

Performance of Ova Water User Association in Konya – Turkey

İlker Cihan, Bilal Acar

Abstract— The aim of the study was to assess performance of Ova Water User Association (OWUA's) at Konya-Çumra province of Turkey. In research, as performance indicators, mainly water delivered, financial and production performance were analyzed. The results showed that annual water delivery per command and irrigated areas varied from 10360 to 13240 m³/ha and from 5958 to 7848 m³/ha, respectively. Irrigation ratio was between 132% and 192%. Unit area per staff was found as 0.0012 staff/ha. Money collection ratio was found as about 75 % for the average of last six years. The average production output or income for the year of 2014 was calculated as about 1210 \$/ha. Although water shortage is the most important serious problem in our region, agriculture is still the single maximum water user sector even more than the world average of 70%. For sustainability of water supplies in region, efficient water use especially in agriculture can be strongly recommended.

Index Terms—A Irrigation management, performance evaluation, water user association

I. INTRODUCTION

Irrigation can be defined as water application process in areas where the natural rainfall is insufficient to meet the whole crop water requirement. As we know that maximum yield can be obtained from the conditions where the soil moisture content is optimum during the vegetation period.

Agriculture is the single maximum fresh water user sector as about 70% in the world [1] with up to 90% in some regions [2]. Water resources are declining in general [3] and are scant in nearby 80 countries having greater than 40% population of the world [4]. If that situation continues, by projections of 2030, water use for irrigation will increase around 14% [5]. Irrigation has the highest production cost in Konya Basin of Turkey since oil market price or water cost is high so water management based on water savings is strongly needed. Topak and Acar [6] reported that the agriculture with this present form has almost 90% of annual consuming water in Konya Basin of Turkey. The annual excess water use from groundwater reservoir is about 1.4 billion m³. Acar *et al.* [7-8] stated that the most important reason of excess water use from the groundwater reservoir is increase of irrigation lands in the favor of high water consuming crops such corn without considering the current water supply. Performance analyze is the most useful strategy to evaluate the efficiency of irrigation management. Cakmak *et al.* [9] reported that performance in many irrigation systems are far from the expectations due to

the some shortcomings such as deficiencies in design, construction, operation and maintenance works.

There are different government and private organizations that are responsible for irrigation water management in Turkey, and one of them is water user association. Kıymaz [10] stated that main problems of water user associations are poor maintenance-repair works resulting from scarcity of machinery-equipment, deficiency in technical staff as well as very little or none farmer education. The efficiency of such associations can be determined by evaluation. Almost very little detailed studies have been cited in the literatures about the agricultural water management in our region, therefore, in this research, performance of OWUA's was analyzed with detail, and some practical recommendations for better irrigation water management were outlined.

II. MATERIAL AND METHOD

The research was performed at irrigation areas, mostly irrigated by canals, of OWUA's situated at Konya-Çumra province of Turkey. The study region, semi-arid climate with annual average rainfall of 300 mm, is about 1016 m above the sea level. The soil of region is alluvial origin having high lime contents with scant organic matter. The soils have no salinity as well as drainage problems such as water table [11]. Although there are 21 water user associations in Konya province of Turkey, OWUA's has one of the biggest irrigation lands serving actively about 48000 ha farmlands. The data were obtained from records of OWUA's as well as 4 th General Directorate of State Hydraulic Works (DSI) or other relevant organizations. In research, performance indicators of water delivery, financial and production performances were as follows:

1. Water delivery performance:

Irrigation ratio=(Irrigated area (ha))/(Command area (ha)) x100

Total annual water delivery per command area=(Total volume of irrigation water inflow (m³))/(Command area (ha))

Total annual water delivery per irrigated area=(Total volume of irrigation water inflow (m³))/(irrigated area (ha))

2. Financial performance:

Revenue collection ratio=(Total service revenue collected)/(Total service due) x100

Unit area per staff member=(Total number of staff employed in association)/(Total command area served by the

İlker Cihan, IV General Directorate of State Hydraulic Works, Konya – Turkey.

