## 3.7. Changes of agricultural crops capacity and efficiency of drainage water reuse in places of its origin.

Field investigations on drainage water reuse show, that frequent irrigations during vegetation period, high soil moisture and soluble salt optimal concentration keeping within the limits 6-8 g/l provide satisfactory conditions for plants growth and agricultural crops capacity stability.

Assessment of expenses of irrigation and drainage water in places of its origin efficiency are shown in table 3.10.

Data obtained during long-term investigations show, that in the majority of experiments under drainage water reuse plants' growth, development and capacity were not less to compare with control variant, in some cases cotton capacity even increased. Under drainage water irrigation with concentration 2.1-2.8 g/l the fine-fibrous cotton capacity on sandy soils of Turkmenistan increased up to 30-44 c/ha, on the control variant - 30-40 c/ha.

Table 3.10.

Assessment of irrigation water expenses per agricultural production unit
(direction 3: «Field investigations of drainage water re-use in place of its origin»)

| Plot index | Soil-climatic zone | Water allow-ance district | Data type | Used drainage water salinity, g/l | Irriga-tion norm (net), $m^3$/ha | Yield, c/ha | Increase (+) or decrease (-) of yield, c/ha (%) | Water ex-penses for pro-duction unit, $m^3$/c | Agricul-tural crop | Water productivity per production unit | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | experi-ment and control, kg/ $m^3$ | FAO recom-menda-tions, kg/ $m^3$ |
| **UZBEKISTAN** | | | | | | | | | | | |
| 03.2.Uz. | Ц-II-В | IV | О | 2,0-5,6 | 10900 | 27 | +2(7 %) | 404 | cotton | 0,248 | 0,4-0,6 |
| | | | К | 0,6-1,0 | | 25 | | 436 | | 0,229 | |
| 03.3.Uz. | Ц-II-А | V | О | 2,1-3,1 | 9900 | 30,3 | 0 | 327 | cotton | 0,306 | 0,4-0,6 |
| | | | К | 0,4-0,6 | 8200 | 30,3 | | 271 | | 0,370 | |
| 03.4.Uz. | Ц-II-$А_1$ | VI | О | 0,8-2 | 7900 | 35,3 | -1,6(4,3) | 224 | cotton | 0,447 | 0,4-0,6 |
| | | | К | 0,4-1,0 | 7900 | 36,9 | | 214 | | 0,467 | |
| 03.5.Uz. | Ц-II-$А_1$ | V | О | 2,0-4,4 | 10950 | 28 | 0 | 391 | cotton | 0,256 | 0,4-0,6 |
| | | | К | 0,5-0,9 | 10950 | 28 | | 391 | | 0,256 | |
| 03.7.Uz. | Ц-II-Б | IV | О | 3-7 | 6510 | 28,7 | -2,2(7,1) | 227 | cotton | 0,441 | 0,4-0,6 |
| | | | К | 0,7-1,0 | 6510 | 30,9 | | 211 | | 0,475 | |
| **TURKMENISTAN** | | | | | | | | | | | |
| 03.1.Tur. | Ю-II-Б | V | О | 2,1-2,8 | 9750 | 43,9 | +3,3(7,5) | 222 | cotton | 0,450 | 0,4-0,6 |
| | | | К | 0,5-0,6 | 9750 | 40,6 | | 240 | | 0,416 | |
| 03.2.Tur. | Ю-II-Б | IV | О | 2-3 | 9790 | 37,4 | -5,6(13) | 262 | cotton | 0,382 | 0,4-0,6 |
| | | | К | 0,7-1,4 | 9790 | 43,0 | | 228 | | 0,430 | |

| Plot index | Soil-climatic zone | Water allow-ance district | Data type | Used drainage water salinity, g/l | Irriga-tion norm (net), $m^3$/ha | Yield, c/ha | Increase (+) or decrease (-) of yield, c/ha (%) | Water ex-penses for pro-duction unit, $m^3$/c | Agricul-tural crop | Water productivity per production unit | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | experi-ment and control, kg/ $m^3$ | FAO recom-menda-tions, kg/ $m^3$ |
| **KAZAKHSTAN** | | | | | | | | | | | |
| 03.1.Kaz. | C-II-$A_1$ | IV | O | 0,7-2,0 | 8100 | 26 | 0 | 312 | cotton | | 0,4-0,6 |
| | | | K | 0,7-1,0 | 8100 | 26 | | 312 | | | |
| 03.2.Kaz. | Ц-I-$A_1$ | IV | O | 0,7-2,0 | | 50,4 | -2,7(5) | 465 | rice | | 0,7-1,1 |
| | | | K | 0,7-1 | | 53,1 | | 440 | | | |
| **KYRGYZSTAN** | | | | | | | | | | | |
| 03.1.Kyr. | Ц-II-Г | I | O | 1,8-2,2 | 7100 | 64,6 | -17(21) | 110 | lucerne | 0,909 | 1,5-2,0 |
| | | | K | 0,5 | 7100 | 82,0 | | 87 | | 1,15 | |
| | | | O | 1,8-2,2 | 4800 | 268 | -92(23) | 18 | maize | 5,58 | 10-13 |
| | | | K | 0,5 | 4800 | 360 | | 13 | | 7,50 | |

**Explanations**:

**O** - pilot plots;
**K** - control version

Gradual cotton yield growth up to 27-28 c/ha to compare with initial 7-9 c/ha was obtained as under variant with fresh water so under drainage water use due to negative water-salt balance on background of well operating drainage and agrotechnical methods application in conditions of medium loam and initially strongly saline soils of Central Fergana

In other experiments insignificant cotton growth delay within 1.6-5.6 c/ha was observed, it is typical for strong on mechanical composition soils.

Insignificant rice capacity decrease up to 2.7 c/ha to compare with fresh water was observed (South Kazakhstan).

More sharp alfalfa and maize capacity decrease on 20% and 23%, respectively, was observed in conditions of Chu valley of Kyrgyzstan, where soda content and soils sodification signs ware found.

In respect to irrigation water expenses for crops grown unit the differences between variants are not found. Over different variants for 1 quintal water expenses constituted on average 210 $m^3$ /c for cotton, 13-18 $m^3$/c for maize, 87-110 $m^3$/c for alfalfa and 440-465 $m^3$/c for rice.

In a whole, used water productivity over different pilot sites for crop grown unit fluctuated from 0,210 to 0,475 kg/$m^3$ and corresponds to the last indicators recommended by FAO for cotton (0,4-0,6 kg/$^3$m), that shows satisfactory efficiency of drainage water reuse.

Graph of dependence between cotton capacity decrease and used water salinity (fig. 3.6) was drew up according to results of field investigations on drainage water reuse and its influence on crops capacity. Graph allowed to predict the value of cotton capacity decrease depending on expected irrigation water salinity.
As it is shown, that under used water salinity from 1 to 2 g/l cotton capacity decreased on 2-6%, under 2-4 g/l - from 2 to 12%, and 4-6 g/l - up to 30-40% depending on water availability.

Graph of dependence $Y_m \backslash Y_c = f\ (C_m \backslash C_o)$ was drew up on a base of data of table 3.10, which allowed to predict the cotton capacity depending on relation between drainage and irrigation water salinity (fig.. 3.7).

Dependence between alfalfa capacity decrease (hay and green mass) and irrigation water salinity with regard to the harvest in the control variant (water salinity is 0,8-1,2 g/l) is shown on the figure 3.8.