APPENDIX 2

1. Outline of Laboratory Methods
2. Local Methods of Salinity Assessment
3. Results of Soil Survey and Laboratory Analysis of Soil Samples:

A2.1 Soil Profile Stratification According to the Survey of Sample Fields
A2.2 Assessment of Soil Profile Non-uniformity in Horizons A and B (USBR method)
A2.3 Comparison of Soil Textural Classes by Local and USBR Methods
A2.4 Statistical Summary of Physical Analysis of Soil Samples
A2.5 Average Bulk Density by Sample Farms
A2.6 Summary of Penetrometer Readings in Soil Profiles
A2.7 Variation of Soil Texture in Sample Fields (USBR Classification)
A2.8 Correlation Matrix between Soil Physical Characteristics
A2.9 Correlation Matrix between Soluble Salts in Soil Samples
A2.10 Exchangeable Cations, Cation Exchange Capacity and Soil Salinity Class in Farms 23 and 28
A2.11 Crop Yield Achievement, Rooting Depth and Soil Characteristics
A2.12 Patterns of Compaction in Soil Profiles

1   OUTLINE OF LABORATORY METHODS

Most of the local laboratory methods used for analysis of soil and water samples are familiar to international laboratories, albeit somewhat out of date. The objective of this Appendix therefore is not to give a detailed account of local procedures but to identify them. Methods are clearly described in local books.

1.1   Soil Preparation

Soil samples are air dried, ground in a mortar with a rubber pestle, and only the fraction passing a 1mm sieve, the "fine earth", is retained for analysis. The international standard is most commonly 2mm, but because most Central Asian soils have a peak particle size distribution in the international "silt" fraction, this difference is unlikely to create much difference in analysis values.

1.2   Soil Extract

On account of the predominant importance of salinity, analyses normally are made on an aqueous extract of the soil. A 20g fine earth sample of soil is shaken with 100ml of distilled water for 5 minutes and the suspension is filtered.

1.3   Analyses of Soil Extracts and of Water Samples

1.3.1   Units of measurement

pH is expressed in standard pH units, and electrical Conductivity (EC) is measured directly in dS/m (=mmhos/cm). All other standard measures are expressed as percent of fine earth fraction of soil or as g/l of water. Some laboratories also express ionic concentrations in me/l or me/100g soil.

1.3.2   EC

This is measured by electrodes, with automatic temperature compensation. Portable conductivity meters were imported in 1996 for use in laboratory and field. A portable instrument has been designed in SANIIRI and limited numbers have been produced for experimental use in the field.

1.3.3   TDS

Total dissolved solids are measured by weighing residue from an aliquot dried in a basin by oven. For soils the following equation is used:

(Wt of salt (g) x vol of extractant (100ml) x 100 x K) / (Vol of aliquot x wt of soil (20g))

where K is a coefficient, normally 1, that adjusts for the soil not being dry.

1.3.4   pH

Measured with a standard calomel half-cell electrode with automatic temperature compensation. In the case of soil, the pH is measured in a 1:5 aqueous suspension. pH measured in suspensions with KCl or $CaCl_2$ solution are not customary as they ought to be on account of salinity.

1.3.5 HCO_3^-

A 10ml aliquot of extract or water is measured by titration against 0.01N H_2SO_4 using methyl orange as indicator. Percent HCO_3^- in fine earth fraction of soil is 0.0315x, where x is the titre in ml.

1.3.6 SO_4^-

A 5ml aliquot of extract or water is heated with $BaCl_2$ solution and the precipitate washed with hot, dilute HCl, before being dried and weighed.

1.3.7 Cl^-

A 10ml aliquot of extract or water is titrated against a standard solution of $AgNO_3$ to colour change.

1.3.8 Ca^{++}

A 10ml aliquot of extract or water is titrated against a 0.05N solution of Fixanol (which may be EDTA) using Murexide as the indicator.

1.3.9 **Mg^{++}**

A 10ml aliqot of extract or water is titrated against a standard solution of Fixanol using Eriochrome Black as the indicator.

1.3.10 K^+ and Na^+

Measured by gas flame photometer using appropriate filters.

1.4   CEC and Exchangeable Cations

A fine earth sample of soil is shaken with ammonium acetate solution.

1.5   Texture

A fine earth sample of soil is dispersed by shaking with Calgon solution and transferred to a 1litre measuring cylinder with paddle. Samples are withdrawn from fixed depth by pipette at standard time intervals, corresponding to the following particle diameters:

1, 0.25, 0.1, 0.05, 0.01, 0.005, 0.001 and <0.001mm according to Stokes' Law.

Samples are dried by oven in basins and weighed. Note that these thresholds do not correspond with any international classification of texture. Local data can be transformed on the basis of the cumulative weight percentage less than the above thresholds and the international fractions can be obtained from the curve by interpolation. With a strong peak common in the silt fraction, the plot normally is not linear. To improve the accuracy of interpolation, a log/linear or log.log/linear transformation may be made.

2   LOCAL METHODS OF SOIL SALINITY ASSESSMENT

Four different methods are currently used in Central Asia for the assessment of soil salinity. In Uzbekistan, the method based on the amount of chloride ion in the soil is used in the three oblasts of the Ferghana Valley. The method based on the quantity of water extractable salts (TSS) in the soil is used in Khorezm, Djizak, Syrdariya, Karakalpakistan, Bukhara and Surkhandariya oblasts. Kashkadariya Oblast is different in using the more advanced concept of "toxic salts", a gravimetric method including the ions Na^+, Mg^{++}, Cl^- and SO_4^{--} but excluding CaSO4, the carbonates and bicarbonates. Some surveys have used the soil content of sodium for assessing salinity.

The criteria for classifying soil salinity in one of five classes are shown for the four different local methods and the international method (FAO) are shown in Table A2.1.1.

