6. FARM PROFILES

6.1 Farm Size and Land Development

The total area of the 22 sample farms is 169,964 ha, the total gross irrigated area is 84,040 ha, and the total net irrigated area is 67,635ha. Average farm areas are shown in Table 6.1. The average land development ratio (between the total gross irrigated area and the total farm area) on average for WUFMAS sample farms is 0.49, with considerable variation between republic averages, and between farms within the republics.

Table 6.1 Average Farm Size and Irrigated Area (1997)

Average by republic	Kazakhstan	Kyrgyzstan	Tadjikistan	Turkmenistan	Uzbekistan	Overall
Total farm area (ha)	9,647	11,121	4,151	4,409	6,977	7,726
Irrigated gross (ha)	4,649	2,838	2,344	4,080	4,125	3,820
Irrigated net (ha)	3,043	2,680	2,140	3,170	3,413	3,074
Land Development Ratio	0.66	0.34	0.54	0.93	0.65	0.49
Range	*0.32-0.98*	*0.17-0.67*	*0.36-0.71*	*0.88-0.97*	*0.31-0.97*	
Irrigated Landuse Ratio	0.68	0.94	0.93	0.78	0.84	0.80
Range	*0.72-0.86*	*0.91-0.96*	*0.90-0.96*	*0.68-0.88*	*0.65-0.97*	

Unirrigated land of the farms in Kazakhstan and Kyrgyzstan that have low land development ratio, is used as pasture and for rainfed crops.

The average irrigated land use ratio (between the net irrigated area and the gross irrigable area) is 0.80 but again the range between farms is considerable. By international standards for irrigation schemes, these values are generally low. Privatisation of the farms in Kazakhstan between 1996 and 1997 resulted in a decrease in irrigated area: the area of farm No 1 decreased by 787ha, No 2 by 1902ha, No 3 by 167ha, No 4 by 6232ha. The ratios on farms in Turkmenistan and Karakalpakistan are low because of the system of fallowing salt-affected fields on a rotational basis (termed “dry drainage”).

6.2 Characteristics of Sample Fields

Sample fields, ten per sample farm, were deliberately selected to be small to medium in area, to minimise the likelihood of subsequent subdivision. Out of 220 sample fields in the 1997 survey, the size distribution is shown in Table 6.2. The majority of fields are in the 5-10ha range as requested.

Table 6.2 Sample Field Characteristics

Field area (ha)	Percent of fields	Field slope (%)	Percent of fields	Natural drainage-state	Percent of fields
<5	13	<0.01	9	Excessive	1
5-10	58	0.01-0.05	9	Good	38
10-15	18	0.05-0.10	23	Moderate	28
15-20	9	0.10-0.50	30	Poor	30
20-25	3	0.50-1.00	6	Very poor	2
		>1.00	24		

Table 6.2 also shows the distribution of sample fields with respect to slope. The majority of fields have slopes in the range 0.05 to 0.5 percent (0.0005 – 0.005), ideal for surface irrigation. Almost level fields are about 18 percent of those sampled and 6 percent had acceptable slopes of from 0.5 to 1 percent (0.005 – 0.01). Almost a quarter of sample fields, located on the farms in Tadjikistan and Kyrgyzstan, had slopes greater than one percent

(0.01). Such slopes are difficult or impossible to irrigate by surface methods at a reasonable level of water use efficiency.

The natural drainage-state of the land in the fields surveyed is described in Table 6.2. Fields are evenly distributed between good, moderate and poor natural drainage, with very few fields of excessive and very poor drainage.

6.3 Cropping Pattern

The average irrigated cropping pattern of sample farms is shown in Appendix Table A3.1, and is summarised by republics and for 1996 and 1997 in Table 6.3. Crop area as percent of irrigated land is approximately reflected in the distribution of sample fields within farms. The number of sample farms was reduced to 21 in 1997 from 36 in 1996, and one new farm was added in Tadjikistan. Table 6.3 compares data from only the 21 farms that were common to both years so that differences in cropping pattern may reflect a national trend.

Cotton and winter wheat are produced on about two thirds of the irrigated land of the Aral Sea Basin. Out of 220 sample fields in 1997, 91 fields (41 percent) were under cotton, 58 fields (26 percent) were under winter wheat, 24 fields (11 percent) were under lucerne and 23 fields (10 percent) were under rice. There are some striking contrasts between the sample farms in different republics and small differences between years, as shown in Table 6.3.

