S o i l s o f
C h i r c h i k - A h a n g a r a n B a s i n

1. Soil-climatic zoning of the territory

According to the soil-climatic zoning adopted in the Republic of Uzbekistan, all its northern, northwestern and western parts of the plain are attributed to the system of latitudinal zones of the Eurasian continent that come within so called a "desert (arid) zone". The rest of the territory (mountainous and foothill-flat terrain) is attributed to the system of vertically distributed soil zones in the Tien Shan and Pamir-Alai mountains within the Turan geological province (Genusov, Gorbunov, Kimberg, 1960).

Vast territory of the Chirchik-Ahangaran Basin and a wide range of absolute heights of terrain - 220-3500m above sea level determined such specific features of the regional soil-climatic zoning as its latitudinal and vertically distributed character. Geomorphologic zoning reflects geographic distribution of soils according to relief and depending on types of soil-forming rocks. Within each zone of soil type and sub-type soil-geomorphologic areas are defined.

The current geomorphologic zoning of the Chirchik-Ahangaran Basin is defined as follows:

1. High mountains;
2. Mid-heights mountains;
3. Low mountains and folded foothills;
4. Loess-tertiary low mountains;
5. Swell-ridge loess foothills - here and there alternating with loess-tertiary foothills;
6. Flat ground (terraced) alluvial/proluvial plains;
7. Sub-mountain plains (the 4^{th} and 5^{th} terraces of the Chirchik and Ahangaran rivers);
8. The third loess terrace flat ground;
9. Alluvial plains of the Chirchik and Ahangaran rivers.

Against the general background of soil zones vertical distribution that determines their main genetic differences, quality and agro-productive properties of lands are subject to considerable changes caused by a number of natural and economic factors; among them there are the following factors: - relief of terrain; - nature of mother rock; - conditions of soil moisturing; - texture of soil; - peculiarities of salinity and erosion processes; - impacts caused by economic activities of human beings, etc.

All these factors have determined wide-range diversity of soil-formation conditions as well as genetic and agro-productive properties of lands.

The following soil types are identified on the territory of the basin:

1. Light-brown grassland-steppe soils;
2. Mountain brown soils;
3. Sierozem:
   а) dark;
   б) typical.

In addition, transient soils are identified: grassland-sierozem and sierozem-grassland soils. In terms of hydro-morphic series there are: grassland dark, grassland light, grassland-marsh and marsh soils.

Soils of the basin have been formed in various soil-climatic zones:

1. Subnival (high mountainous light-brown soils);
2. Humid-climate-formed type (mountainous brown woodland and mountainous brown soils);
3. Sub-arid (dark sierozem soils);
4. Semi-arid (typical sierozem soils).

2. Description of major genetic soils types in the basin

In what follows, description of typical soil profiles is adduced with regard to major genetic soil types, their attributes and brief characteristics of physical and chemical properties.

BROWN SOIL TYPE

Brown soil subtypes

Brown leached soils. The profile has the following morphological structure:

A – humus horizon, 50-70 cm thick, dark, brownish-gray, heavy loam or clay, cloddy or cloddy-granular, carbonate-free, heavily cut with plant roots; visible change to next horizon;

B_t – metamorphic horizon, 20-30 cm thick, bright brown, clayey, compact, nut structure; gradual change;

$BC_{(к)}$ – transient metamorphic horizon, 20-35 cm thick, heterogeneous in color, sometimes carbonate in lower part, lighter in texture than B_t and less compact; gradual change;

$C_к$ – carbonate mother rock.

Humus content in humus horizon is 4 to 8 %, gradually decreasing down the profile (the content drops to 1% at a depth of 100sm). Total nitrogen content is 0.25-0.35 %, ratio C : N = 9-11. fulvic acids prevail in humus.

pH_{H_2O} in carbonate-free horizons is 6,5-7,0, the exchange capacity is 30-40 mg-eqv per 100 g of soil in upper horizons and 22-30 mg-eqv per 100 g of soil in lower ones. Exchangeable calcium content is 85-90 % of total exchangeable cations. This type of soils is formed in more moistened areas of brown soil areal under oak or hornbeam-oak forests with nut-tree, alycha, etc.