Table A2.1.1 Criteria for Classification of Soil Salinity by Different Methods

Method/ /Class number	Units	None 1	Slight 2	Mod-erate 3	Severe 4	Very severe 5
Chloride method	me Cl/100g soil	<0.2	0.2-1.0	1.0-2.0	2.0-4.0	>4.0
Sodium method	me Na/100g soil	<1.0	1.0-2.0	2.0-4.0	4.0-8.0	>8.0
Total Soluble Salts method	% in fine earth					
Salinity type:Cl	Cl/SO_4 : <0.2	<0.05	0.05-0.15	0.15-0.3	0.3-0.7	>0.7
$Cl:SO_4$	0.2-1.0	<0.2	0.2-0.4	0.4-0.6	0.6-0.9	>0.9
$SO_4:Cl$	1.0-2.0	<0.1	0.1-0.2	0.2-0.4	0.4-0.8	>0.8
SO_4 –gypsum	>2.0	<0.3	0.3-0.4	0.4-0.8	0.8-1.2	>1.2
SO_4+gypsum	>2.0	<1.0	1.0-1.2	1.2-1.5	1.5-2.0	>2.0
Total Toxic Salt method	% in fine earth					
Salinity type:Cl	Cl/SO_4 : <0.2	<0.03	0.03-0.1	0.1-0.3	0.3-0.6	>0.6
$Cl:SO_4$	0.2-1.0	<0.1	0.1-0.25	0.25-0.5	0.5-0.9	>0.9
$SO_4:Cl$	1.0-2.0	<0.05	0.05-0.12	0.12-0.35	0.35-0.7	>0.7
SO_4	>2.0	<0.15	0.15-0.3	0.3-0.6	0.6-1.4	>1.4
ECe method (FAO)	dS/m	<2	2-4	4-8	8-16	>16

Table A2.1   Soil Profile Stratification According to the Survey of Sample Fields

Republic, oblast	Farm code	Elevation above sea level, m	Number of visually defined soil horizons with different colour and texture within 0 - 100 cm of soil depth (average for 10 fields)
3 Kazakhstan			
Kyzyl – Orda	1	117.5	1.8
	2	117	1.6
	Average		*1.7*
Chimkent	3	257	1.7
	4	257	1.9
	average		*1.8*
4 Kyrgyzstan			
Bishkek	9	954	1
	10	873	1.3
	average		*1.15*
Osh	7	730	1.5
	8	958	1.5
	average		*1.5*
5 Tadjikistan			
Kanibadam	14	425	1.3
6 Turkmenistan			
Mary	17	240	1.8
	18	244	1.8
	average		*1.8*
7 Uzbekistan			
Surkhandarya	21	390	1
	22	390	1.4
	average		*1.2*
Syrdarya (new irrigated zone of Golodnaya steppe)	23	280	1.8
	24	280	1.8
	average		*1.8*
Syrdarya (old irrigated zone of Golodnaya steppe)	31	267	1.2
	32	265.5	1.9
	average		*1.55*
Khorezm	25	90	1.7
	26	90	1.5
	average		*1.6*
Karakalpakistan	27	80	2.1
	28	75	2.1
	average		*2.1*
Bukhara	35	230	1.4
	36	230	1.3
	average		*1.35*

Table A2.2   Assessment of Soil Profile Non-Uniformity in the Horizons A and B,
Based on Textural Analysis by USBR Classification Method

Republic Oblast	Farm code	% of fields with	
		uniform texture	non-uniform texture
1	2	3	4
Kazakhstan Kyzyl-Orda	01	30	70
	02	40	60
	average	35	65
Kazakhstan Chimkent	03	70	30
	04	80	20
	average	75	25
Kyrgyzstan Osh	07	30	70
	08	36	64
	average	33	67
Kyrgyzstan Bishkek	09	90	10
	10	60	40
	average	75	25
Tadjikistan	14	67	33
Turkmenistan Mary	17	40	60
	18	40	60
	average	40	60
Uzbekistan Surkhandarya	21	50	50
	22	70	30
	average	60	40
Uzbekistan Sydarya (new irrigated zone In Golodnaya steppe	23	40	60
	24	50	50
	average	45	55
Uzbekistan Khorezm	25	50	50
	26	100	0
	average	75	25
Uzbekistan Karakalpakistan	27	50	50
	28	40	60
	average	45	55
Uzbekistan Syrdarya (old irrigated zone In Golodnaya steppe)	31	50	50
	32	70	30
	average	60	40
Uzbekistan Bukhara	35	60	40
	36	60	40
	average	60	40

Table A2.3 Comparison of Soil Textural Classes by Local and USBR methods

Class	Code	No.		% total		hC	mC	lC	hL	mL	lL	LS	cnS	Total no.
		USBR system				Clays			Loams			Sands		
Clays	C	13	13	3	**3**	11	1	1						13
Silts	Z	4	291	1	**65**						1	2	1	4
	ZC	18		4		7	7	4						18
	ZCL	61		14		1	4	23	33					61
	ZL	208		47			2	6	31	107	40	19	3	208
Loams	CL	19	137	4	**31**			7	10	2				19
	L	86		19				1	13	47	21	4		86
	SCL	6		1					1	5				6
	SL	26		6						5	10	6	5	26
Sands	LS	4	4	1	**1**							2	2	4
Most likely USBR equivalent class						C	ZC	ZCL	ZCL	ZL	ZL	ZL	SL	
Number of samples	445			100		19	14	42	88	166	72	33	11	445
							75			326		44		
Percent of total						4	3	9	20	37	16	7	2	100
							17			**73**		**10**		

Note: based on textural analysis of 445 soils and classification by both methods

USBR C = clay, Z = silt, L = loam, S = sand

Kachinski C = clay, L = loam, S = sand, h = heavy, m = medium, l = light
cn = consolidated

Table A2.4 Statistical Summary of Physical Analysis of Soil Samples

Statistic/ Texture class (USBR)	EC 1:5 dS/m	pH	Texture (USBR) sand %	silt %	clay %	IQR	Moisture content (v/v) at pF 4,2	3,5	3,0	2,5	2,0	0,0	AWC %	Bulk density g/cm3	Penetrometer kN/m2
Average															
C	0,50	7,66	7	27	66	311	20,9	24,9	32,1	33,6	35,5	49,7	14,6	1,34	956
CL	0,74	7,81	25	43	32	6	18,7	21,6	26,5	29,7	34,2	46,7	15,6	1,42	1 161
L	0,96	7,62	38	43	19	4	14,0	17,2	21,4	25,1	29,2	44,6	15,2	1,48	1 094
LS	0,17	7,35	81	14	5	3	5,7	7,4	12,1	13,8	16,0	48,2	10,3	1,38	693
S			90	6	5	4									
SCL	0,29	7,51	57	20	23	5	18,0	19,0	24,0	27,4	37,0	49,1	19,0	1,36	1 285
SL	0,63	7,62	60	28	12	4	12,6	12,9	16,1	20,0	27,2	43,2	14,6	1,52	912
Z	1,65	7,70	11	84	5	3	15,6	18,5	20,7	24,0	31,5	50,4	15,9	1,32	2 562
ZC	0,68	7,67	6	51	43	12	22,2	26,9	31,3	34,3	39,2	48,6	17,0	1,37	945
ZCL	0,77	7,67	11	56	32	6	21,3	24,7	28,8	31,5	37,3	44,8	16,0	1,48	1 341
ZL	1,14	7,65	20	63	17	4	15,1	19,2	23,7	27,7	30,9	45,6	15,7	1,44	1 226
Grand mean	0,96	7,65	25	53	22	14	16,2	19,4	23,8	27,4	31,9	45,6	15,6	1,45	1 183
Minimum Value															
C	0,14	7,10	1	13	47	17	11,7	12,7	19,5	24,0	26,0	44,1	10,8	1,15	528
CL	0,15	7,30	21	23	27	5	12,2	16,0	19,0	23,0	27,0	38,3	13,2	1,10	460
L	0,09	6,89	26	29	9	3	6,0	6,3	11,4	11,8	16,0	34,8	10,0	1,23	81
LS	0,10	7,20	76	9	3	3	5,0	7,0	9,0	11,0	14,0	42,5	9,0	1,27	422
S			89	4	4	4									
SCL	0,19	7,20	50	11	21	4	11,0	13,0	18,0	22,0	24,0	45,4	13,0	1,25	1 285
SL	0,12	7,01	52	14	4	3	5,0	7,0	9,5	12,0	18,0	35,2	11,0	1,30	152
Z	0,22	7,40	6	80	2	3	3,9	6,0	7,0	9,0	12,0	46,8	8,1	1,27	513
ZC	0,14	7,20	0	40	40	8	13,0	15,0	18,0	21,0	25,0	38,1	12,0	1,11	275
ZCL	0,12	6,94	2	45	27	5	10,0	12,0	16,0	20,0	23,0	35,9	5,4	1,10	226
ZL	0,12	6,80	3	21	4	3	4,5	5,8	9,4	12,0	14,0	35,4	9,1	1,13	210
Grand mean	0,09	6,80	0	4	2	3	3,9	5,8	7,0	9,0	12,0	34,8	5,4	1,10	81
Maximum Value															

