

G	<p>Summary of research project</p> <p><i>1 Objective and technical fields:</i> Comparison of effects of different doses of nitrogen fertilizers on grain crops to raise their yield; definition of optimal leaching and irrigation rate providing water use improvement and creating favorable conditions for nutrient elements adoption.</p> <p><i>2 Scientific and technical approaches:</i> Development of irrigation regime and definition of optimal norms of nutrient elements insertion into the soil, based on field experiments with grain crops. Meaning of experiment: scientific grounded proposals on irrigation and mineral fertilizers insertion for grain crops.</p> <p><i>3. Environment characteristics:</i> Relief is slightly corrugated with common slope 0.0025 to north -west. Surface altitude is 430 m. Climate is sharply continental. Average annual temperature is 13 -14.8⁰ C; in June - 23⁰ C, in July - 25⁰ C. Annual precipitation is 90 -172 mm. Aridity coefficient is 17 -35. Evaporativity is 1000 - 1175 mm. Relative air humidity is 56 -64 %. Lithology: quaternary sediments of Isfairam -Sokh cones of withdrawal: loam (2.5 m), coarse sand (13.5 m), gravel with sand filling (22 m), loam alternating with sand (38 60 m), alternates of loam, sand and gravel (300 m). Clay content is 20 - 30 %, permeability coefficient is 0.3 0.6 m/day. Gypsum content is 20 %, permeability coefficient is 0.1 -0.15 m/day. Root zone's full field moisture capacity is 26 % of dry soil weight and 34 % of its volume. Groundwater initial level before irrigation was 2.6 3.0 m in autumn; during water storage and leaching periods it was 1.2 2.2 m; within the growing season -1.8 2.2 m. Soils were slightly and middle salinized. Salt content within the arable horizon is 1.3 -1.6 % on solid residue and 0.01 -0.02 % on chlorine -ion. Groundwater salinity was 2.2 -4.1 g/l and 0.06 -0.11 g/l on chlorine -ion. Humus content within 0 - 40 cm -layer was 1.98 -1.89 %, within 40 -60 cm -layer 1.21 -1.3 %.</p> <p><i>4. Parameters of Pilot Projects and Technical Solutions:</i> Pilot site's area is 160 ha (gross) or 153 ha (net). Cotton share is 50 %, grain crops -50 %, irrigation network is concrete flumes with efficiency 0.95 -0.96. Technical state is satisfactory. Drainage network - close horizontal drains. Drainage extent is 6400 m, density is 40 m/ha, distance between drains -280 m. Drains' depth is 2.7 m at the head and 3.0 m at the tail. Drainage tubes are asbestos - cement, length is 4 m, diameter - 279 mm. Drainage tubes were laid on gravel basement (particles diameter is 40 mm). Openings' diameter is 5 - 8 mm. Groundwater regime was observed through piesometric network in 4 points on depth of 3.0 m. Pilot site is surrounded by collectors with depth of 4 m. Test field's area was 8 ha (length was 330 m, width - 240 m). Irrigation furrow length was 330 m, distance between furrows - 90 cm.</p> <p><i>5 Methodology:</i> Field investigations of water, nutrients movement within unsaturated zone; of irrigated field as a whole under different irrigation norms; nutrient insertion norms providing the highest yield of grain. Irrigation regime was performed according to methodology developed by "Zerno" Association. Depending on tasks, number of versions varied within 1995, 1996, 1997. Test versions -1995. Version 1. During growing season insertion of 85 kg/ha nitrogen + 50 kg/h phosphorus + wheat 3 times irrigation - control. Version 2. For the same period - 85 kg/ha nitrogen +50 kg/ha phosphorus + 2 irrigations. Version 3. For the same period - 150 kg/ha nitrogen + 50 kg/ha phosphorus +3 irrigations. Version 4. For the same period - 250 kg/ha nitrogen +50 kg/ha phosphorus + 2 irrigations.</p>
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Test versions - 1996.

Version 1. During growing season - wheat - 4 irrigations. Without fertilizes - control.