Generous brown soils. The profile has the following morphological structure:

A – humus horizon, 25-50 cm thick, grayish-brown, heavy loam or clayey, cloddy, carbonate-free, cut with roots; visible change;

$B_{tк}$ – metamorphic horizon, about 30 cm thick, brown, clayey, cloddy-nut structure, compact, carbonate; gradual change;

$BC_к$ - metamorphic, transient to carbonate horizon, 20-35 cm thick, heterogeneous in color, heavy loam, less compact than horizon $B_{tк}$;

$C_к$ - carbonate soil-formation stratum.

Content and qualitative characteristics of humus are the same as of brown leached soils. pH_{H_2O} is 7,0-7,5 in upper horizons and about 8 in lower ones. Total exchangeable bases are 35-45 mg-eqv per 100 g of soil in upper horizons and 25-35 mg-eqv per 100 g of soil in lower ones. Exchangeable calcium percentage in the exchange capacity is the same as in brown leached soils and equals 85-90 % of total exchangeable bases.

Generous brown soils are formed in drier conditions, mainly under shallow oak forests with hawthorn, nut-tree, alycha, and sloe.

Brown carbonate soils. The profile has the following morphological structure:

$A_к$ – humus horizon, 20-35 cm thick, grayish-brown, carbonate from the surface but not deeper than 20-25 cm, heavy loam, cloddy, turfy; gradual change;

$B_{tк}$ - metamorphic horizon, 20-30 cm thick, brown, heavy loam, compact, cloddy-nut-small-lumpy structure; gradual change;

$BC_к$ – metamorphic transient horizon, about 30 cm thick, heterogeneous in color, heavy loam, carbonate; gradual change;

$C_к$ – mother rock, carbonate.

The reaction of upper soil horizons is alkaline (pH_{H_2O} is 7.5-8 and 8-8.2 in upper and lower horizons, respectively). Total exchangeable bases are 30-45 mg-eqv per 100 g of soil in upper horizons and 20-25 mg-eqv per 100 g of soil in lower ones. Relative percentage of exchangeable calcium is slightly lower than in other subtypes and equals 70-90 % of total exchangeable bases.

For brown carbonate soils, claying of metamorphic horizon $B_{тк}$ is poorer, while distribution of silt fraction throughout the profile is more uniform as compared to generous and leached soils.

This subtype of soils is formed in drier part of brown soil areal and is a transition to gray-brown sierozem or chestnut soils. Vegetation is second growth bush forests with oak, nut-tree, dogberry-tree and juniper.

SIEROZEM SOIL TYPE

Sierozem soil subtypes

Generous sierozem soils. Generous sierozem soils cover medium (in terms of elevation) belt of sierozem zone. They refer also to foothill plains, undulating foothills and low mountains within 400-1200 m above sea level. Generous sierozem soils are usually formed in loess and loess-like loam under motley grass, sedge and fowl-grass cover under influence of different types of vegetation.

Soil profile has the following morphological structure:

A_d – turf, 4-8 cm thick, compact, gray;

A_1 – humus horizon, up to 15 cm, including A_d, thick, gray or light gray, loamy or light loamy, flakey-cloddy structure, caprolits found;

AB – humus transient horizon, about 25 cm thick, light gray with visible straw-colored tint, loamy or light loamy, cloddy, porous; carbonates are found in form of mold and concretions; bored passages and cells throughout the horizon;

$B_к$ – carbonate-illuvial horizon, grayish and straw-colored, loamy, compact; carbonates in form of diffuse spots and concretions;

$C_к$ – light straw-colored, silt loam, porous, accumulation of carbonates; gypsum is found in form of small crystals at a depth of 130-200 cm.

Generous sierozem is not rich in humus; humus content is 1.5-3.5 % in upper horizons and abruptly decreases down the profile; humus composition is fulvic. Reaction is alkaline (pH_{H_2O} 8,1-8,5). The exchange capacity of soil in upper horizons is 12-15 mg-eqv per 100 g of soil. In absorbed bases calcium accounts for 80-90 % of the exchange capacity; magnesium, 10-15%; and, potassium + sodium, 5-8 %.

Generous sierozem soils are widely used in irrigated agriculture for growing cotton and other crops; besides, these soils are used in rain-fed agriculture in high foothills.

Dark sierozem. Dark sierozem soils are spread mainly in high foothills and in area of low mountains in western and southern spurs of the Tien Shan and Pamir-Alai. They occupy the upper belt of the zone within 700-1000 to 1400-1600 m above sea level. Dark sierozem soils are mainly formed in loess-like heavy loam under ephemeral, couch grass and motley grass cover.