Table 6.3 Cropping Pattern in 1996 and 1997
(percent of irrigable land)

Crop Group	Kazakhstan (4 farms)		Kyrgyzstan (4 farms)		Tadjikistan (1 farm)		Turkmenistan (2 farms)		Uzbekistan (10 farms)		Average (21 farms)	
	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
Cereals	**28**	**36**	**31**	**41**	**17**	**22**	**49**	**41**	**42**	**39**	**36**	**38**
Winter Wheat	9	4	21	34	12	16	46	38	29	27	23	24
Rice	16	29	0	0	1	1	0	0	9	10	9	11
Other	2	3	10	8	5	6	3	3	3	2	4	3
Fibres/stimulants	**34**	**33**	**24**	**31**	**32**	**37**	**33**	**33**	**43**	**49**	**36**	**41**
Cotton – Upland	34	33	24	31	27	37	33	33	37	41	34	37
Roots/Tubers	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Curcurbits	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**0**
Grain legumes	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**
Vegetables	**0**	**0**	**1**	**1**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**
Oilseeds	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Forage crops	**35**	**30**	**22**	**17**	**5**	**5**	**13**	**14**	**8**	**6**	**17**	**13**
Lucerne	30	29	17	11	3	3	13	12	5	6	14	12
Plantations	**1**	**1**	**21**	**9**	**45**	**32**	**4**	**9**	**6**	**4**	**8**	**6**

Once the predominant crop in Central Asia, cotton cultivation declined rapidly after independence of the Republics but has stabilised at a little more than a third of irrigated land. Its importance is somewhat more in Uzbekistan because of state orders, and less in Kyrgyzstan on account of the less favourable climate. Between 1996 and 1997, there was a 30 percent increase in cotton in the Kyrgyzstan farms, in Uzbekistan 14 percent and 16 percent on the Tadjikistan farm. This reflects the importance of cotton as an easily marketed cash crop. Upland cotton (*Gossypium hirsutum*) is the most favoured type due to the short growing season for cotton and the small price premium of pima cotton. Only the more southern parts of Uzbekistan and Tadjikistan produce pima cotton (*G. barbadense*).

The drive for self-sufficiency in cereals has been the reason for the fall in the importance of cotton. In most areas, winter wheat is the favoured crop because of its yield potential and very good physical return to irrigation water, but in mountainous areas, irrigation is supplementary to rainfall for wheat. Between 1996 and 1997 there was an overall fall in area of winter wheat, except in Kyrgyzstan and Tadjikistan. The reason may have been the drop

in world grain prices since their peak in 1995. The small percentage on the Kazakhstan farms reflects the availability of rainfed wheat from the Steppe, the very cold winters in Kyzl Orda and the perceived benefits of rice production.

Rice is still a highly favoured crop for the Aral Sea littoral zone, and in pockets of less-well-drained land throughout the lowlands. Production increased markedly on Kazakhstan farms between 1996 and 1997. The main incentives for rice production are its buoyant price and ease of marketing, and the need to leach salt-affected fields. In view of the exceptionally high water requirement of rice and the massive discharge to the groundwater that results, in most areas secondary salinity from the high watertable is the consequence of rice production.

Forage production, like cotton, has declined in importance, particularly in Uzbekistan in response to privatisation of the national herds and flocks, and its replacement by wheat. There was a further marked decline in area on the farms in Kazakhstan and Kyrgyzstan between 1996 and 1997. The low price of livestock products and in consequence of this, the transfer price of fodders for stock feed, is responsible for the unpopularity of lucerne. The decline in the traditional rotation of cotton with lucerne is responsible in part for the very low levels of soil organic matter and apparent fall in soil fertility.

Plantation crops and orchards are a minor irrigated land use except on the sample farm in Tadjikistan, where steep slopes, stony soil and climate favour fruit trees. Although more important in both Tadjikistan and Kyrgyzstan, the land area devoted to plantation and other permanent crops decreased sharply between 1996 and 1997. On these sample farms, land so released was used for increasing cotton and wheat production.

Other cereals, root and tuber crops, cucurbits, other vegetables, grain legumes and oilseed crops are of minor importance, together accounting for less than 5 percent of land use overall. The proportion is somewhat greater in the more diverse agricultural economies of Kyrgyzstan and Tadjikistan.

6.4 Labour Resources

The employment patterns on the survey sample farms are shown in Table 6.4. The average sample farm, with an irrigated crop area of 3162ha, employed 1316 men and women on a permanent basis during 1997, and supplemented them with 362 seasonal employees mainly for cotton picking. This was an overall reduction of 6 percent compared with 1996 but the changes were not uniform between republics.