Version 2. For the same period - 100 kg/ha nitrogen +50 kg/ha phosphorus +4 irrigations.

Version 3. For the same period - 100 kg/ha nitrogen + 50 kg/ha phosphorus + 3 irrigations.

Version 4. For the same period - 200 kg/ha nitrogen + 50 kg/ha phosphorus +4 irrigations.

Version 5. For the same period - 200 kg/ha nitrogen +50 kg/ha phosphorus +3 irrigations.

Version 6. For the same period - 300 kg/ha nitrogen +50 kg/ha phosphorus + 4 irrigations.

Version 7. For the same period - 300 kg/ha nitrogen +50 kg/ha phosphorus + 3 irrigations.

Test versions -1997

Version 1. Wheat 3 irrigations during growing season without fertilizes -control.

Version 2. For the same period -150 kg/ha nitrogen +20 kg/ha phosphorus + 3 irrigations.

Version 3. For the same period - 200 kg/ha nitrogen + 20 kg/ha phosphorus + 3 irrigations.

Version 4. For the same period - 250 kg/ha nitrogen + 20 kg/ha phosphorus +3 irrigation.

Version 5. For the same period - 250 kg/ha nitrogen + 20 kg/ha phosphorus +4 irrigations.

Note: within all versions actual amount of fertilizes fully corresponds to above versions.

6. Results:

Wheat sowing was performed on October 8, 1994. Wheat sort is "Yanbash". Water storage irrigation by norm of 1200 cu.m/ha was executed on October 20 -22, 1994. 350 cu.m/ha from this norm was removed. During wheat growing season -1995 within all versions the first irrigation was performed on February 2 -5, 1995 by norm of 1150 cu.m/ha with removal of 175 cu.m/ha; the second irrigation was implemented on March 24 -28 by norm of 1200 cu.m/ha, from which 200 cu.m/ha removed; versions 1,2,3 on April 25 -29 by norm of 1290 cu.m/ha from which 190 cu.m/ha were removed. Thus during growing season -1995 wheat was irrigated within versions 1,3,4 3 times by norm of 3640 cu.m/ha from which 565 cu.m/ha were removed.

Within the second version wheat was irrigated 2 times by norm of 2350 cu.m/ha from which 375 cu.m/ha were removed. To make more precise irrigation norm and irrigation intervals soil moisture after each vegetation irrigation was determined. Data obtained within growing season -1995 show that before the first irrigation soil moisture within the arable layer (0-40 m) is 16.8 -18.8 % and within 1m-layer is 18.8 -20.7 % of dry soil weight. After irrigation moisture content was 26.8 -29 % and within 1m-layer 28.4 -30.0 %.

Within the time between the first and second irrigation (47 days) soil has dried up and before the 2-nd irrigation soil moisture was within arable layer 18.2 -19.4 and within 1 m -layer it was 22.4 - 23.8 %. The second wheat vegetation irrigation was performed on March 24 - 28. After irrigation soil moisture within arable layer was 24.7 -26.2 % and within 1m -layer it was 27.3 -28.6 %. The third vegetation irrigation was executed on April 35 -29 within 3 test versions. During time between 2-nd and 3-rd irrigation (28 days) soil moisture went down negligibly and it was 20.4 -22.5 % within arable layer and 22.8 -26.6 within 1 m-layer. Such slight moisture losses depended on groundwater position close to land surface and soil shaded by wheat stems decreasing evaporation from land surface. After the third vegetation irrigation soil moisture within the arable layer within 1,3,4 versions increased from 25.7 to 30.2 % and within 1 m -layer from 30.7 to 31.6 %. Within the second version, where the third irrigation was not performed, soil moisture before irrigation was 22.1 %, within 1 m -layer 24.5 %. It is worth to note that due to close to surface groundwater level position irrigation norm change did not influence on root zone moisture content and consequently on wheat yield. The same regularity was kept during 1996, 1997. Wheat yield - 1995 was as follow (t/ha): version 1 -3.27 , version 2 - 3.47 , version 3 - 3.64, version 4 - 4.8.