Soil profile has the following morphological structure:

A – humus horizon, up to 17 cm thick, dark gray; upper 5-8 cm are comprised of compact turf, soil texture – heavy loam, cloddy structure; a lot of worm tracks and caprolits found;

AB – humus transient horizon, 17-45 cm thick, gray with brownish and straw-colored tint, mainly heavy loam, lumpy-cloddy structure; porous;

$B_к$ – carbonate-illuvial horizon, 45-100 cm thick, straw-colored with gray humus spots, mainly heavy loam, compact; carbonates in the form of white patches and concretions;

$C_к$ – straw-colored or yellowy straw-colored, heavy loam, usually gypsum and readily soluble salts are not found up to 2 m deep.

Dark sierozem soils usually contain 2.5-5.0% of humus in upper horizons, which then gradually decreases down the profile; humus composition is fulvic-humate (Cr : Cf about 0.8-0.9). The exchange capacity of soil in upper horizons is about 18-20 mg-eqv per 100 g of soil; calcium dominates in absorbed bases. The reaction is alkaline (pH_{H_2O} 8.1-8.5).

Dark sierozem soils are used in agriculture, including rain-fed agriculture, growing of cereals (wheat, maize) and forage-crops, as well as in horticulture and viticulture.

GRASSLAND-SIEROZEM SOIL TYPE

Grassland-sierozem soil subtypes

Grassland-sierozem subtypes. These soils are spread in all vertical belts of sierozem zones. They develop on relatively low surfaces soils that are mainly formed in loess and loess-like loam under sedge and fowl-grass-ephemeral cover with participation of licorice, cheegrass and other plants in conditions of groundwater tables at depths of 3.5-5.0m.

Soil profile has the following morphological structure:

A – humus sod horizon, about 10 cm thick, gray, mainly loam, flakey-cloddy structure;

AB – humus transient horizon, about 25-30 cm thick, light gray, loamy with cloddy structure; carbonates are found in the form of mold;

$B_к$ - carbonate-illuvial horizon, brownish-straw-colored or whitish-yellow, loamy, compact; carbonates in the form of white patches and concretions;

$C_к$ – straw-colored, often of general whitish tint caused by total saturation with carbonates, loam with traces of gleying in the form of pale dove-colored and small rusty spots.

Grassland-sierozem soils contain slight amount of humus in the upper horizon (1.5-2.0 %).

Subtype of grassland-sierozem soils. The soils are observed in all vertical belts of sierozem zone. They develop on relatively low surfaces soils in conditions of groundwater tables at the depth of 2.5-3.5 m on soil-forming rocks represented mainly by loess and loess-like loam, sometimes by melkozem and stony rocks under close vegetation cover consisting of grassland species with wide participation of plants having deep root system and with participation of spring ephemerals.

Soil profile has the following morphological structure:

A – humus sod horizon, about 10-15 cm thick, gray, loam or light loam, of flakey-cloddy structure;

AB – humus transient horizon, about 30-40 cm thick, light gray, loam or light loam, with large-clods structure; carbonates are observed in the form of mold;

$B_к$ – light, whitish-yellow, sometimes dove-colored, loam or light loam; carbonates are observed in the form of whitish spots;

$C_к$ – light-yellow or straw-colored, mainly loam or light loam; starting from the depth of 1.0-1.5 clear signs of gleying are observed in the form of dove-colored and ochre-colored spots.

Soils of grassland-sierozem subtype contain small amount of humus – 2-2.5% of it in the upper horizon.

GRASSLAND SOIL TYPE

Grassland soil subtypes

Grassland (typical) soils subtype. They spread throughout the whole of sierozem zone along river plains and deltas, in lower parts of foothills slopes in conditions of stable groundwater tables at the depth of 1.5-2.5 m, under typical grassland-plants cover, on flaky alluvial and proluvial sediments.

Soil profile has the following morphological structure:

A - humus sod horizon, 12-17 cm thick, dark gray, of small-clods structure, firmly fixed with small roots;

AB_g - humus transient horizon, up to 50 cm thick, gray, with dove-colored tint downwards, cloddy;

$B_{кg}$ - whitish horizon due to total saturation with carbonates, gleying is observed in the form of rust-ochre spots;

G – gley horizon, whitish-dove-colored, sticky (boggy), greasing, often strongly marly.

Content of humus in upper horizons of grassland (typical) soils is – 2-4%. Soil effervescence from HCl is observed on the surface. Reaction is alkaline. Absorbing complex is completely saturated with bases.

