REGISTER OF RESEARCH ON IRRIGATION AND DRAINAGE

QUESTIONNAIRE

A	**Project title:**
	Study of nutrient elements balance distribution and their removal by drainage outflow

B	**Topic n° :** 2	Sub-topic n°: 2
1)	01	Technical field n°: 2

C	**Project location**		
	Fergana province, Ahunbabayev district collective farm “Niyazov”		
	Country: Republic of Uzbekistan	Area:	40 ha, pilot site – 9 ha
	Precise details if possible		
	Country(ies):	Locality(ies):	
	City(ies):	Others(s):	

D	**Duration of the project:**		
	Year in which the project was started 1994	Project completed:	1996
		Expected completion date:	1997

E	**Organizations and technical staff involved**	
1	Supervisor/project coordinator (SURNAME, First name): Byelousov Oleg	100%
	Organization: SANIIRI Address: 11, Karasu-4, Tashkent telephone: E-mail: fax:	Staff resources
Other counterparts:	Organizations (full name or acronym) Surname First name	2)
1		%
2		%
3		%
4		%
Other collaborators:	man-years	

F	**Funding agencies**	
	Full name or acronym	Percentage of project finance provided
1	Ministry for Land Reclamation and Water Management	100%
2		%
3		%

G	**Summary of research project (see instruction on page 1)**

1 Objective and technical fields:

Definition of possibility of effective use of nitrogen by crops from soil nitrogen and mineral fertilizers' and its losses reduction due to washing out and denitrification. Management by irrigated land's soil water-nutrieut regime on background of horizontal drainage.

2 Scientific and technical approach:

Definition of relationship between soil water and thermic regime, time and doses of mineral fertilizers insertion with mineral nitrogen migration in irrigated land soil. Definition of regularity of nitrogen transformation in soil depending on moisture and temperature.

Project importance: irrigated land productivity increase under mineral fertilizers use, by means of optimal conjunction of volumes and time of hydroreclamation and agrotechnical measures.

3 Environment characteristics:

Climate is sharply continental. Annual average air temperature is 13.2^0C, in January – 2.4^0C, in July – $26,9^0$C. Precipitation is 182 mm, evaporation is 1100 mm. Average annual wind velocity is 1.5 m/sec, average monthly is 1-2.1 m/sec.

Relief: slightly corrugated plain with slope 0.0025 to the south.

Lithology: multi-layer quaternary sediments: cover loam (2.5 m), coarse-grained sand (13.5 m), gravel with sand filling (22 m), loam with sand stratum (to 250 m).

Loam permeability coefficient (Kp) is 0.3-0.6 m/day; loam has stratum of gipsum on depth of 1-2.5 m, whose Kp=0.1-0.05 m/day. Unpermeable layer is located on depth of 250 m.

Loam is middle and light.

Soil permeability is characterized by the following indices: absorbtion within 1^{st} hour is 4 cm, 6^{th} hour – 1.8 cm, total for 6 hours – 16.2 cm.

Average volume weight of soil 1 m – layer is 1.3 g/cu.cm, arable horizon – 1.16 g/cu.cm.

Average porosity of 1m-layer is 47.5 %, arable horizon – 51.3 %, full field moisture capacity – 33 %. Soil salinization type is chloride-sulphate, salinization rate is slight.

Groundwater level within the growing season varies within 1.4 and 2.5 m, in non-growing period decreases to 2.8 m.

Artesian water head is 1.2-2.2 m below surface.

Groundwater salinity is stable. It is 3.6-4.6 g/l on solid residue and 0.09-0.11 g/l on chlorine. Humus content within 1m-layer is 0.91 %, within 0-40 cm layer is 1.41 %; nitrogen is, respectively, 0.163 and 0.185 %, phosphorus – 0.189 and 0.187 %.

4 Parameters of Pilot Projects and Technical Solutions:

Pilot site's area is 9 ha.

Crops pattern: cotton (sort C6524) and barley (sort "Aikor").

Irrigation was performed by furrows.

Distance between furrows – 90 cm.

Close horizotal drainage with distance between drains 250 m, depth 3.2-3.3 m, slope 0.002-0.0025 has been constructed.

Drainage modulus was 2.3-2.4 l/sec/ha.

