Role of Water Organizations for Better Water Productivity in Agriculture

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Abstract

The aim of present study was to assess irrigation organizations in respect to water productivity. In accordance of our analysis, quality of staff working in water organizations is very important role to play in success of such organizations. In order to maximize water delivery performance, maintenance-repair works, very important for better conveyance efficiency, should be performed on time and all water delivery systems should be converted to lined-canals even if possible replacing to pipes systems. Agriculture is the highest water user sector in worldwide especially in water scant regions. Thus, in water-starved regions, addition of crops having low water consuming to current crop pattern is one of the most efficient ways for sustainable use of water supplies. Beside that preference of crops highly resistant for drought climate can be advisable for minimizing pressure on water resources. The other applicable solution for water poor regions is deficit irrigation, and up to 25% deficit irrigation by drip irrigation not resulting significant yield reduction by comparison to full irrigation can be recommended.

Key words: Agriculture, water management, water organizations, crop pattern.

Introduction

Among all sectors, there is no doubt that fresh water resources have been used intensively in irrigation as about 70% worldwide. It is almost impossible to get reliable agro-production without irrigation especially in arid and semi-arid regions (Shahnazari *et al.*, 2007; Yavuz *et al.*, 2015a,b). In those environments, groundwater resources are used in most for irrigation. Excess water extraction from the groundwater supplies has resulted none sustainable use of water resources as well as increase in energy consumption (Yavuz *et al.*, 2016).

As we all know that crop yield is affected by some agro-practices such as application of fertilizers as plant nutrients, cultivation of soils by proper agro-machines, selections of crop cultivars best suited to environment and so on but possibly the most important one is irrigation within the all those. Irrigation can be defined as artificially water application process for crops in areas where rainfall is insufficient for meeting whole crop water needs. By irrigation, not only crop water requirement is met but also increases availability of plant nutrients. Selection of irrigation method is important but possibly correct water management is vital important for sustainable water uses in agriculture.

Besides that, deficit irrigation by drip system is recommended for water poor regions and up to 25% deficit irrigation by drip irrigation system had no significant yield reductions in some crops such as potato, sunflower, sugar beet, dry bean and so on (Acar *et al.*, 2014).

Water management is performed by different organizations such as water associations, (WA), irrigation cooperatives (IC), municipalities and local communities in Turkey (Özkan, 2012). Acar and Yılmaz (2018) stressed that quality of training program for both irrigation managers and farmers, and qualifications of irrigation organizations are some the important factors affecting efficient water management.

There are common problems facing WA such as inadequate maintenance-repair works resulting from lack of proper equipment's, none or little qualified workers employment in organizations, and almost none education program relevant to water use in farm level. Regular check of irrigation water delivery systems is vital important for better performance of water organizations (Kıymaz, 2006).

The aim of the present study was, therefore, to research water organizations for worldwide, and giving some practical recommendations to the irrigation organizations for better water productivity in agriculture.

Performance evaluation of irrigation organizations

Suheri and Topak (2005) evaluated water management organizations in semi-arid Konya plain of Turkey. In that purpose, they examined 3 WA, 2 IC and 2 local communities. They underlined that level of technical experiences of staff in irrigation organizations was the most important factor affecting performance of such organizations.

Omid *et al.* (2012) evaluated water associations in three different places namely Mogan, Tajan and Varamin at Northern part of Iran by using survey technique. Among 2500 farmers, they selected 262 farmers by using randomized sampling method. Ages of surveyed farmers varied from 26 to 70 with an average of 50. The most of the farmers having about six years memberships in such associations were graduated from the intermediate school. The average land size of those farmers was 7 ha with three parts. Water scarcity was main problem in irrigation season so each farmer has about 1.3 ha farmland under no production. Farmers have great interest to farming with about 27-year experience. They recommended following five procedures to achieve maximum efficiencies of those organizations; 1- structural and technical problems of associations should be solved on time, 2- new constructions of lined water delivery canals are needed, and maintenance-repair works of all canals serving irrigation areas should be made regularly, 3- farmers should be trained about effective water use in agriculture, 4- irrigation costs should be paid by farmers regularly, and 5- legal regulations resulting more attendance of farmers in water management of associations should be made.

Zhang *et al.* (2013) analyzed 21 WA by using information from 315 farmers in Minle province of China. The number of farmer who obtains water from the canal was between 37 and 630 with an average of 276. The age of managers in water user associations was between 35 and 59 with an average of 46. In general, increase in the age of managers has resulted positive responses from the farmers and water management strategies have applied with more efficient under such conditions. On the other hand, in some irrigation schemes of WA, young managers

were observed more successful in applications of innovative procedures. They revealed that more participants of farmers in agricultural water management were possibly one of the most important factors yielding more water savings in irrigation especially for water scant regions.

Agide *et al.* (2016) examined performance of 10 different WA in Ethiopia. They are placed as 2 of in Tigray, 3 of in Amhara, 2 of in Oramia and 3 of in Southern parts of Ethiopia. Registered farmers in those organizations varied from 233 to 500. They researched Relative Irrigation Supply, RIS, as a performance indicator. They expressed to RIS as the ratio of Irrigation Water Supply (m^3) to Irrigation Water Demand (m^3). If RIS value is greater than 1, means that water organizations gives more water than farmers' requirement. In that case, there is no water shortage for farmers in irrigation schemes of irrigation associations. They listed RIS values in Table 1 in accordance of associations. In both irrigation seasons, RIS was calculated high in associations at May-Nigus as an average of 5.80, and Gelena as an average of 6.0. However, farmlands belonging Hare-Weir, Megech and Hare-Diversion Headworks were suffering from water shortage conditions during the both irrigation seasons due to having RIS value lower than the 1.