Grassland (typical) soils are used in irrigated agriculture.

Moistened-grassland (marsh-grassland) soils subtype. The soils are observed throughout the whole of sierozem zone in depressions of river flood-plains and deltas, on plains at the foot of mountains in conditions of constantly high ground capillary moistening and stable groundwater tables at depths of not lower than 1-1.5 m. They develop under gramineous and sedge-gramineous plants.

Soil profile has the following morphological structure:

A - humus sod horizon, up to 20 cm thick, dark gray, black when moistened, with granular-cloddy structure;

AB_g - humus horizon, 20-30 cm thick, dark gray with dove-colored tint, small-clods structure;

B_g – gleyey horizon, whitish-dove-colored, marly;

G – gley, soil-forming rock.

Upper horizons of moistened-grassland soils contain 4-5 % of humus; diminution of humus downwards along profile is gradual. Effervescence from HCl is observed on the surface. Reaction is alkaline. Absorbing complex is completely saturated with bases.

MARSH SOIL TYPE

Marsh soils subtypes

Muddy-marsh soils subtype. These soils have bounded distribution. They are formed in depressions under marshland plants in conditions of periodical excessive moistening and becoming dry on the surface – groundwater table is observed at the depth within the range of 50-70 cm.

Soil profile has the following morphological structure:

A_g – humus horizon, up to 50 cm thick, dove-colored-gray, heavy soil texture – from loam to clay; rusty spots of gleying;

G – gley horizon, more light, whitish-dove-colored, marly.

Upper horizon contains 2-4 % of humus; reaction is alkaline; absorbing complex is completely saturated with bases. The soils are used in agriculture as hay-lands.

Peaty-marsh soils subtype. These soils can be occasionally met in depressions of river flood plains, in depressions of plains at the foot of mountains, under marshland sedge-plants or reeds in conditions of prolonged stagnation of water on the surface.

Soil profile has the following morphological structure:

T – organogenic peat horizon, up to 50 cm thick, rarely – up to 1 m, brown, dark brown;

G – gley horizon, wet, dove-colored or whitish dove-colored, often strongly marly.

3. Soils map of the Chirchik-Ahangaran Basin

Generalization of soil maps (scales: 1:10000, 1:25000 and 1:100000), based on data of geomorphology experts of "Uzgiprozem" institute, resulted in drafting a 1:200000 scale soils map.

37 soil differences have been identified on the territory of the Chirchik-Ahangaran Basin. (Annex – the soil map and explication). Classification of soil types is based on principles of vertical zoning of the territory, climate and vegetation. Detailed information on properties of each soil difference is adduced in the Annex; at that, the list of soil differences is given with reference to relief elements and mother rocks, since in condition of foothill and mountainous terrain they determine soil-forming processes. .

HIGH-MOUNTAINS SOILS

The belt of high-mountains soils in Tashkent province is located at altitudes of 2200-3500 (3700) m above sea level. Conditions of soil formation here are characterized by inclement climate, contrast hydro-thermal regime, diversity of relief forms, mountain rocks and their composition. The relief is acute, mountainous, largely cleaved by deep narrow valleys. Watersheds are represented either by ridges or plain slightly wavy and sloping surfaces. There are highland plateaus in the basin. Landscapes of slopes are mostly rough. At the heights of 3000 m and higher there are *trog*[1]-like valleys, *kar*[2]-like depressions, snowfields and glaciers.

Soil-forming rocks are represented by eluvial, dealluvial, in some places proluvial and glacier sediments. Soils are represented by sandy loams, rock skeletons and coarse-rock skeletons, 0.3-1.5 m thick.

In the high-mountains belt three major soil types are determined:

- Light-brown grassland-steppe high mountainous soils;
- Grassland high mountainous soils;
- Marsh high mountainous soils.

Light-brown grassland-steppe soils are widely spread in high mountains. They are classified as middle-level humus content, low-level humus content and high-level humus content soils.

MID-HEIGHTS MOUNTAINS SOILS

The altitudes are 1000-2400 m above sea level.

Erosion processes is the peculiarity of soil-forming conditions. Soil-forming rocks are eluvial, located in thick melkozem sediments on shady slopes and not susceptible of washing away; rock skeletons and coarse-rock skeletons soils on sunny slopes are susceptible of washing away, outcrop of basement rock occurs.

Soils on loess are heavy loam, on rock skeletons – light sandy, rubbly. Soils on dolomite and marl have carbonate differences.

