

Monitoring and investigating the effectiveness of crop-improvement and plant-breeding techniques on reducing the exploitation of water resources in the 4th-phase sites of sustainable agriculture project in the Lake Urmia basin

This study to help restore Lake Urmia on field scale in the irrigated fields of Lake Urmia basin was conducted in the Miandoab, Mahabad , Naghadeh and Urmia irrigation networks within sustainable agriculture project to reduce agricultural water consumption during 2017-2018. Therefore, different better farming and management techniques including: protective farming, modern irrigation systems, improvement of surface irrigation systems, irrigation based on the actual plant requirement (real time irrigation scheduling), appropriate cultivars, optimal planting date, deficit irrigation, irrigation management, geometry optimization of border and basin irrigation systems, precision leveling operations and others, was applied commensurate with the conditions of each farm. The main purpose of this study was the effectiveness investigation of various techniques that was performed in the project in reducing irrigation water consumption and draw the water balance on the fields, monitoring the performance of engineering and technology companies and the implementation of required training courses in the study area. The pilot farms were selected in terms of physical and chemical soil characteristics, cropping pattern, common management and water resource so that represent the current status of the region. In addition to technical issues, farmers collaboration and promotional discussions, were very important in this project. In this regard, monitoring the performance of engineering and technology companies in Miandoab, Mahabad , Naghadeh and Urmia named “monitoring network” and independent monitoring in Miandoab named “main monitoring” in Dashtappe village by Urmia University was performed. The monitoring network done in 17 wheat fields in fall planting and 21 fields in spring planting: tomato (in the two farms), sunflower (in the two farms), corn (in the two farms, sugar beet (in the nine farms) and apple (in the six orchards); and the main monitoring done in three wheat fields in fall planting and three spring planting: sugar beet (in the two farm) and apple (in the one orchard). Each farm included control and treatment section which control without technology and treatment had irrigation techniques such as optimal system geometry (border and basin), improve the irrigation method, manage irrigation interval and precision leveling operation. To monitor irrigation and calculating water productivity and irrigation efficiency in each farm and irrigation events, were measured some parameters such as: physical and chemical characteristics of soil, soil moisture coefficients (FC and PWP), survey of selected farms to determine system geometry

and slope, meteorological information to calculate real time crop water requirement, inflow by WSC flumes, soil permeability by double cylinder, soil profile moisture before and after each irrigation events, advance and recession phases, root depth and crop yield. In the wheat fields under main monitoring (W1 to W3), in forrow's length reduction treatment (in W3 filed) about 68.3% saving (reducing) in irrigation water, about 220% increase in the water productivity and about 51% increase in application efficiency was obtained. In length reduction along with leveling treatment (in W2 filed), about 38.8% saving in irrigation water, about 63 % increase in water productivity and about 14.3% increase in application efficiency was obtained. Also, this values for leveling treatment (in W1 filed) are about 25.9, 41 and 13.4%, respetively. In the fourteen wheat fields under monitoring network (W4 to W17), under length reduction treatments about 41.8% saving in irrigation water, about 76% increase in water productivity and about 27.8% increase in application efficiency were obtained. Also in these fields, (W4 to W17), in terms of leveling as treatment, about 19% saving in irrigation water, about 23.1% increase in water productivity and 10.8% increase in application efficiency were obtained. This values for improvment irrigation method as treatment, from border to forrow irrigation were about 18, 20.6 and 8.5%, respectively. Also, this values in width reduction treatments were about 7.4, 12.9 and 6.5%, respectively. According to the results, in terms of importance and priority length decrease and leveling, are very important in improvement of application efficiency and reduce of water consumption. Considering that farms in terms of area are usually small, therefore, the length of the borders as a treatment, only in certain circumstances can be implemented. and in most farms, the borders length is the same field length. Also, The irrigation scheduling method in farms can be implemented that the water source was well only. The average of wheat water productivity in the all fields of treatment and control, were obtained 2.6 and 1.87 kg/m³, respectively, which is accordingly about 39% water productivity improved in treatment fields. Also, the average wheat grain yield in treatment and control fields were obtained 8.14 and 8.46 ton/ha, respectively, which is indicated by treatment in farms, the yield not only don't decrease, it also increased on some farms. The wheat grain yield range were varied from 3.6 to 12.8 ton/ha. The average grain yield of wheat in control fields were 8.14 ton/ha with standard deviation about 2.44 ton/ha with a coefficient of variation of 30%. These numbers indicate that the yield was not affected only by irrigation depth and many other factors such as: soil salinity, cultivar, crop management, soil fertility, application of toxins and fertilizers and others, are effective on yield. In the spring fields, some results were significant in water savings and good results were obtained

regarding improvement of irrigation methods. The average of water productivity in treatments about 48.9% increased compared with control fields. According to the results, different better farming and management techniques that was performed in farms under monitoring urmia university and engineering and technology companies, caused about 27.7% saving in irrigation water and about 17.3% increase in irrigation efficiency. By changing the irrigation method from surface irrigation to drip tape, about 38% saving in irrigation water, about 48.7% increase in water productivity and about 32.8% increase in irrigation efficiency was obtained. Also, these values increased significantly and arrived to 188, 42.3 and 65.1% with removing of alfalfa in orchards. Also, water saving in use of techniques drip irrigation with remove alfalfa, alternate furrow irrigation and circular method in orchards were about 59, 46.5 and 34.4%, respectively. Maximum increasing water productivity was obtained in changing irrigation method to drip tape with remove alfalfa treatment (S17, about 188%) then in changing irrigation method to furrow treatment (S1, about 106%). According to the results, the case of combined remove alfalfa technique with drip irrigations results significant reduction in irrigation depth.