C	1,01	8,06	23	39	86	469	32,2	32,6	39,6	41,1	47,0	56,7	18,5	1,49	1 767
CL	4,86	8,19	39	50	40	9	26,3	31,4	35,7	39,4	42,0	58,8	18,5	1,65	2 376
L	4,13	8,28	51	50	28	5	30,0	36,0	38,0	40,0	45,0	53,9	21,0	1,74	3 000
LS	0,30	7,60	86	21	10	4	7,0	8,1	18,2	19,3	20,0	52,4	13,0	1,53	1 200
S			91	7	5	4									
SCL	0,47	7,97	65	27	25	5	23,3	23,8	33,1	34,6	46,0	53,3	22,7	1,46	1 285
SL	2,22	8,13	74	40	20	4	25,2	24,0	28,0	32,0	41,0	51,3	21,0	1,73	2 347
Z	3,00	7,90	18	87	7	3	28,3	31,4	33,8	37,2	45,0	52,4	24,6	1,42	7 786
ZC	1,86	8,01	19	60	49	22	29,4	33,0	37,3	41,0	48,0	58,4	22,6	1,65	1 642
ZCL	3,52	8,10	20	68	40	9	31,6	35,6	41,0	42,2	50,0	58,8	26,3	1,71	3 000
ZL	5,00	8,74	69	81	27	5	29,0	33,2	40,6	52,1	47,0	57,7	26,1	1,73	3 000
Grand mean	5,00	8,74	91	87	86	469	32,2	36,0	41,0	52,1	50,0	58,8	26,3	1,74	7 786

Number of Samples

C	13	13	13	13	13	13	13	7	7	7	13	13	13	13	13
CL	19	19	19	19	19	19	17	13	13	13	17	18	17	18	18
L	86	79	86	86	86	86	82	79	79	79	82	85	82	85	67
LS	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3
S	0	0	2	2	2	2	0	0	0	0	0	0	0	0	0
SCL	6	6	6	6	6	6	6	3	3	3	6	6	6	6	1
SL	26	21	26	26	26	26	22	17	17	17	22	22	22	22	21
Z	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
ZC	18	18	18	18	18	18	18	9	9	9	18	18	18	18	18
ZCL	61	61	61	61	61	61	59	43	43	43	59	59	59	60	50
ZL	208	200	208	208	208	208	195	169	169	169	195	206	195	206	164
Grand mean	445	425	447	447	447	447	419	347	347	347	419	434	419	435	359

Variance

C	0,09	0,13	60	67	150	10169	48,0	41,9	41,9	30,4	48,9	19,8	5,3	0,014	131 553
CL	1,22	0,05	17	41	20	1	17,2	27,3	35,8	32,3	16,3	33,3	2,6	0,024	267 009
L	0,80	0,08	50	29	17	0	18,3	21,5	22,1	24,4	36,6	26,0	5,8	0,018	431 774
LS	0,01	0,04	17	28	11	0	1,3	0,4	28,0	22,9	12,0	26,1	5,3	0,019	192 975
S			2	5	1	0									
SCL	0,01	0,06	41	38	2	0	16,5	30,2	63,7	41,9	54,4	8,5	11,2	0,006	
SL	0,34	0,08	44	62	14	0	28,2	23,4	27,9	32,0	54,8	18,1	7,7	0,013	333 174

	EC 1:5	pH	sand	silt	clay	IQR	4,2	3,5	3,0	2,5	2,0	0,0	AWC	Bulk density	Penetrometer
Z	1,81	0,05	26	8	6	0	117,6	119,4	130,4	140,7	267,0	6,2	46,9	0,004	12 204 869
ZC	0,32	0,06	43	44	8	16	25,0	35,6	36,7	38,4	41,5	23,7	8,7	0,017	147 423
ZCL	0,64	0,08	21	20	13	1	21,0	17,9	24,7	19,7	16,5	25,1	11,4	0,018	604 651
ZL	1,06	0,09	88	71	31	0	26,6	31,0	38,9	50,3	52,6	19,9	7,7	0,015	422 539
Grand mean	0,88	0,08	293	231	145	2927	33,5	37,2	44,4	47,9	55,2	23,7	8,4	0,017	538 947
Coefficient of Variation															
C	18	2	889	249	226	3274	230	168	131	91	138	40	36	1	13 764
CL	166	1	68	96	61	24	92	126	135	109	48	71	17	2	22 992
L	83	1	132	68	90	3	131	126	103	97	125	58	38	1	39 451
LS	5	0	21	201	208	1	24	6	233	166	75	54	52	1	27 840
S			2	82	11	1									
SCL	4	1	72	192	9	1	92	159	265	153	147	17	59	0	0
SL	54	1	72	224	119	2	224	182	173	160	202	42	53	1	36 535
Z	110	1	233	10	106	0	752	647	631	587	848	12	296	0	476 334
ZC	47	1	729	87	19	139	113	132	117	112	106	49	51	1	15 603
ZCL	83	1	183	36	41	15	98	72	86	63	44	56	72	1	45 101
ZL	93	1	449	112	180	5	176	162	165	182	170	44	49	1	34 461
Grand mean	92	1	1173	437	657	21658	206	192	187	175	173	52	54	1	45 574
VR	3,16	1,55	169	156	206	421	17,2	14,4	13,5	9,8	13,1	4,2	3,5	4,36	3
Signif	***	ns	***	***	***	***	***	***	***	***	***	***	***	***	**
SE mean	0,14	0,04	1,23	1,13	0,80	2,63	0,77	0,89	0,98	1,06	1,02	0,72	0,44	0,02	120
LSD (P=0.05)	0,38	0,12	3,41	3,13	2,22	7,29	2,13	2,47	2,72	2,94	2,83	1,98	1,21	0,05	332

Table A2.4   Continued……….