Vegetation consists of grassland-steppe semi-savanna plants, mountain wood, bushes, and highland xerophytes.

Soils are:

- Brown typical;
- Brown carbonate;
- Brown leached.

LOW MOUNTAINS SOILS

Low mountains brown soils

Soil-forming evolves in this region on dealluvial/proluvial, melkozem-rubble sediments, in some places – on loess and basement rocks. They are subdivided into irrigated, dry and virgin soils.

Dry brown and conditionally-irrigated soils are formed on loess-like loam and diluvium of limestone. These cultivated lands are located at altitudes of 1400-1450 m.

Brown soils of loess-tertiary low mountains

Soil-forming rock are loess-like sediments and products of tertiary rocks wind-erosion. Layer of leached brown soil is up to 40 cm thick.

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[1] *Trog* is German for a trough. *Trog*-like mountain valleys are formed by glaciers.

[2] *Kar* is German for a chair. *Kar*-like depressions are formed by small glaciers or snowfields around tops of mountains.

Brown soils are carbonate; they have light and mid-skeleton structure. 8-12% on an upper third of northern slopes is subject to denudation, therefore eluvium's cover is thin – at the depth of 120 cm detritus of red basement rock is bedded, and all soil layers are mid-light-rubbly.

Brown soils of intermountain valleys

In this geo-morphological region soils are subdivided into: conditionally-irrigated mountain brown soils; virgin mountain brown soils; virgin leached carbonate soils.

Brown mountain-wood soils

They are formed in the area of loess-tertiary low-height mountains at altitudes of 1000-1600 m, on loess-like thick sediments.

D A R K S E R O Z E M S O I L S

Dark sierozem soils of low mountains and folded foothills

Low mountains area is formed by dealluvial/proluvial, melkozem-rubble sediments, in some places – by loess-like loam.

Soils are subdivided here only into virgin non-washed soil and washed away to various extents soil. Virgin dark sierozem mid-washed away soils are of heavy-loam texture.

Dark sierozem soils of loess-tertiary low mountains

The area is formed by proluvial/dealluvial loess-like and tertiary sediments. Soils area is subdivided into dry and virgin types.

Dry sierozem soils are melkozem on loess and loess-like sediments.

High-carbonate, low-carbonate and slightly leached soils

Virgin soils are non-washed, in some places slightly washed away types; mid/heavy-loam on proluvial/dealluvial melkozem sediments.

Dark sierozem soils of swell-ridge loess and loess-tertiary foothills

Major part of the area is formed by loess, dusty, carbonate, porous loam with rear interlayers of light clays and insignificant sand content.

Soils are subdivided here into conditionally-irrigated, dry and virgin types.

T Y P I C A L S E R O Z E M S O I L S

Typical sierozem soils of low mountains and folded foothills

Soils are subdivided here into conditionally-irrigated, dry and virgin typical sierozem types. Soil-forming rocks are: limestone, ancient-quaternary proluvium, Holocene deluvium and loess. Shady slopes of low mountains (N, NE, NW, and W - oriented) are covered mainly by melkozem top-crust of weathering. Loess sediments are usually observed on these exposures. Slopes exposed to the sun (S, SW, SE, and E) are more often covered by thin, rubbly-melkozem top-crust of weathering. Its thickness on upper and mid-thirds of slopes is within the range of 50-70 cm. On lower parts of sunny slopes, where accumulation of deluvium is supposed to develop, rubbly-melkozem sediments are 70 cm thick.

In the area of low mountains in the typical sierozem soil belt, intensive creep of deluvium occurs. On shady slopes landslides, mud-streams are formed; on sunny slopes erosion processes dominate.

Low mountains are characterized by relief unfavorable for farming, and at present (as well as in the past) they are used as pastures. Unreasonable, irregular, and excessive pasturing leads to pasture erosion. As a result, not only sunny, but shady slopes too, are exposed to destructive erosion processes. Due to these effects washed-away soils are formed on shady slopes, and on sunny ones - undeveloped, thin, skeletal sierozem with close underlying detritus and basement rock.

Typical sierozem soils of swell-ridge loess and loess-tertiary foothills

This soil zone is formed by loess-like sediments loess, in some places by proluvial ruddy sediments.