5 Methodology:

Field investigations on moisture and nitrogen migration within the system "atmosphere-soil-groundwater –drainage". Phenological observations and measurement of water and mineral nitrogen for their balance establishing. Pilot site was equipped by all necessary devices.

6 Results:

During depth growing season 4 waterings by depth of 350-1150 cu.m/ha, water-storage waterings

by norm of 1450-1700 cu.m/ha and operational watering by depth of 2000-2500 cu.m/ha. Irrigation norm changes within 3740-4100 cu.m/ha.

Irrigations were started by root zone moisture 0.7-0.8 FFMC. During the winter barley growing season 2 vegetation waterings were performed by depth of 1240 and 1100 cu.m/ha. Winter barley was sowed (autumn 1996) to replace cotton (1994, 1995). Sowing was performed in autumn over standing cotton.

Nitrogen for cotton was inserted by rate 168-235 kg/ha (pure nitrogen) and 3 insertions by rate 40-96 kg/ha; for barley it was inserted by rate of 128 kg/ha (78+50 kg/ha) on February 17 and April 10. Nitrogen insertion for cotton was performed by three steps: before sowing, before formation of 2-3 first leaves and before start of budding.

Nitrogen concentration (ammonium+nitrate) was changing within 1994-1996 within 1m-layer as 30-60 mg/l; 5-20 mg/l phosphorus and 60-90 mg/l potassium were fixed, nitrogen content in ground and drainage water was 18-30 mg/l, the traces of phosphorus and potassium were found, nitrogen content in irrigation water was 3 mg/l.

Cotton yield was 3.01 t/ha, winter barley – 4.95 t/ha.

Analysis of data obtained allowed: to establish relationships describing processes of soil nitrogen transformation with regard to its moisture content and temperature, to obtain quantitative characteristics of these processes.

1) Process of ammonification rate is 6-8 % per year that allows to make free 45-65 kg/ha nitrogen.
2) Process of nitrogen oxidation to nitrate (nitrification) rate can achieve 5-6 kg/ha/day.
3) Process of nitrogen loss from soil to atmosphere due to nitrification; tests and calculations show that nitrogen loss due to nitrification constitute 30-50 % of soil mineral nitrogen

- to develop methodology of mineral nitrogen balance establishing within soil root zone and unsaturated zone; observations and balance calculations showed that during growing season 20-40 % of nitrogen is adopted by plants, 40-50 % evaporate to the atmosphere, 20 % remain within the soil, 5-7 % is washed out;
- to definite, that nitrogen amount removed to collector-drainage network is proportional to mineral nitrogen amount inserted into the soil and constitutes 3-11 % of it;
- to definite, that most effective time and close of mineral nitrogen insertion are:

1) For cotton: 3 times – within sowing (10-15 %), before badding (30-35 %) and within flourishing (50 %); phosphorus should be inserted 2 times: before ploughing (after leaching) and within growing period;
2) For grain: after shoots appearing (30-40 %) and within buching (60-70 %). This order of nitrogen insertion cuts down its losses, increases its adoption by plants, promotes high yield receiving.

H	**Suggested key-words**		
1	Soil water-nutrient regime	4	Nitrification
2	Soil mineral nitrogen balance	5	Denitrification
3	Ammonification	6	Nitrogen removal

I	**Most recent publications (maximum 3)**
1	Author(s): O.Byelousov, K.Umarov
	Title: Development of zonal recommendations on soil water-salt regime regulation, providing irrigated land productivity increase under deficit and bad quality of water resources
	Publication details: Analysis of laboratory and theoretical investigations devoted to nutrient elements migration and transformation within the soil. Detailed description and analysis of field investigations in Central Fergana is performed.

	Mathematical models of moisture and nutrient elements migration within the soil are elaborated. Methodology of mineral nitrogen balance establishing within root zone and unsaturated zone is developed.			
	Year of publication: 1997	free access [x]	restricted [ ]	confidential [ ]
2	Author(s):			
	Title:			
	Publication details:			
	Year of publication:	free access [x]	restricted [ ]	confidential [ ]
3	Author(s):			
	Title:			
	Publication details:			
	Year of publication:	free access [x]	restricted [ ]	confidential [ ]