Statistic/ Texture class (USBR)	EC 1:5 dS/m	pH	Texture (USBR)			IQR	Moisture content (v/v) at pF						AWC	Bulk density	Penetr- ometer
			sand %	silt %	clay %		4,2	3,5	3,0	2,5	2,0	0,0	%	g/cm3	kN/m2
Standard deviation of sample															
C	0,30	0,36	8	8	12	101	6,9	6,5	6,5	5,5	7,0	4,4	2,3	0,12	363
CL	1,10	0,23	4	6	4	1	4,2	5,2	6,0	5,7	4,0	5,8	1,6	0,15	517
L	0,89	0,29	7	5	4	0	4,3	4,6	4,7	4,9	6,1	5,1	2,4	0,13	657
LS	0,09	0,19	4	5	3	0	1,2	0,6	5,3	4,8	3,5	5,1	2,3	0,14	439
S															

SCL	0,11	0,25	6	6	1	0	4,1	5,5	8,0	6,5	7,4	2,9	3,4	0,08	
SL	0,58	0,29	7	8	4	0	5,3	4,8	5,3	5,7	7,4	4,3	2,8	0,11	577
Z	1,35	0,22	5	3	2	0	10,8	10,9	11,4	11,9	16,3	2,5	6,8	0,07	3 494
ZC	0,56	0,25	7	7	3	4	5,0	6,0	6,1	6,2	6,4	4,9	2,9	0,13	384
ZCL	0,80	0,28	5	4	4	1	4,6	4,2	5,0	4,4	4,1	5,0	3,4	0,13	778
ZL	1,03	0,29	9	8	6	0	5,2	5,6	6,2	7,1	7,3	4,5	2,8	0,12	650
Grand mean	0,94	0,29	17	15	12	54	5,8	6,1	6,7	6,9	7,4	4,9	2,9	0,13	734

75% probable range: upper limit

C	0,60	7,77	9	29	70	343	23,1	27,0	34,2	35,3	37,7	51,1	15,3	1,38	1 072
CL	1,09	7,89	27	45	33	6	20,0	23,3	28,4	31,5	35,5	48,5	16,1	1,47	1 326
L	1,25	7,71	41	45	20	4	15,4	18,6	22,9	26,6	31,1	46,2	16,0	1,53	1 304
LS	0,20	7,41	82	15	6	4	6,0	7,6	13,7	15,3	17,1	49,8	11,1	1,43	833
S															
SCL	0,32	7,59	59	22	23	5	19,3	20,8	26,6	29,5	39,4	50,0	20,1	1,38	1 285
SL	0,82	7,71	62	30	13	4	14,3	14,4	17,8	21,8	29,5	44,5	15,5	1,55	1 096
Z	2,08	7,77	13	84	6	3	19,1	21,9	24,3	27,8	36,7	51,2	18,0	1,34	3 677
ZC	0,86	7,75	8	53	44	13	23,8	28,8	33,2	36,2	41,3	50,1	18,0	1,41	1 067
ZCL	1,02	7,76	13	58	33	6	22,8	26,1	30,4	32,9	38,6	46,4	17,1	1,52	1 589
ZL	1,47	7,74	23	66	19	4	16,8	20,9	25,6	30,0	33,2	47,0	16,6	1,48	1 433
Grand mean	1,26	7,74	30	58	26	31	18,1	21,3	25,9	29,6	34,3	47,1	16,6	1,49	1 417

75% probable range: lower limit

C	0,41	7,55	4	24	62	278	18,7	22,9	30,0	31,8	33,2	48,2	13,8	1,31	840
CL	0,38	7,74	24	41	30	6	17,3	19,9	24,5	27,9	32,9	44,8	15,1	1,37	996
L	0,68	7,53	36	41	17	4	12,6	15,7	19,9	23,5	27,3	42,9	14,4	1,44	885
LS	0,14	7,29	80	12	4	3	5,3	7,2	10,4	12,2	14,9	46,6	9,6	1,34	553
S															
SCL	0,25	7,43	55	18	23	5	16,7	17,3	21,5	25,3	34,6	48,2	18,0	1,33	1 285
SL	0,44	7,53	58	25	11	4	10,9	11,4	14,4	18,2	24,8	41,8	13,7	1,48	728
Z	1,22	7,63	10	83	4	3	12,2	15,0	17,0	20,2	26,3	49,6	13,7	1,30	1 448
ZC	0,50	7,59	4	49	42	10	20,6	25,0	29,4	32,3	37,2	47,0	16,1	1,33	822
ZCL	0,51	7,59	10	55	31	6	19,9	23,4	27,3	30,1	36,0	43,2	14,9	1,43	1 093

ZL	0,81	7,56	17	61	15	4	13,5	17,4	21,7	25,4	28,6	44,2	14,9	1,41	1 019
Grand mean	0,66	7,56	20	48	18	-4	14,4	17,4	21,6	25,2	29,5	44,0	14,7	1,41	948

Farm	Bulk density, g/cm3	Percentage of fields with bulk density, g/cm3		
		<1.3	1.3-1.5	>1.5
Farm 01 Horizon A	1,30	100	0	0
Farm 01 Horizon B	1,38	100	0	0
Farm 02 Horizon A	1,24	100	0	0
Farm 02 Horizon B	1,44	100	0	0
Average for 01,02 (horiz. A)	1,27	100	0	0
Average for 01,02 (horiz. B)	1,41	100	0	0
Farm 03 Horizon A	1,45	100	0	0
Farm 04 Horizon A	1,49	100	0	0
Average for 03,04 (horiz. A)	1,47	100	0	0
Farm 07 Horizon A	1,41	100	0	0
Farm 07 Horizon B	1,37	100	0	0
Farm 08 Horizon A	1,45	100	0	0
Farm 08 Horizon B	1,42	100	0	0
Average for 07,08 (horiz. A)	1,43	100	0	0
Average for 07,08 (horiz. B)	1,40	100	0	0
Farm 09 Horizon A	1,48	100	0	0
Farm 09 Horizon B	1,43	100	0	0
Farm 10 Horizon A	1,45	100	0	0
Farm 10 Horizon B	1,49	100	0	0
Average for 09, 10 (horiz. A)	1,46	100	0	0
Average for 09, 10 (horiz. B)	1,46	100	0	0
Farm 14 Horizon A	1,48	100	0	0
Farm 14 Horizon B	1,46	100	0	0
Farm 17 Horizon A	1,58	100	0	0