Staff reductions were almost exclusive to the sample farms in the liberalised economies of Kazakhstan, Kyrgyzstan and Tadjikistan. Between 1996 and 1997, employment overall increased by 10 percent in Uzbekistan and 23 percent in Turkmenistan, the main increase in staffing being in both permanent and seasonal labourers. In Uzbekistan, this is mainly explained by the big increase in cotton area since this crop is labour-consumptive, but cotton area on the Turkmenistan farms remained static between 1996 and 1997. It is noteworthy that with the exception of Turkmenistan, there was a marked decrease in the number of drivers employed, maybe reflecting the decline in number of operating tractors and better employment opportunities away from the farm. Management staff and field overseers were markedly reduced during the period in Kazakhstan, in response to the privatisation of the former kolkhozes.

Table 6.4 shows the area of irrigated crop per employee in each category. Overall, there is 1.9ha of irrigated crop per person on the payroll, but farms vary considerably, values ranging from 0.7ha on Sadikov state farm near Bishkek to 9.2ha on the extensive rice farms in Kyzl Orda. These levels of employment per farm and per hectare are very high by international standards, not only of developed economies but also by the standards of subsistence farming. They reflect the agricultural development strategy of the Soviet period, when a rural

community was located and dependent on the state farm. Farm resources and production are in decline yet the rural population continues to grow. In the absence of alternative economic activities in these rural communities, dependency on the fabric of the kolkhoz, despite privatisation, is increasing.

Table 6.4 Employment Patterns on Farms

Category	Kazakhstan (4 farms)	Kyrgyzstan (4 farms)	Tadjikistan (1 farm)	Turkmenistan (2 farms)	Uzbekistan (10 farms)	Average (21 farms)
Average employees per farm in 1997						
Management staff	45	39	66	48	29	38
Field overseers	13	22	23	22	39	28
Mechanics	124	74	106	50	110	100
Drivers	25	36	40	28	21	26
Labourers	681	1463	1545	1228	1102	1124
Seasonal workers	0	375	0	865	438	362
All staff	**889**	**2008**	**1780**	**2240**	**1740**	**1678**
Percentage Change in Employment 1996 to 1997						
Management staff	-24	-2	2	37	-3	-5
Field overseers	-40	6	-12	30	-15	-13
Mechanics	191	1	-35	-19	4	16
Drivers	-46	-10	-30	14	-26	-25
Labourers	-48	-20	-3	21	10	-10
Seasonal workers	-100	-32	0	30	22	7
All staff	**-40**	**-21**	**-6**	**23**	**10**	**-6**
Irrigated Crop Area per Employee in 1997 (ha)						
Management staff	67	70	46	66	116	84
Field overseers	230	125	132	147	87	111
Mechanics	24	36	29	63	31	32
Drivers	120	74	76	113	162	120
Labourers	4	2	2	3	3	3
Seasonal workers	0	7	0	4	8	9
All staff	**3**	**1**	**2**	**1**	**2**	**2**
Range	*2.0-9.2*	*0.7-4.1*	*1.7*	*1.2-1.8*	*0.9-6.1*	

6.5 Use of Agrochemicals

This section describes the acquisition and use of agrochemicals by the whole farm: detailed information about their use in the sample fields is discussed in later chapters.

There was practically no use of pesticides on the sample farms in 1997.

A wide range of fertilisers was available for use on farms in Kazakhstan and Uzbekistan, but the range was limited in the other three republics (Table 6.5). Of the major plant nutrients, predominant was nitrogen, accounting for 91 percent of fertilisers applied in Kazakhstan, 94 percent in Uzbekistan and all the fertiliser in the other republics. No phosphate fertilisers were used in Kyrgyzstan and Turkmenistan, and in the other republics, the proportion was less than 20 percent of all fertilisers. Potash fertilisers represented 7 percent of all fertilisers in Kazakhstan and 2 percent in Uzbekistan, but none were applied in the other republics. There was wide variation between farms in use of different fertilisers probably reflecting their availability.

Table 6.5 Use of Different Fertilisers (percent of total fertiliser use in 1997)

Fertiliser	Kazakhstan	Kyrgyzstan	Tadjikistan	Turkmenistan	Uzbekistan
Ammonium nitrate	40	100	81	100	49
Potassium nitrate	2	0	0	0	0
Urea	0	0	0	0	18
Ammonium sulphate	39	0	0	0	11
Total N fertilisers	**81**	**100**	**81**	**100**	**78**
DAP	0	0	0	0	3
MAP	10	0	0	0	13
Total N+P fertilisers	**10**	**0**	**0**	**0**	**16**
Single Superphosphate	2	0	20	0	3
Total P fertilisers	**2**	**0**	**20**	**0**	**3**
Muriate of potash	0	0	0	0	2
Potassium sulphate	7	0	0	0	0
Total K fertilisers	**7**	**0**	**0**	**0**	**2**
Other	0	0	0	0	0

6.6 Drainage

Table 6.6 summarises the sample farm drainage facilities by republic, but more detail for each farm is given in Appendix 3, Table A3.2.

