6.9 Country Report of Turkey

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1. Introduction

Turkey (geographically Anatolia or Asia Minor) has been the home of many ancient civilisations, where irrigation has always been practised.

Agriculture constitutes 76.7% of the national gross income and gives employment to 72.3% of the population.

Annual precipitation varies between 220 and 2 400 mm, the southern and western plains receiving an average of 630 mm and the north eastern coast a maximum of 2 400 mm; the inland plateaux have precipitation varying between 220 and 459 mm.

Summers are dry, with rain in winter and spring on the coast and snow in winter on the inland plateaux. There is a moisture deficiency for main crops like cotton, rice, fruits, vegetables, tobacco, etc. On the coast and on the inland plateaux the cereal-fallow system is practised.

Present land use is summarized in Table 1.

Table 1: Present Land Use in Turkey

Type			Area (1 000 hectares)
1.	Agricultural land		23 539
	(a) cropland	14 170	
	(b) fallow land	7 030	
	(c) orchards, vineyards	2 339	
2.	Pasture, meadow		30 839
3.	Forest land		10 584
Total			64 962

2. Irrigation

Several dams provide water for the crops. The irrigation systems involve some 7 898 km of main irrigation and drainage canals with a total value of about 2 billion TL.

(a) Water resources

The total annual surface flow of rivers is estimated to be 167 x $10^9 m^3$ of which 155 x $10^9 m^3$ can be controlled. The underground water reserve which can be drawn off annually for irrigation is about 4 x $10^9 m^3$.

(b) Land and soils

The total irrigable land is 12.6 million ha. Reconnaissance soil surveys indicate that approximately 6 million ha can be economically provided with irrigation water. Topographical conditions in the irrigation areas are generally favourable for irrigation. These lands are flat to gently sloping and need light to medium levelling for efficient irrigation.

Soils in the irrigated lands may be characterized as deep alluvial, colluvial terrace and alluvial fan. Textures are extremely variable, ranging from loamy sands to heavy clays.

(c) Irrigated areas

At the beginning of 1968, 1 724 334 ha were covered by irrigation systems. Approximately 1 million ha of this area obtained water by privately constructed systems and 724 334 ha are provided with water by state constructed systems.

3. Salinity and Waterlogging

The main causes of waterlogging are:

i. surface topography, depressions acting as outlets for surface or underground flow;

ii. flooding of depressions from streams;

iii. inefficient irrigation practices;

iv. seepage from streams or irrigation canals.

Waterlogging due to the first two factors existed in the low coastal plains and in the closed basins of the central plateaux long before irrigation systems were established, but with the introduction of irrigation systems without accompanying drainage facilities and efficient irrigation practices, new areas became waterlogged.

Salinity in Turkey, therefore, is directly related to inadequate drainage. All waterlogged areas have not yet become saline, but most of the salty land has waterlogging problems.

(a) Extent

According to the preliminary soils map of Turkey, completed in 1954, hydromorphic saline alluvial (halomorphic) soils cover 650 200 ha and solonchak soils cover 69 700 ha. These figures refer to land that has become basically non-arable due to salinity. It is also recognized that 25% of the young alluvial soils (820 400 ha), 681 200 ha of the hydromorphic alluvial soils, 89 800 ha of beach, sand dune and marsh complexes exhibit salinity and drainage problems. This totals 2 311 300 ha. These areas include almost all the problem soils of Turkey except erosion areas.

(b) Type

The nation-wide preliminary soil survey prepared in 1954 designates two groups of saline soils, the distinction between the two being based on practical reclamation potential rather than scientific significance. Both may have saline, alkali and saline-alkali classes.

i. Hydromorphic saline alluvial (halomorphic) soils: These include the alluvial soils with inadequate drainage and with an excess of salts. They occur in all parts of Turkey in stream valleys, deltas and basins in association with other alluvial soils. The main causes of salt accumulation are irrigation without adequate drainage and seepage from irrigation canals.

ii. Solonchak soils: The principal areas of these soils are fairly large tracts in old lake basins and in valleys where groundwater rises to or near the surface temporarily or for long periods.

4. Research on Saline and Waterlogged Soils

Starting with one in 1948, there are now eight Research Stations and Institutes located at important problem or project areas, e.g. the Tarsus, the Cumra and the Menemen Plains.

All stations are operated by the General Directorate of Soil Conservation and Farm Irrigation (TOPRAKSU) while the State Hydraulic Works (DSI) supervises temporary experimental sites in various parts of the country. Subjects of study are related to the practice of irrigation application and irrigation farming.

The surveys and investigations carried out on saline and waterlogged soils show the following:

i. In irrigated areas salinity and waterlogging result from a change in the water balance caused by seepage from unlined canals, wild flooding and inadequate drainage facilities.

ii. As a consequence, the water tables rise and remain so during the dry summer months.

iii. Most alluvial formations are rich in soluble salts; the soil salt content of a boring down to 72 metres at Gukurova Plain varied betwen 0.23 to 1.75%.