Table A2.5 Average Bulk Density by Sample Farms

Farm 17 Horizon B	1,631	100	0	0
Farm 18 Horizon A	1,56	100	0	0
Farm 18 Horizon B	1,60	100	0	0
Average for 17, 18 (horiz. A)	1,57	100	0	0
Average for 17, 18 (horiz. B)	1,62	100	0	0
Farm 21 Horizon A	1,50	100	0	0
Farm 21 Horizon B	1,56	100	0	0
Farm 22 Horizon A	1,57	100	0	0
Farm 22 Horizon B	1,49	100	0	0
Average for 21, 22 (horiz. A)	1,53	100	0	0
Average for 21, 22 (horiz. B)	1,53	100	0	0
Farm 23 Horizon A	1,48	100	0	0
Farm 24 Horizon A	1,42	100	0	0
Average for 23, 24 (horiz. A)	1,45	100	0	0
Farm 25 Horizon A	1,53	100	0	0
Farm 25 Horizon B	1,53	100	0	0
Farm 26 Horizon A	1,53	100	0	0
Farm 26 Horizon B	1,46	100	0	0
Average for 25, 26 (horiz. A)	1,53	100	0	0
Average for 25, 26 (horiz. B)	1,49	100	0	0
Farm 27 Horizon A	1,55	100	0	0
Farm 27 Horizon B	1,43	100	0	0
Farm 28 Horizon A	1,53	100	0	0
Farm 28 Horizon B	1,38	100	0	0
Average for 27, 28 (horiz. A)	1,54	100	0	0
Average for 27, 28 (horiz. B)	1,41	100	0	0
Farm 31 Horizon A	1,38	100	0	0
Farm 32 Horizon A	1,44	100	0	0
Average for 31, 32 (horiz.	1,41	100	0	0

A)				
Farm 35 Horizon A	1,46	100	0	0
Farm 35 Horizon B	1,39	100	0	0
Farm 36 Horizon A	1,41	100	0	0
Farm 36 Horizon B	1,41	100	0	0
Average for 35, 36 (horiz. A)	1,44	100	0	0
Average for 35, 36 (horiz. B)	1,40	100	0	0
Note	Horizon A -Topsoil			
	Horizon B - Subsoil			

Table A2.6 Summary Penetrometer Readings in Soil Profiles

Republic Oblast	Farm code	Penetrometer readings, kN/m2 average	maximum	minimum	% of cases with average penetrometer readings in the layer 0-70 (0-50) cm, kN/m2 (1) <500	500-1500	>1500
Kazakhstan	1	890,6	2148,5	194,0	0	90	10
Kzyl-Orda	2	854,4	1559,5	272,5	0	100	0
	Average	*872,5*	*1854,0*	*233,3*	*0*	*95*	*5*
Kazakhstan	3	1380,0	2601,0	445,5	0	70	30
Chimkent	4	1337,7	3000,0	309,5	0	60	40
	Average	*1358,8*	*2800,5*	*377,5*	*0*	*65*	*35*
Average for Kazakhstan		**1115,7**	**2327,3**	**305,4**	**0**	**80**	**20**
Kyrgyzstan	7	1176,7	3000,0	54,0	10	60	30
Osh	8	1150,6	3000,0	397,0	0	75	25
	Average	*1163,7*	*3000,0*	*225,5*	*6*	*67*	*28*
Kyrgyzstan	9	841,3	1853,0	254,5	0	100	0
Bishkek	10	1078,7	3000,0	253,5	0	90	10
	Average	*960,0*	*2426,5*	*254,0*	*0*	*95*	*5*
Average for Kyrgyzstan		**1061,8**	**2713,3**	**239,8**	**3**	**79**	**15**
Tadjikistan	14	722,0	1468,0	81,0	33	67	0
Turkmenistan	17	718,4	1812,5	131,0	40	60	0
Mary	18	684,4	1281,0	126,0	10	90	0
	Average	*701,4*	*1546,8*	*128,5*	*25*	*75*	*0*
Uzbekistan	21	1335,5	3000,0	124,5	20	40	40
Surkhandarya	22	1587,1	3000,0	189,0	20	30	50
	Average	*1461,3*	*3000,0*	*156,8*	*20*	*35*	*45*
Uzbekistan	23	1176,2	3000,0	213,5	0	90	10
Syrdarya	24	1561,8	3000,0	221,0	0	50	50
(new zone Gol St)	*Average*	*1369,0*	*3000,0*	*217,3*	*0*	*70*	*30*

Uzbekistan	**25**	1569,1	3000,0	350,0	0	40	60
Khorezm	**26**	1295,3	3000,0	201,0	0	80	20
	Average	*1432,2*	*3000,0*	*275,5*	*0*	*60*	*40*
Uzbekistan	**27**	1613,3	3000,0	226,0	0	50	50
Karakalpakistan	**28**	1197,9	2363,5	62,5	0	80	20
	Average	*1405,6*	*2681,8*	*144,3*	*0*	*65*	*35*
Uzbekistan	**31**	1076,3	2302,5	283,0	0	80	20
Syrdarya	**32**	745,0	2143,5	144,0	40	50	10
(old zone Gol St)	*Average*	*910,6*	*2223,0*	*213,5*	*20*	*65*	*15*
Uzbekistan	**35**	1584,9	3000,0	368,5	0	40	60
Bukhara	**36**	1275,7	3000,0	312,5	0	60	40
	Average	*1430,3*	*3000,0*	*340,5*	*0*	*50*	*50*
Average for Uzbekistan		**1334,8**	**2817,5**	**224,6**	**7**	**57**	**36**

Note (1): Readings were taken at 25cm intervals down profile

Table A2.7   Variation of Soil Texture in Sample Fields (USBR classification)