Table 1. The RIS values of examined water user associations (Agide *et al.*, 2016).

Associations	**Irrigation period I (January-May)**			**Irrigation period II (June-December)**		
	Water Demand, m^3	**Water Supply, m^3**	**RIS**	**Water Demand, m^3**	**Water Supply, m^3**	**RIS**
Koga	30.378.240	57.024.000	1.90	6.117.120	20.736.000	3.40
Meki	2.514.648	7.257.600	2.90	2.112.480	7.257.600	3.40
May-Nigus	429.754	2.073.600	**4.80**	114.566	777.600	**6.80**
Wukro	1.308.701	3.545.856	2.70	620.747	2.592.000	4.20
Hare-Weir	2.830.464	2.177.280	0.80	3.610.286	2.903.040	0.80
Gelena	103.680	518.400	**5.00**	103.680	725.760	**7.00**
Megech	7.361.280	3.680.640	0.50	6.625.520	4.423.680	0.70
Waro	630.967	1.140.480	1.80	598.752	1.347.840	2.30
Hare-Diversion Headworks	1.741.824	1.555.2000	0.90	2.221.714	2.073.600	0.90
Dessie-Zurie	6.946.560	7.464.960	1.07	1.244.160	3.110.400	2.50

Cihan and Acar (2016) researched actual water supply for unit irrigation area, irrigation ratio, money collection ratio and mean income for unit-irrigated land at irrigation areas of Ova Irrigation Association, OWA's, situated at Konya-Çumra province of Turkey. Those parameters were calculated as between 5960 m^3/ha and 7850 m^3/ha, between 132% and %192, 75%, and 1210 USD/ha, respectively. In accordance of water delivery performance, about more than two fold of command area is irrigated so irrigation ratio was greater than 100%. They also added that more than 70% of fresh water supplies has used as irrigation purpose. The reason behind was increase of area with high water consuming crops. In order to minimize the pressure on over water extraction from the groundwater resources in research region, crop patterns should be designated in accordance of current water supplies.

Kırnak and Karaca (2017) analyzed some performance parameters for Sarıoglan irrigation association in Kayseri province of Turkey. The data were obtained from 12th General

Directorate of State Hydraulic Works, GSSHW, and records of Sarıoglan irrigation association. The irrigation water supply for irrigation areas of such association is Sarıoglan Dam. The number of people within the council of water user association was 35. Total 6 people are employed in this organization: 1 manager, 1 accounter and 4 irrigation labors. The association had pressurized irrigation network with about 188 km. They examined irrigation ratio, IR, and money collection ratio, MCR, as performance criteria's. The minimum and maximum IR values were found 50% and 85% for 2010-2015, respectively. The labor intensity, LI, of irrigation systems in 2010-2014 and 2015 was about 31 km/staff and 27 km/staff, respectively. They stated that number of staff for unit length of irrigation networks was calculated as low, and the reasons behind were all irrigation water delivery networks' were pressurized systems as well as all very recently constructed. In addition, the qualifications of personnel in water associations had very important role to play in performance of water management.

Abdelgalil and Bushara (2018) examined performance of water user association in Gash Delta in Sudan by using face-to-face survey technique with farmers. They reported following parameters affecting efficient water use in agriculture: first one was poor coordination between farmers and water association members, second one was rough topography affecting uniform water distribution in irrigation lands, and third one was in adequate water deliveries.

Dejen *et al.* (2012) evaluated RIS, water charges, MCR, and IR as performance criteria's for three water user associations Godino, Gohaworki and Golgata in Ethiopia. The command areas of Golgota, Godino and Gohaworki were 600 ha, 300 ha and 60 ha, respectively. They reported RIS values for those three associations were calculated as 3.17, 1.20 and 1.90, respectively. According to those findings, water organizations allocated more water than farmers demand even more than three fold of water was given to irrigation area of Golgota irrigation scheme. The reason behind, in that irrigation scheme, water has allocated to farmers in accordance of farmers demand, and there was no water charge for farmers belonging to the Golgota irrigation scheme. Unlike the Golgota irrigation scheme, there was water charge in farmers being memberships to the Godino and Gohaworki irrigation schemes. The irrigation cost for farmers was about 60 USD / ha/ season. As a result, water supplies were used more efficient in irrigation schemes of Godino and Gohaworki. IR values for Golgota, Godino and Gohaworki irrigation schemes were determined as 92%, 67% and 83%, respectively.

Conclusion

Efficient water use in agriculture is necessarily prerequisites for sustainable use water resources especially water scant regions. For that reason, following suggestions are made: 1- crop pattern should be organized in accordance of current water supplies. In that regard, addition of some low water consuming crops into current crop pattern is a viable solution for water savings in agriculture or government should subsidize farmers performing rain fed farming. By planting seeds best suited to dry environments are recommended, 2- maintenance-repair works performing on time is also very important playing role for more efficient water deliveries. If water organizations have enough budgets, they should built pipe lines in water distributions, 3- water charges should be volumetric basis instead of irrigation area, 4-deficit irrigation especially by drip irrigation system should be used in practice in water scarcity regions. and 5-

possible the most important one is technical skills of the personals in water management organizations. Thus, both staff of the water management organizations and farmers should be well trained about efficient water use in agricultural.

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