Wheat sowing was performed on September 10, 1995. Wheat sort - "Yanbash";

Water storage irrigation was executed on September 15 -20, 1995 by norm 1211 cu. m/ha from which 211 cu.m/ha were removed. During growing season -1996 within all test versions the first irrigation was implemented on March 12 -16 by norm 1017 cu/m/ha from which 167 cu.m/ha were removed; the second irrigation was performed on April 18-21 by norm 744 cu.m/ha (69 cu.m/ha were removed). The third irrigation was performed on May 12 -15 by norm 1080 cu.m/ha (119 cu.m/ha were removed). According to test program the fourth irrigation was performed within versions 1,2,4,6 by norm 930 cu.m/ha (209 cu.m/ha were removed). Thus during growing period - 1996 within test 1,2,4,6 versions wheat was irrigated 4 times by norm of 3720 cu.m/ha (563 cu.m/ha were removed); within 3,5,7 versions wheat was irrigated 3 times by norm of 2790 cu.m/ha (354 cu/m/ha were removed). Wheat yield -1996 was as follow (t/ha): version 1 -2.36; version 2 - 4.72, version 3 -4.7, version 4 - 5.18, version 5 - 5.12, version 6 5.73 and version 7 - 4.84 t/ha.

- Wheat sowing was performed on October 10, 1996. water storage irrigation was executed on October, 12 -15 by norm of 1427 cu.m/ha (360 cu.m/ha were removed). During growing season -1997 within all test versions the first irrigation was performed on February 21 -24 by norm of 1258 cu.m/ha (270 cu.m/ha were removed); the second irrigation was performed on April 5 -9 by norm 1302 cu.m/ha (276 cu.m/ha were removed). The third irrigation within all versions was executed on May 16 20 by norm 1168 cu/m/ha (253 cu.m/ha were removed). The fourth irrigation was performed only within version 5 by norm 945 cu.m/ha without removal. Thus during growing period -1997 within versions 1,2,3,4 irrigation norm was 3728 cu.m/ha (800 cu.m/ha were removed); within version 5 4 irrigations were performed by norm of 4673 cu.m/ha (800 cu/m/ha were removed). Wheat yield -1997 was as follow (t/ha): version 1 - 2.3 ; version 2 -4,41; version 3 -4.75; version 4 -5.33; version 5 -5.36. Average wheat yield was 4.43 t/ha. Depending on irrigation norm and fertilizers inserted different water volume (cu/m) was spend for production of 1-st wheat.

1995: version 1 - 1113; version 2 -676; version 3 -1000; version 4 -746;

1996: version 1 -1576; version 2 -767; version 3 - 593; version 4 720; version 5 -545; version 6 -650; version 7 -473.

1997: version 1 -1630; version 2 - 845; version 3 - 785; version 4 - 700; version 5 -871.

Brief conclusion.

Under conditions of Central Fergana on slightly and middle salinized soils under groundwater level 1.5 -2.0 m, grain crops sowing should be performed on September - October. Before sowing over standing cotton it is necessary to make cultivation (tillage) which would create arable soil layer covering crop seeds. Water -storage irrigations should be performed by norm 1200 -1400 cu/m/ha. This amount of water fully moistens soil and is enough to leach it. If during growing season groundwater level depth is 1,5 -2.0 m 2-3 irrigations are sufficient by norm of 2400 -3800 cu.m/ha. Fertilizers play important role in yield growth: under 100 kg/ha nitrogen and 50 kg/ha phosphorus wheat yield was 5.12 t/ha and under 300 kg/ha nitrogen and 50 kg/ha phosphorus it was 5.9 t/ha. It witnesses that Fergana soils are poor for nutrient elements and high doses of fertilizers are returned by high yield.

H	Suggested key-words		
1	Irrigation regime	4	Wheat yield
2	Irrigation norm	5	
3	Mineral fertilizers	6	

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