Soils are subdivided here into irrigated, dry, and virgin typical sierozem types. Long-time irrigated typical sierozem soils are most specific for ancient oases of Central Asia. One of the main peculiarities of these soils is homogeneity of soil profile to the depth of 1.0-1.5 m. Absence of differentiation is explained by development of thick agro-irrigation layer augmenting from year to year due to silt brought by irrigation water and application of earthy fertilizers.

Leveling and earthy fertilizers considerably equalize differences in soil texture and predetermine dominating distribution of heavy loams as compared with mid-loam and clay soils.

Typical sierozem soils of valley alluvial/proluvial plains

The area is formed by alluvial/proluvial melkozem-rubbly (pebbles), in some places – loess sediments. Soils are subdivided here into irrigated, virgin typical sierozem and long-time irrigated sierozem-grassland types.

SOILS OF SUB-MOUNTAIN LOESS PLAIN

Irrigated lands occupy 85 % of this territory; dry arable lands - 10 %; hay-lands and pasture - 5 %. Irrigated soils are subdivided into typical sierozem, grassland-sierozem, sierozem-grassland and grassland types. Depending on how long the land has been irrigated, soils are subdivided into long-time irrigated, newly irrigated and newly developed. In terms of land reclamation, there are highly cultivated, mid-cultivated and poorly cultivated soils.

Long-time irrigated sierozem soils owing to impacts of long-term irrigation have lost signs of natural soils throughout the whole depth of profile. They are characterized by a thick agro-irrigation horizon (100 cm and more), deep, relatively uniform distribution of humus across the profile.

Highly cultivated soils have optimal water-physical properties; they are humus-enriched, provided with nitrogen, phosphorus and potassium. Their nitrification capacity is increased. Signs of erosion, salinity, water logging, alkalinity are completely absent on these soils. Land plots are well leveled. These soils are very effective in terms of agricultural productivity.

Poorly cultivated soils are characterized by low content of nutrition elements, lesser storage of humus, decreased nitrification capacity. Usually, these soils have a sole shoe, are poorly leveled, and weedy. Crops on such soils are highly rarefied; cotton and other crop yields are low.

Mid-cultivated soils occupy intermediate position between highly cultivated and poorly cultivated soils in terms of their properties.

Due to wavy relief and dominance of $2\text{-}5^0$ slopes, all surface area of sub-mountain loess plain is subject to slight washing away. Long-time typical sierozem soils are subdivided into slightly washed away and rarely mid-washed away types.

Typical sierozem soils of the third loess terrace flat ground

Soil cover of the third loess terrace is represented by the following groups of soils: irrigated and dry typical sierozem, grassland-sierozem, sierozem-grassland, and grassland sazovy soils.

The largest massifs of long-time irrigated typical sierozem are located on the right-bank territory of the Chirchik and Angren rivers. These soils for the most part are highly cultivated. They have thick agro-irrigation horizon, deep and uniform distribution of humus, and high level of biological activity. The soils are non-saline. As to soil texture, mid-loam and heavy loams prevail.

SOILS OF ALLUVIAL PLAIN

The alluvial plain consolidates the 1st and 2nd terraces of the Chirchik and Angren rivers. Depending on the depth of groundwater table and historical background of soil-forming process there are grassland-sierozem, grassland and marsh-grassland soils.

At the depth of 1.0-1.5 m there are underlying layers of pebbles or sand.

4. Formation of SLISYS data base

Classification of soils is based on the "Dokuchaev's principle" of determining genetic types, sub-types, kinds, genus, and differences. Each soil type reflects five soil-forming factors:

1. Relief
2. Mother (soil-forming) rock
3. Vegetation
4. Climate
5. Age

Considering principles of forming the SOTER data base (Fig.1), we reckon to assign as a SOTER UNIT – a soil contour of the soil classification of the Chirchik-Ahangaran Basin territory. For this purpose information have been collected with regard to specific soil profiles that contain morphological description of profile by genetic horizons, chemical composition of soils and physical properties by genetic horizons (Annex).