Republic Oblast	Farm Code	Horizon	Percentage distribution by soil texture class											
			C	CL	SCL	ZC	ZCL	ZL	L	S	SL	LS	Z	No. of samples
Kazakhstan Kzyl-Orda	01, 02	A	20	15	5	35	15	10	0	0	0	0	0	20
		B	25	0	0	30	10	25	10	0	0	0	0	20
Kazakhstan Chimkent	03, 04	A	0	0	0	0	0	80	20	0	0	0	0	20
		B	0	5	0	0	0	65	30	0	0	0	0	20
Kyrgyzstan Osh	07, 08	A	5	14	5	10	24	10	5	5	24	0	0	21
		B	14	5	14	10	14	19	5	5	10	5	0	21
Kyrgyzstan Bishkek	09, 10	A	0	20	0	0	0	35	45	0	0	0	0	20
		B	0	5	0	5	5	40	35	0	10	0	0	20
Tadjikistan	14	A	0	0	0	0	0	0	100	0	0	0	0	3
		B	0	0	0	0	33	0	33	0	0	33	0	3
Turkmenistan Mary	17, 18	A	0	5	0	0	0	25	55	0	15	0	0	20
		B	0	0	0	0	0	45	25	0	30	0	0	20
Uzbekistan Surkhandarya	21 ,22	A	0	5	0	0	60	20	10	0	5	0	0	20
		B	0	5	0	5	70	10	10	0	0	0	0	20
Uzbekistan Syrdariya	23, 24	A	0	5	0	0	10	30	45	0	10	0	0	20
		B	0	0	0	0	20	45	30	0	0	0	5	20
Uzbekistan Khorezm	25, 26	A	0	5	0	0	10	60	25	0	0	0	0	20
		B	0	0	0	0	25	50	20	0	0	0	5	20
Uzbekistan Karakalpakia	27, 28	A	0	0	0	0	5	85	5	0	5	0	0	20
		B	0	0	0	10	15	55	0	0	5	10	5	20
Uzbekistan Syrdariya	31, 32	A	0	10	0	0	0	80	0	0	0	0	10	20
		B	0	0	0	0	0	75	25	0	0	0	0	20
Uzbekistan Bukhara	35, 36	A	0	10	0	0	15	75	0	0	0	0	0	20
		B	0	0	5	0	15	70	10	0	0	0	0	20
Overall average		A	2	8	1	4	13	46	20	0	5	0	1	224
		B	4	2	2	5	16	45	18	0	5	2	1	224

Notes:

Horizons: A-topsoil 0-30 cm; B-subsoil 30-70 cm; Textures: ZL-silt loam, L-loam, S-sand, SL- sandy loam, LS-loamy sand, Z-silt

C-clay, CL-clay loam, SCL-sandy clay loam, ZC-silty clay, ZCL-silty clay loam

Table A2.8 Correlation Matrix Between Soil Physical Characteristics

	$EC_{(1:5)}$ dS/m	pH	Content, % sand	silt	clay	Moisture content (% v/v) at pF 4,2	3,5	3	2,5	2	0	AWC, %	Bulk density, g/cm^3	Penet-rometer readings kN/m^2
$EC_{(1:5)}$, dS/m	1													
pH	-0,35	1												
sand,%	-0,08	-0,08	1											
silt,%	0,22	-0,01	-0,71	1										
clay,%	-0,17	0,12	-0,50	-0,25	1									
pF=4.2	0,26	0,08	-0,38	0,01	0,50	1								
pF=3.5	0,32	0,06	-0,44	0,13	0,44	0,95	1							
pF=3	0,30	0,07	-0,43	0,11	0,45	0,92	0,95	1						
pF=2.5	0,35	0,05	-0,41	0,16	0,36	0,89	0,92	0,96	1					
pF=2	0,26	0,08	-0,36	0,04	0,43	0,93	0,92	0,89	0,90	1				
pF=0	0,10	-0,01	-0,12	0,05	0,10	0,04	0,02	0,03	0,03	0,09	1			
AWC, %	0,14	0,04	-0,14	0,07	0,11	0,40	0,48	0,49	0,55	0,70	0,16	1		
Bulk density, g/cm^3	-0,09	0,03	0,15	-0,10	-0,08	0,01	0,03	0,00	0,00	0,05	-0,94	-0,15	1	
Penetrometer readings,kN/m^2	-0,02	-0,02	-0,13	0,18	-0,04	-0,07	0,03	0,03	0,04	-0,05	-0,08	0,01	0,11	1

Note: statistically significant correlations are marked -

Table A2.9 Correlation Matrix Between Soluble Salts in Soil Samples

Parameter	pH	EC	TDS	Soluble ions (me/100g soil)			Sum	Sum	Ratio	Ratio	SPP	SSP	Ratio

			(%)	HCO3	Cl	SO4	Ca	Mg	Na	K	cations	anions	C/A	Na/K			Ca:Mg
pH	-	0,14	0,09	-0,12	0,35	0,06	0,13	0,16	-0,37	0,02	0,15	0,12	0,10	-0,04	0,01	-0,16	-0,19
EC		-	0,73	0,07	0,42	0,71	0,43	0,76	0,47	0,15	0,76	0,75	0,04	0,01	-0,19	-0,25	-0,23
TDS (%)			-	0,12	0,37	0,97	0,74	0,83	0,51	0,25	0,97	0,98	-0,04	0,06	-0,25	-0,38	-0,03
HCO3				-	-0,01	0,07	0,10	0,11	-0,02	0,17	0,11	0,09	0,00	-0,09	0,06	0,04	-0,11
Cl					-	-0,22	0,06	0,50	0,66	0,03	0,45	0,40	0,22	0,05	-0,13	0,21	-0,17
SO4						-	0,78	0,80	0,45	0,28	0,96	0,98	-0,11	0,08	-0,22	-0,44	0,00
Ca							-	0,41	-0,05	0,28	0,71	0,72	-0,02	-0,10	0,17	0,71	0,36
Mg								-	0,48	0,19	0,86	0,85	0,06	-0,01	0,19	-0,33	-0,38
Na									-	0,04	0,58	0,55	0,15	0,41	0,24	-0,49	-0,18
K										-	0,28	0,27	0,07	-0,32	0,75	0,25	0,02
Sum Cat											-	0,99	0,07	0,08	-0,22	-0,34	-0,04
Sum An												-	-0,05	0,08	-0,23	-0,37	-0,04
C/A													-	-0,02	0,13	0,10	-0,05
Na/K														-	0,42	-0,38	-0,10
SPP															-	0,04	-0,02
SSP																-	-0,19
Ca:Mg																	-