All the sample farms in Kazakhstan, Turkmenistan and Uzbekistan have installed drainage. It covers 93 percent of irrigable land on average in the Kazakhstan and Uzbekistan farms and 78 percent of the Turkmenistan farms. Only about a quarter of the Tadjikistan farms area have a drainage system, where the watertable is high due to proximity of Kairakkum reservoir. The land of the Kyrgyzstan farms has good natural drainage and there is little need for artificial drainage.

Open drains are three times more common than sub-surface drains and reflects the age of the developments. Subsurface drains are most concentrated in the “new land” schemes of Syrdariya and Surkhandariya, where the average inter-drain spacing is about 200m, mostly about optimum for the soil and groundwater conditions. Subsurface drains installed in the old lands of Bukhara and Leninabad are 300-400m apart, too wide to be effective. Overall, 46 percent of the sub-surface drains are not operational, but the situation is particularly critical in Turkmenistan and Surkhandariya where most of the system is out of action. The reasons are believed to be poor installation, silting and breakage of the pipes and blockage of the collectors.

Open drains are widely distributed on most of the sample farms excepting Mactaaral farm in S Kazakhstan and the Kyrgyzstan farms. Because maintenance is easier and cheaper to organise, a lower proportion of these drains is out of action, 32 percent overall. Again, the most critical situation is on the farms of Turkmenistan but the old lands of Khorezm have some problems too. On account of the restriction that open drains represent to farm machinery, inter-drain spacing is much wider at 546m overall on average. Only on the Tadjikistan farms does inter-drain spacing approach an acceptable value for effective operation.

Drainage by pumping from tubewells was not so widespread, and most are concentrated on the farms of S Kazakhstan, Tadjikistan and Bukhara. When working, there is considerable range in specific yield of the wells from 11 to 71 l/s. There is also considerable variation in the command area of each well, from less than 10ha in Kanibadam area to 140 ha in S

Kazakhstan. Due to lack of cash to pay for electricity and repair pumps, very little installed vertical drainage is now working. The pumps on the farms of Tadjikistan worked for about 6 hours daily during the season, but elsewhere tubewells have been abandoned.

Table 6.6 Farm Drainage Facilities (average per farm in 1997)

Item	Units	Kazakhstan (4 farms)	Kyrgyzstan (4 farms)	Tadjikistan (2 farms)	Turkmenistan (2 farms)	Uzbekistan (10 farms)	Overall (22 farms)
Gross irrigated area	ha	4,649	2,838	2,344	4,080	4,125	3,820
Total drained area	ha	4,406	0	453	3,170	4,378	3,120
Part of gross area drained	%	93	0	23	78	93	68
Open drains:							
Drained area	ha	2,934	0	164	2,795	2,708	2,033
Drain length	km	58	1	30	30	64	45
Length not working	km	4	0	7	21	22	13
Percent not working	%	10	-	25	62	38	32
Density on drained land	m/ha	21	-	219	12	24	48
Average inter-drain spacing	m	486	-	53	1,317	499	546
Subsurface (closed) drains:							
Drained area	ha	0	0	186	375	1,425	699
Drain length	km	0	0	19	11	84	41
Length not working	km	0	0	9	10	36	16
Percent not working	%	-	-	43	85	35	46
Density on drained land	m/ha	-	-	100	31	143	115
Average inter-drain spacing	m	-	-	100	329	220	218
Vertical drains (tubewells):							
Drained area	ha	1,472	0	104	0	245	388
Total no wells	no.	11	0	19	0	5	6
Av. Yield of wells	l/s	0	-	44	-	7	16
Drained area per well	ha	140	-	6	-	50	63
Total working wells	no.	0	-	2	-	0	0
Average working time	h/mnth	0	-	190	-	0	54
On-farm collectors:							
Drain collector length	km	21	0	42	53	83	50
Collector length not working	km	1	-	11	34	33	20
Volume of drainage pumped	tcm	0	-	0	0	4,038	1,817
Pump operating time	h/mnth	0	-	0	0	715	301
Total drain discharge	tcm	3,533	-	607	4,896	16,956	8,726

Enumerators recorded considerable lengths of collectors on the farms, 50km on average per farm, but varying from almost none, up to 250km per farm in Karakalpakistan. The distinction between open field drains and smaller collectors is not always clear so that some variation may be due to the perception of the enumerators. Some 40 percent overall of the collectors are not operational, due partly to weeds and silting up, but in some cases due to failure of the pumping station on the main collector.

6.7 Water Resources and Farm Machinery

These issues are discussed in more detail in Sections 7 and 8 of this report.