REGISTER OF RESEARCH ON IRRIGATION AND DRAINAGE

QUESTIONNAIRE

A	**Project title:**
	Vegetable water consumption under conditions of Pricopetdag zone

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

C	**Project location**		
	Akhalksky etrap, state farm “Watan”		
	Country: Turkmenistan	Area:	
	Precise details if possible		
	Country(ies):	Locality(ies):	
	City(ies):	Others(s):	

D	**Duration of the project:**	
	Year in which the project was started 1970	Project completed: 1972 Expected completion date: 1972

E	**Organizations and technical staff involved**	
1	Supervisor/project coordinator (SURNAME, First name): Djumanazarova Tilla Kurbanovna	50%
	Organization: TurkmenNIIGIM Address: 30, Ostrovsky st. Ashhabad telephone: E-mail: fax:	Staff resources
Other counterparts:	Organizations (full name or acronym) Surname First name	2)
1	TurkmenNIIGIM, Amanov Khodjamed	50%
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:

Soil water-salt regime regulation on the base of scientific water consumption norms and optimal irrigation regime utilization. Objectives: irrigated lands reclamation state improvement and irrigated field productivity increase under soil water regime regulation according to plants water requirements.

2 Scientific and technical approach:

Soil water-salt balance regulation is based on irrigation according to calculated norms and timely elimination of inflow to groundwater from surface water and providion of optimal moisture regime in root zone.

Importance of investigation: scientifically grounded water consumption norms definition under different groundwater level depth, groundwater discharge into unsaturated zone; irrigation schedule development for different hydromodulus districts of Pricopetdag zone.

3 Environment characteristics:

Climatic conditions are typically arid. Sum of positive temperatures is 5300-5400 ^{o}C, which is favourable for plants growth and development. Relative air humidity is 20 % in August, 75-77 % in January. Serene days are 128-144 in a year. Sun radiation duration is 2712-2870 hours or 67 % of possible.

Average annual precipitation is 186-257 mm, 50-70 % precipitation occurres in spring.

Area is covered by proluvial sediments – middle and heavy loam.

State farm “Vatan” is located 20 km to north-east from Ashgabat. Slope of proluvial plain is 0,005 in north-east direction. Groundwater level depth is 4.5 m, salinity is 3 g/l, salinity type – chloride-sulfate. Pilot plot’s soils are slightly salinizated. Soil upper layer volumetric weight is 1,45 g/cu.cm specific weight is 2.70 g/cu.cm, limit field moisture capacity is 21,8 %, full moisture capacity is 32,0 %.

4 Parameters of Pilot Projects and Technical Solutions:

Field investigations for definition of water consumption and irrigation regime of vegetables (tomato and onion), water-solt exchange processes in unsaturated zone, elements of irrigated field water balance. The base of these investigations were lysimetric and water-balance observations.

There are 18 lysimeters within the pilot site which are represented by metal tubes d-1,63 sq.m and depth 1,2 and 3 m.

In order to study soil structure influence on water consumption value a lysimeter was installed on the pilot site which is filled with monolith (groundwater level is 1 m). Under deep groundwater when inflow to root zone from groundwater and filtration outside this layer are negligible, water consumption is determined by water balance method.

Comparative analysis of calculation methods of water consumption definition – biocliamatic, diffusion – biological and some empirical relations were used.

5 Methodology:

Main agricultural crop is cotton. There are 18 lysimeters within the site with depth of 1,2 and 3 m and d - 1,63 sq.m. For water level regulation there are two steel tubes with length of 5 cm more than lysimeter depth. There are 10 distributive canals with earthy beds.

6 Results:

Optimal moisture limits, irrigation depth in connection with agricultural crops growth and

germination, number of irrigations, irrigation norms.

Optimal regime of calculated soil horizons moisture under tomatoes is created under lower threshold of moisture before irrigation supported at the level of 70 % of normal moisture during planting – blooming, 75 % - blooming-germination, 80 % - germination-fruit bearing. For onion optimal lower threshold of moistening is 70 % during shoots appearance and 80 % later.

Irrigation regime is recommended according to accepted hydromodulus zonning with regard to soil mechanical composition and groundwater level depth for III, V and VII GMR according to plants development phases and their water demand within given period.

To support optimal regime of moistening for tomato during their planting-blooming phase three irrigations by depth of 300-400 cu.m/ha are needed. Five irrigations by depth of 1900-2400 cu.m/ha, that is twice more to compare with planting period, are needed during ripening period. Within fruit bearing period it is necessary to irrigate by depth of 5400-7800 cu.m/ha under 12-13 irrigations. Total irrigation norm for growing season is 8200 cu.m/ha for VII, 9400 – for V, 11400 – for VII GMR. For onion during its formation (April-May) irrigation depth is 400-600 cu.m/ha under 3 irrigations. During the period of highest consumption (June-August) 13-14 irrigations with depth 400-600 cu.m/ha are recommended.

Agricultural crop yield variability depending on soil moisture.

Comparison of data under different level of moistening of calculated horizons of soil showed, that under optimal level of moisture before irrigation 70-75-80 % of normal moisture tomato yield was 64,5 t/ha as average for three year; irrigation water specific depth for yield unit was 1,66 mm. With decrease of moisture before irrigation to 65-70-75 % yield decreased to 51,8 t/ha and specific irrigation water depth was 2.21 mm. With increase of moisture to 70-75-80 % yield was 64,7 t/ha and water specific depth was 2,46 mm. As is evident from above specific water depth for yield unit under optimal moistening regime is 0,55-0,8 mm lesser to compare with options of too low and too high irrigation depth.