**Table A2.10   Exchangeable Cations, Cation Exchange Capacity and
Soil Salinity Class in Farms 23 and 28**

Farm No	Field No	Exchangeable cations (me/100 g)				CEC (me/100g soil)		Clay	CEC me/100g clay	ESP	pH	ECe	FAO soil class
		Ca	Mg	K	Na	By anal.	By sum cations	%		%		(dS/m)	
23	1	5.8	6.4	0.2	0.3	12.6	12.6	13	89	2	8.2	0.86	Non saline
23	2	6.0	5.4	0.2	0.2	10.4	11.8	18	60	2	8.3	1.34	Non saline
23	3	6.2	6.6	0.1	0.3	13.0	13.2	12	102	2	8.4	1.64	Non saline
23	4	5.6	6.6	0.1	0.1	13.0	12.4	15	76	1	8.4	2.28	Non saline
23	5	5.4	7.4	0.3	1.9	14.4	15.0	11	127	13	8.4	1.22	Non saline
23	6	1.0	3.2	0.2	4.9	10.0	9.3	12	69	52	8.4	2.36	Non saline-sodic
23	7	2.4	4.6	0.2	5.7	12.2	12.9	19	63	44	8.2	2.04	Non saline-sodic
23	8	1.6	3.8	0.2	4.9	9.8	10.5	12	79	46	8.4	0.46	Non saline-sodic
23	9	5.4	5.2	0.3	4.1	13.6	15.0	12	117	27	8.2	2.78	Non saline-sodic
23	10	3.8	4.0	0.3	4.2	12.4	12.4	8	143	34	8.2	1.12	Non saline-sodic
28	1	2.6	3.2	0	3.5	0	9.3	18	46	38	7.8	1.36	Non saline-sodic
28	2	1.4	3.6	0	3.3	0	8.3	10	73	40	7.8	0.88	Non saline-sodic
28	3	3.0	5.3	0.1	4.3	0	12.7	15	78	34	7.7	4.84	Saline-sodic
28	4	5.2	2.8	0	3.5	0	11.4	14	74	30	7.9	1.22	Non saline-sodic

28	5	2.6	5.5	0	3.4	0	11.5	27	39	29	7.8	1.0	Non saline-sodic
28	6	2.6	8.1	0.1	3.7	0	14.5	13	104	26	7.8	1.64	Non saline-sodic
28	7	2.8	4.7	0	3.8	0	11.4	14	74	34	7.9	1.78	Non saline-sodic
28	8	5.6	6.1	0	5.2	0	17.0	17	94	31	7.7	3.12	Non saline-sodic
28	9	3.5	4.3	0.1	3.7	0	11.6	12	88	32	7.9	1.42	Non saline-sodic
28	10	4.2	7.1	0.1	3.5	0	14.9	11	126	24	7.8	1.92	Non saline-sodic

Note: Farm 23 is Gafar Guliyam, Syrdariya Oblast, Uzbekistan
 Farm 28 is Shortanbey, Karakalpakistan

Table A2.11 Crop Yield Achievement, Rooting Depth and Soil Characteristics

Republic	Oblast	Farms	Field	Penetro meter reading kN/m^2	Depth of max. Penetro meter reading cm	Max. rooting depth cm	Average yield by sample field t/ha	Bulk density g/cm^3	ECe dS/m	Sample plot yield t/ha	Y/ Ymax
Kazakhstan	S Kazakhstan	3	6	2261	40	155.8	2.12	1.32	1.56	2.11	0.54
Kazakhstan	S Kazakhstan	3	4	1795.5	35	170	1.99	1.39	1.48	1.94	0.50
Kazakhstan	S Kazakhstan	3	10	1673.5	30	126	2.21	1.60	1.46	2.39	0.61
Kazakhstan	S Kazakhstan	3	3	2217	20	171.4	3.16	1.38	0.92	3.39	0.87
Kazakhstan	S Kazakhstan	3	2	2323.5	30	170	1.43	1.39	1.20	1.61	0.41
Kazakhstan	S Kazakhstan	3	1	2523	30	171.8	2.82	1.64	2.48	2.61	0.67
Kazakhstan	S Kazakhstan	4	9	2123.5	40	143	1.91		2.14	2.39	0.61
Kazakhstan	S Kazakhstan	4	6	1704.5	30	154.6	2.57		1.66	3.00	0.77
Kazakhstan	S Kazakhstan	4	10	1447.5	40	150	2.31		0.76	2.61	0.67
Kazakhstan	S Kazakhstan	4	4	2078.5	35	163.4	3.34		2.28	3.61	0.93
Kazakhstan	S Kazakhstan	4	3	1412.5	20	159.2	3.44		1.76	3.89	1.00
Kazakhstan	S Kazakhstan	4	2	2145.5	20	150	3.66		1.24	3.89	1.00
Kyrgyzstan	Osh	9	9	1069.5	30	110	2.69	1.73	0.46	2.83	1.00
Kyrgyzstan	Osh	9	4	1288	50	115	2.50	1.50	0.42	2.67	0.94
Kyrgyzstan	Osh	9	10	1254	25	112	2.67	1.43	0.36	2.75	0.97
Kyrgyzstan	Osh	9	1	1381	30	114	3.70	1.24	0.48	2.67	0.94
Kyrgyzstan	Osh	10	10	1255.5	40	122	2.26	1.23	0.48	2.42	0.85
Kyrgyzstan	Osh	10	6	941	30	124	2.03	1.31	0.42	2.13	0.75
Kyrgyzstan	Osh	10	7	1805	40	118	1.83	1.44	0.38	1.88	0.66
Kyrgyzstan	Osh	10	5	1941.5	25	120	2.19	1.52	0.36	2.21	0.78
Kyrgyzstan	Osh	10	8	791.5	35	124	2.33	1.53	0.38	2.45	0.86
Kyrgyzstan	Osh	10	1	1715.5	5	122	2.44	1.46	0.44	2.50	0.88
Kyrgyzstan	Osh	10	2	758	50	120	2.26	1.46	0.42	2.48	0.88
Kyrgyzstan	Osh	10	3	1120.5	25	122	2.32	1.38	0.50	2.56	0.90
Kyrgyzstan	Osh	10	4	1775	35	124	2.28	1.65	0.38	2.79	0.99
Tadjikistan	Leninabad	14	5			137.6	1.44			2.18	0.83
Tadjikistan	Leninabad	14	6			132.4	2.39			2.62	1.00
Tadjikistan	Leninabad	14	7	1468	50	124.8	2.24		3.50	1.99	0.76
Tadjikistan	Leninabad	14	8			83.8	0.11			0.11	0.04
Tadjikistan	Leninabad	14	1	1058	40	114	2.00		1.56	1.75	0.67
Tadjikistan	Leninabad	14	3			97.6	1.17			1.74	0.67
Tadjikistan	Leninabad	37	9			108.7	1.61			0.92	0.35
Tadjikistan	Leninabad	37	8			109.4	2.36			1.87	0.72
Tadjikistan	Leninabad	37	2			110.2	2.44			1.83	0.70
Tadjikistan	Leninabad	37	1			110.6	1.94			0.92	0.35
Turkmenistan	Mary	17	5	1204.5	25	88.8	3.30	1.68	1.86	3.65	0.80
Turkmenistan	Mary	17	8	830	30	70.6	3.31	1.52	0.56	4.56	1.00
Turkmenistan	Mary	17	7	1665.5	35	47.6	1.58	1.56	3.16	2.17	0.48
Turkmenistan	Mary	17	6	1395	30	83.2	2.52	1.64	2.00	3.31	0.73
Turkmenistan	Mary	17	10	809	40	63.6	2.82	1.69	0.62	3.75	0.82
Turkmenistan	Mary	18	10	1281	35	110.2	2.80	1.73	5.24	3.08	0.68
Turkmenistan	Mary	18	8	1223	50	93.8	3.76	1.70	2.62	4.33	0.95
Turkmenistan	Mary	18	9	978.5	50	99.6	2.61	1.63	0.64	2.95	0.65
Turkmenistan	Mary	18	4	1106	35	102.2	1.64	1.36	1.14	1.87	0.41

