by ESEM–EDX (Figure S6) revealed that water-soluble salts mostly consisted of thenardite (α-Na_2SO_4) and halite (NaCl), but also bischofite ($MgCl_2 \cdot 6H_2O$) could be present.

Figure S 4: X-ray powder diffractograms of bulk soil from three profiles and respective horizons. Intensities are square root transformed for better visualization of trace mineral phases.

Figure S 5: X-ray diffractograms of clay fractions from two treatments of three soil types and four different horizons. Abbreviations: S = smectite, V = vermiculite, C = chlorite, I = illite, K = kaolinite, and Q = quartz.

Figure S 6: Scanning electron micrographs (a, c, d) and EDX spectra (b) of the fine earth fraction of Solonchaks. The two common salt minerals halite (a, b) and thenardite (c, d) are shown. In a), halite is represented by the white region embedded in gypsum crystals. In c), thenardite is the finely textured coating on the larger mineral, d) is the enlargement of c).

References

Dohrmann, R., Rüping, K. B., Kleber, M., Ufer, K. and Jahn, R.: Variation of preferred orientation in oriented clay mounts as a result of sample preparation and composition, Clays Clay Miner., 57(6), 686–694, doi:10.1346/CCMN.2009.0570602, 2009.

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