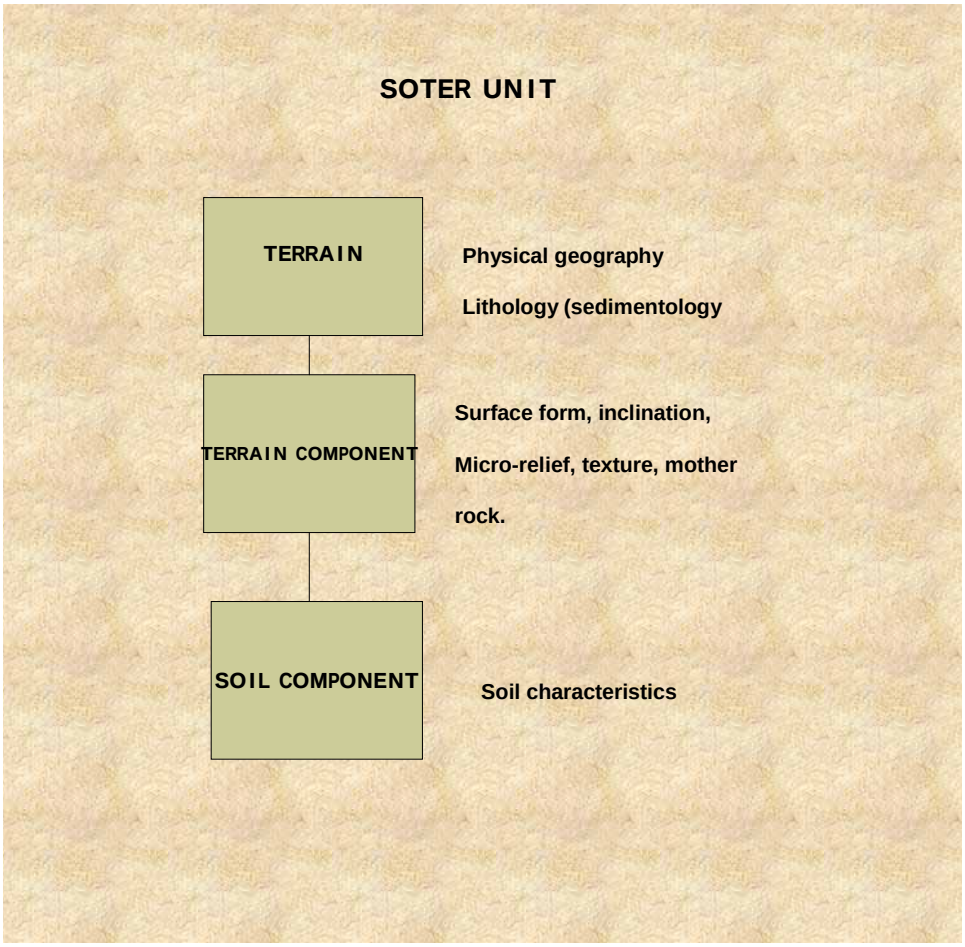

Fig.1 SOTER DATA

EXPERT STULINA GALINA

ANNEX

EXPLICATION

№№ - indices of soil differences	Appellation of soils
Belt of typical sierozem – upper IV-V terraces of the Chirchik and Ahangaran rivers	
15	Long-time irrigated sierozem – typical, mid-cultivated, in some places lightly washed away, mid-loam, on loess-like and loam-gristly sediments
16	Newly irrigated sierozem – typical, mid-cultivated, in some places lightly washed away, mid-loams, on loess loams and highly-gristly sediments
17	Newly irrigated sierozem – typical, mid-cultivated, mid-and-highly washed away, mid-loam, on loess-like and gristly-loam sediments, in some places pebbles at depths of 0.5-1m. 2-5^{o} slopes
18	Newly irrigated sierozem – typical, poorly cultivated, low and mid-saline, mid-loam on loams
19	Newly developed sierozem lands – typical, poorly cultivated, eroded to various extents, mid-loam, on loess-like loams
20	Sierozem – typical, virgin-dry, eroded to various extents, in some places low-saline, mid-loam, loess-like and loam-gristly sediments
21	Long-time irrigated grassland-sierozem, mid-cultivated, mid-and-heavy loam, rubbly-gristly, on mid-loams foliated with sand and gristle, in some places pebbles at the depth of 1-2 m
22	Newly irrigated – sierozem-grassland, mid-cultivated, in some places lightly saline and eroded, heavy loam on homogenous loess-like loams and flaky proluvial sediments – mid-and-heavy loams dominating
23	Long-time irrigated grassland, sazovy, mid-cultivated, mid-loam on heavy loams. Bottoms of ravines and ravine-like depressions
24	Homogenous – grassland, mid-cultivated, non-saline, up to 20% of soils are lightly saline, heavy loam on mid-and-heavy loams. Small spots of grassland-marsh and marsh soils - partly developed. Closed depressions
III terrace of the Chirchik and Ahangaran rivers	
25	Long-time irrigated sierozem – typical, highly cultivated, in some places lightly washed away, mid-loam on loess-like loams
26	Long-time irrigated sierozem – typical, highly cultivated, heavy loam on loams
27	Newly irrigated sierozem – typical, mid-cultivated, in some places lightly washed away, mid-loam on loess-like loams
28	Newly irrigated sierozem – typical, poorly cultivated, light and mid-salinity, mid-loam on loess-like loams
29	Sierozem – typical, virgin-dry, eroded to various extents, mid-loam on loess-like loams
30	Long-time irrigated sierozem-grassland, highly cultivated, in some places lightly saline, heavy loam on loams
31	Long-time irrigated grassland, highly cultivated, in some places lightly saline, heavy loam on flaky sediments partly with pebbles at depths of 1-2 m
32	Marsh-grassland, in some places lightly saline, heavy loam on loams, partly with pebbles at depths of 0.5-1 m
1-II terraces of the Chirchik and Ahangaran rivers	
33	Long-time irrigated grass-sierozem, mid-cultivated, heavy loam in loams, foliated with sand, in some places pebbles at depths of 0.5-1 m
34	Newly irrigated sierozem-grassland, mid-cultivated, mid-loam on flaky sediments, pebbles at depths of 1-1.5 m and some places – 0.5-1 m
35	Long-time irrigated grassland, alluvial, mid cultivated, in some places lightly saline, heavy loam on sandy-loam sediments, pebbles at depths of 1-2 m
36	Newly irrigated grassland, mid-cultivated, in some places lightly saline, heavy loam on flaky sediments, pebbles at depths of 1.0 m, seldom – at 0.3 m
37	Grassland virgin, heavy loam on flaky pebble-loam sediments, in some places pebbles