Republic	Oblast	Farms	Field	Penetro meter reading kN/m²	Depth of max. Penetro meter reading cm	Max. rooting depth cm	Average yield by sample field t/ha	Bulk density g/cm³	ECe dS/m	Sample plot yield t/ha	Y/ Ymax
Uzbekistan	Surkhandariya	21	1	1629	70	127.6	3.14		0.36	3.04	0.68
Uzbekistan	Surkhandariya	21	10	831	40	114	2.12		4.04	2.17	0.48
Uzbekistan	Surkhandariya	21	6	3000	5	117.6	2.68		0.42	2.98	0.66
Uzbekistan	Surkhandariya	21	2	1620	40	138.8	3.77		0.42	4.49	1.00
Uzbekistan	Surkhandariya	21	4	2266.5	5	133.6	2.51		0.44	3.01	0.67
Uzbekistan	Surkhandariya	22	6	826.5	50	73.6	1.83	1.63	0.88	1.97	0.44
Uzbekistan	Surkhandariya	22	3	1810.5	20	118	2.54		0.48	2.45	0.54
Uzbekistan	Surkhandariya	22	10	869	40	99.7	2.10	1.55	0.92	2.68	0.60
Uzbekistan	Surkhandariya	22	4	635	25	112.2	3.48	1.48	2.56	3.25	0.72
Uzbekistan	Surkhandariya	22	5	860.5	25	73.4	1.14	1.57	2.52	0.87	0.19
Uzbekistan	Syrdariya	23	6	1327	30	60	1.47	1.42	1.50	0.97	0.39
Uzbekistan	Syrdariya	23	7	1713	40	74.8	3.13	1.26	3.66	1.97	0.79
Uzbekistan	Syrdariya	23	10	1355.5	30	62.82	2.62	1.41	3.52	1.61	0.64
Uzbekistan	Syrdariya	23	2	1874	35	54	1.79	1.34	2.96	1.36	0.54
Uzbekistan	Syrdariya	23	4	1132	25	62	1.49	1.51	2.08	0.67	0.27
Uzbekistan	Syrdariya	23	1	1657.5	25	57.8	1.76	1.40	2.94	1.33	0.53
Uzbekistan	Syrdariya	24	10	1831	35	46.4	1.42	1.38	4.74	1.25	0.50
Uzbekistan	Syrdariya	24	8	1909.5	20	51.4	2.11	1.57	1.14	2.23	0.89
Uzbekistan	Syrdariya	24	4	1441	40		0.00	1.17	5.32		0.00
Uzbekistan	Syrdariya	24	5	1370	40	38.8	1.60	1.28	3.12	2.50	1.00
Uzbekistan	Syrdariya	24	1	3000	5		0.00	1.43	7.00	0.00	0.00
Uzbekistan	Khorezm	25	6	1228.5	35	118.6	1.92		4.58	2.08	0.58
Uzbekistan	Khorezm	25	9	2115.5	30	115.2	3.05		1.12	3.36	0.94
Uzbekistan	Khorezm	25	2	2136.5	30	116.2	2.49		1.26	2.80	0.79
Uzbekistan	Khorezm	25	7	2010.5	30	112.6	3.03		0.82	3.13	0.88
Uzbekistan	Khorezm	25	4	7785.5	70	113.2	3.18		0.54	3.54	0.99
Uzbekistan	Khorezm	25	5	1310.5	35	112.8	3.16		0.40	2.98	0.83
Uzbekistan	Khorezm	25	1	3000	30	138.2	3.01		1.78	3.17	0.89
Uzbekistan	Khorezm	26	10	2191.5	25	113.2	3.18		1.00	3.12	0.88
Uzbekistan	Khorezm	26	9	1499.5	35	119	3.31		0.76	3.57	1.00
Uzbekistan	Khorezm	26	2	2093	5	116	2.82		0.58	2.67	0.75
Uzbekistan	Khorezm	26	3	1815	20	118.6	2.98		0.76	3.13	0.88
Uzbekistan	Khorezm	26	4	3000	5	120	3.57		0.64	3.52	0.99
Uzbekistan	Karakalpakia	27	7	1846	5	42	1.87		0.72	1.90	0.98
Uzbekistan	Karakalpakia	27	10	2421.5	40	41.6	1.78		2.80	1.94	1.00
Uzbekistan	Karakalpakia	27	2	3000	30	33	1.49		0.50	1.65	0.85
Uzbekistan	Karakalpakia	27	6	2396.5	20	33.2	1.61		1.88	1.88	0.97
Uzbekistan	Karakalpakia	27	3	1662	35	30.8	1.32		0.56	1.35	0.69
Uzbekistan	Karakalpakia	27	4	1397.5	20	29.6	1.72		2.24	1.63	0.84
Uzbekistan	Bukhara	35	8	2087	30	83.6	2.74		0.76	3.06	0.81
Uzbekistan	Bukhara	35	10	2354.5	20	91.6	3.11		2.00	3.50	0.93
Uzbekistan	Bukhara	35	5	3000	20	83.2	2.43		3.00	3.11	0.82
Uzbekistan	Bukhara	35	3	1829	20	82.4	2.18		4.66	3.11	0.82
Uzbekistan	Bukhara	36	7	2427	30	88.8	17.19		1.16	2.78	0.74
Uzbekistan	Bukhara	36	8	1089	30	90	2.37		3.82	3.61	0.96
Uzbekistan	Bukhara	36	9	1726	20	85.2	2.71		0.72	3.78	1.00
Uzbekistan	Bukhara	36	10	986	40	92.2	3.12		0.72	3.61	0.96

Above table header: **Table A2.11 Continued…**

| Uzbekistan | Bukhara | 36 | 3 | 1172.5 | 70 | 85.8 | 2.41 | | 0.70 | 3.28 | 0.87 |