On tracts of land where high salinity existed, open or closed drains at an average depth of 1.0-1.5 m and at required spacings proved efficient in lowering the water table and evacuating salts.

In several cases the drains were established during late summer and the land was left to the effect of winter rains. The resulting removal of salts from the soil profile at various locations is shown in Table 2.

Table 2: Leaching of Soluble Salts from Drained Plots as affected by Precipitation

Location:	Tarsus-Alifaki		Izmir-Menemen		Central Anatolia	
Precipitation:	523 mm		453 mm		300 mm 1/	
Date:	8.11.60	30.5.61	2.12.58	12.4.59	Autumn 1963	Spring 1969
Depth cm	$EC_e \times 10^3$		$EC_e \times 10^3$		$EC_e \times 10^3$	
0 - 30	16.9	6.4	4.8	2.1	10.0	3.2
30 - 60	20.3	19.1	23.3	13.0	13.0	8.0
60 - 90	23.4	24.3	59.3	37.9	13.7	9.0

1/ This refers to annual precipitation; the plots were drained at a spacing of 300 m. No corrections have been made for capillary resalinisation, rewetting of soil, etc. (Editor's note).

The growing of a crop that is tolerant to salt and ponded conditions resulted in an effective and economical removal of salts once adequate drainage was provided. Tables 3, 4 and 5 indicate the leaching of salts with an irrigated crop at various locations.

Table 3: Leaching of Soluble Salts in a Drained Rice Field at Tarsus-Alifaki

Note resalinisation under cotton crop (Tarsus Irrigation Research Institute).

Treatments and Dates of Soil Sampling	Total Soluble Salts (in percentages)		
	0-30 cm	30-60 cm	60-90 cm
Original soil (12 April 1957)	0.36	0.44	0.50
Following 1st rice crop (11 November 1957)	0.26	0.32	0.46
Following 2nd rice crop (5 November 1958)	0.13	0.19	0.25
Following spring (20 March 1959)	0.06	0.09	0.12
Following 1st cotton crop (5 October 1959)	0.10	0.22	0.41

Table 4: Leaching of Soluble Salts in a Drained Rice Field at Konya-Cumra (Soil and Fertilizer Research Institute, Ankara)

Treatments and Dates of Soil Sampling	ECe x 10^3				
	0-10 cm	10-20 cm	20-40 cm	40-60 cm	60-90 cm
Original (spring 1959)	56.00	73.04	51.69	38.11	6.61
Following 1st rice crop (Autumn 1959)	4.86	6.80	8.50	6.54	6.30

Table 5: Leaching of soluble salts in a drained pasture field following two years of rice at Tarsus-Alifaki (Tarsus Irrigation Research Institute)

Treatments and Dates of Soil Sampling	Total Soluble Salts (in percentages)		
	0-30 cm	30-60 cm	60-90 cm
Before pasture (8 April 1958)	0.16	0.23	0.26
1st summer under pasture (5 November 1958)	0.12	0.17	0.16
1st winter under pasture (17 March 1959)	0.09	0.14	0.16

The alkali problems were studied at experimental plots using various types and rates of amendments. It appears that:

i. it takes 2-3 years to bring the exchangeable sodium percentage (ESP) to safe levels by using gypsum, sulphur or animal manure;

ii. by adding drainage water to good quality leaching water or by diluting high salt water for leaching, water infiltrates more rapidly into the soils;

iii. most alkali soils are rich in $CaCO_3$ and many have accumulated gypsum. In many areas rice or pasture activated these calcium sources and removal of alkali was possible without amendments.

Leaching under unsaturated conditions was studied on plots representing 3 000 ha of organic soils at Kayseri-Karasaz. It appeared that leaching under intermittent sprinkling was more efficient than under conditions of ponding.

Research related to the qualities of irrigation water sources in Turkey has been initiated by TOPRAKSU. It aims at setting up a national quality standard for Turkey. This project is still in the inventory stage. A preliminary evaluation is given in Table 6.

To prevent further salinisation, irrigation canals are lined and projects provided with drainage. Three training centres providing training from the engineer's to the farmer's level are in operation.

Table 6: A preliminary evaluation of the irrigation waters in Turkey with respect to their qualities (Central TOPRAKSU Research Institute, Ankara)

Salinity (C) Alkalinity (S) Class	Number of Samples in the Class	% of the Number of Samples in the Class to the Total Samples
C_1S_1	174	12.45
C_2S_1	685	49.03
C_2S_2	2	0.14
C_3S_1	370	26.49
C_3S_2	25	1.78
C_3S_3	8	0.57
C_3S_4	4	0.24
C_4S_1	55	3.93
C_4S_2	26	1.83
C_4S_3	12	0.82
C_4S_4	38	2.72
Total	1 397	100.00