№№ - indices of soil differences	Appellation of soils
	at depths of 0.3 m. Depressions
38	Irrigated marsh-grassland with spots of virgin soils and marshes, mid-loam on flaky pebble-loam sediments, pebbles at 0.5-1.5 m, seldom – at 0.3 m. Depressions
39	Alkali soils (I, II terraces of the Syrdarya river; IV terraces of the Ahangaran river)
Belt of dark sierozem soils (foothills and low mountains)	
40	Newly irrigated sierozem – dark, lightly washed away, heavy loam on loams
41	Sierozem – dark and virgin-dry soils, eroded, heavy loam on loams, in some places gristly sediments. Slopes of various steepness, wavy relief of foothills
Belt of dark soils (mid-height mountains)	
42	Brown typical soils, in some places washed away, heavy loam, lightly rubbly on loess-like skeleton-melkozem sediments, in some places – outcrop of basement rocks. Pastures
43	Brown typical soils, highly and moderately washed away, mid-loam, in some places - rubbly on loess-like skeleton-melkozem sediments. Pastures
44	Brown carbonate and low-alkalinity soils, heavy loam, in some places – rubbly on loess-like and skeleton-melkozem sediments. Slopes of various steepness
45	Brown carbonate and low-alkalinity soils, Lightly and in some places mid-washed away, skeleton-loam on loess-like and skeleton-loam sediments. Slopes of various steepness. Pastures
46	Brown carbonate soils, highly washed away, skeleton-loam on thick skeleton sediments. Slopes, high-grass pastures
47	Brown high-alkalinity soils, heavy loam, rubbly on skeleton-loam sediments. Slopes, high-grass pastures
48	Brown high-alkalinity soils, highly eroded, loams, stony on skeleton-loam sediments. Slopes, high-grass pastures, sparse growth of juniper trees
49	Brown mountain-wood soils, heavy loam on loess-like rocks
50	Brown mountain-wood soils, lightly and moderately washed away, heavy loam, rubbly on loess-like and skeleton-loam sediment. Steep slops. Nut-bearing woods.
Belt of light-brown soils of high-mountain grassland-steppes (altitudes of more than 2500 m above sea level)	
51	Light-brown high-mountain grassland-steppe soils in combination with grassland, marsh-grassland and marsh soils, heavy loam, highly rubbly on stony-rubbly sediments, in some places - outcrop of basement rocks. Watershed part of ridges
52	Grassland - high-mountain and peat-marsh, loam, rubbly soils on skeleton-loam sediments. Part of watershed ridges
53	Non-soil formations (slopes, screes, landslides, outcrop of basement rocks)
54	Pebbles and sands
55	Inarable lands
56	Water surface