Onion irrigation under lower moisture threshold 65-75 % of normal moisture gave yield 19,3 t/ha, specific water depth was 5,2 mm. Yield under optimal moistening regime (70-80 % of normal moisture) yield was 2,26 t/ha, i.e. 3,3 t/ha higher and water specific depth for 0,1 t of yield (4,44 mm) was 0,76 mm lower to compare with option of too low level of moisture.

Agricultural crop yield variability depending on water supply.

For year of middle-dry supply, temperature and air humidity deficit tomato water consumption under yield 89,5-105,4 n/ha varied from 1750 mm under groundwater level equal to 1 m to 1480 mm under its depth 3 m. Under deep groundwater level and yield 61,0 – 74,0 t/ha water consumption was 1290 – 1450 mm. Maximum water consumption was indicated during the germination-fruit bearing period (65-75 % of total value).

Under 1 m groundwater level depth average tomato yield of 105,4 t/ha correspondes to total evaporation value – 1750 mm. Besides water depth for yield unit is 117,2 mm/t. Under 2 m groundwater level, average yield 111,7 t/ha and water consumption 1670 mm, water consumption coefficient is 15,5 mm/t in 3 m – lysimeter water specific depth is 16,5 mm.

Onion water consumption under shallow groundwater level is 930-1020 mm and yield – 31,4-40,43 t/ha. Under yield 23,0-24,0 t/ha (groundwater level is lower than 4 m) water consumption varies within the limit of 1160-1240 mm. During the period of intensive development (June-August) water consumption achieves 70-84 % of total value for the growing season.

Maximum yield under groundwater level 1-2 m (42,0-49,0 t/ha) was obtained under total water consumption value 1030-1140 mm, water consumption coefficient was 2,32-2,46 mm. Maximum yield under groundwater level 3 m (32,6 t/ha) corresponds to water consumption of 930 mm. Specific water depth is 2,87 mm.

Comparison of averaged coefficients of water consumption under different groundwater levels shows that minimum values (15,5 mm/t) for tomato and 2,61 for onion are noticed on the depth of 2 m, that indicates on optimal water regime of calculated horizons, which is conductive to crops productivity.

Bioclimatic moistening coefficient for bioclimatic coefficients calculations air humidity deficit as a combined indice is taken which depends on air temperature and humidity and closely correlates with evaporation.

For tomato and onion sharp variation of bioclimatic coefficient is noticed at the beginning and the end of growing season.

Under groundwater level 1-3 m coefficient values are close in April-May (0,2-0,24). Since June their values increase and achieve maximum means for tomato during fruit-bearing period in August – 0,51-0,55. In September these values decrease to 0,41-0,48, in October to 0,31-0,33. Maximum coefficient value for onion is during fruit-bearing period (June and July) – 0,24-0,28 and 0,28-0,31. In August coefficients decrease (0,21-0,24), in September – 0,06-0,07.

Comparison of monthly values of tomato and onion water consumption, calculated by bioclimatic method with actual data showed, that discrepencies in indices during growing season are 4-7 % for tomato and 16-20 % for onion.

Pilot plot water balance with balance partition for soil and groundwater.

Lysimeter contains unsaturated zone model which allows to define three most important component of water balance: total water consumption, groundwater inflow to unsaturated zone and groundwater recharge at expense of surface water.

During three years water balance elements were as follows: water supply 840-1120 mm, precipitation – 90, groundwater inflow to unsaturated zone – 410-880, infiltration into groundwater from surface one – 60-140, total water consumption – 1480-1750 mm.

Water balance elements under deep groundwater level include: irrigations, precipitation, soil water stock discharge, soil water stock accumulation and total water consumption.

In 1971-1972 60-90 mm water from 1110-1310 of surface water were supplied to soil water stock. Soil water discharge together with precipitation was 120-240 mm, total water consumption 1090-1450 mm.

For onion under shallow groundwater water supply irrigation increased with groundwater depth increase from 750 mm (1 m) to 900-990 mm (2-3 m), and natural water supply (precipitation and groundwater inflow to unsaturated zone) decreased from 260 to 80 mm (under groundwater absence precipitation has been taken instead).

Taking into account that surface water infiltration increased from 90 mm (1 m) to 140-250 mm (2-3 m) total water consumption was 820-940 mm.

Under deep groundwater and average irrigation norm 1050 mm, soil water stock discharge – 60, accumulation from surface water –50, total water consumption was 1140 cu.m/ha.

H	**Suggested key-words**		
1	Lysimeter	4	Water-salt regime
2	Unsaturated zone	5	Irrigation regime
3	Water consumption	6	Water balance

I	**Most recent publications (maximum 3)**
1	Author(s): Djumanazarova Tilla
	Title: Vegetables irrigation within the Pricopetdag zone of Turkmenistan / Problems of irrigation agricultural
	Publication details: Results of lysmetric and water balance researches for water consumption norms definition for tomato and onion, which became a base for irrigation regime development. Optimum lower moistening threshold of calculated soil horizons is determined. Irrigation regime with due regard to plants development phases and their water demand according to

	growth periods and hydromodulus districts (III, V, VII)			
	Year of publication: 1981	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 [ ]