Bilal Acar, Department of Farm Buildings and Irrigation, Faculty of Agriculture, University of Selçuk, Konya-Turkey

system (ha))

3. Production performance:

Output per unit command area=(Total annual value of agricultural production (US\$))/(Total planting area served by the system (ha))

II. RESULTS AND DISCUSSION

Water Delivery Performance: Irrigation projects in general are based on the current crop patterns. If the water supply is not enough to meet the whole crop water requirements, changes in crop patterns are needed for efficient use of water resources. Crop patterns in irrigation areas of OWUA’s were presented in table 1.

As seen from table 1, the highest crop pattern for three years average was cereals as 48%, and followed by sugar beet or sunflowers. In recent years, due to the government subsidizes, cropped land of corn has increased notably although it is a high water consuming crop. There is a gradual depletion of groundwater level in our basin due to the over water extractions since surface water supplies are not enough to meet the whole crop water requirements. Farmers in general think about their incomes instead of sustainability of water resources. Thus, cropped land of cereals should be increased for sustainable use of water resources. Seasonal irrigation water requirement of cereals is about 25% of sugar beet or corn plants. Government should subsidize the cereal production for efficient water use in agriculture. In addition, crop patterns should be reorganized in accordance of our available water potential.

Annual water delivery per command and irrigated areas are presented in table 2.

Table 1. Crop Patterns in Research Region [12].

Crops	Planting area (ha)			Crop pattern (%)
	2012	2013	2014	
Cereals	17685	11438	29851	48
Legumes	1932	2250	689	4
Sugar beet	6020	8240	4.791	16
Sunflower	3376	7715	8327	15
Corn	425	4510	2296	6
Potato	1312	1845	477	3
Forage crops	1260	4120	1129	5
Vegetable	675	1655	661	2
Others	82	1112	36	1
Total	32767	42885	48257	100

Table 2. Annual Water Delivery Per Command and Irrigated Area

Years	Annual volume of irrigation water inflow (10 ⁶ xm ³)	Irrigated area (10 ³ xha)	Command area (10 ³ xha)	Irrigation ratio (%)	Annual water delivery per irrigated area (m ³ ha ⁻¹)	Annual water delivery per command area (m ³ ha ⁻¹)
2012	259	33	25	132	7848	10360
2013	331	43	25	172	7697	13240
2014	286	48	25	192	5958	11440

In table 2, annual water delivery per command area was the lowest in 2012 as 10360 m³/ha and the highest in 2013 as 13240 m³/ha; annual water delivery per irrigated area was found the lowest in 2014 as 5958 m³/ha and the highest in 2012 as 7848 m³/ha. Annual water delivery per irrigated area shows the actual water delivery in our study province. According to previous studies, average irrigation water requirement of current crop patterns is about 550 mm. The irrigation efficiency is about 75% so dividing 550 mm to 0.75

we may get about 735 mm or 7350 m³/ha as an average. It means that OWUA’s has allocated to the water delivery in accordance of current crop patterns or irrigation area instead of command area. Rodriguez *et al.* [13] determined the water delivery per command area as about 1500-4654 m³/ha and water delivery per irrigated area of 1500-4740 m³/ha for five representative irrigation places of Andalusia, Spain. Our results are higher than findings of such researchers. Possible reasons might be differences in climate conditions, crop

patterns and their irrigation water requirements as well as differences in managerial strategies.

Irrigation ratio varied from 132% to 192% since irrigation association gives the irrigation water for more than the command area of about 25000 ha. In 2014, irrigated area reached up to the 48000 ha that was almost two fold of command area. Therefore, irrigation ratio was greater than the 100%. Cakmak *et al.* [9] determined such value as about 44%-54% for Asartepe Irrigation Association irrigated land conditions in Sakarya Basin of Turkey. The result obtained in this present study is higher than the finding of Cakmak *et al.* [9].

Financial performance:

In our study region, revenue collection ratio was found as about 75 % for the average of last six years. Cakmak *et al.* [9] reported that ratio of 54%-100% for Asartepe Irrigation Association irrigated land conditions in Turkey. Kocabas and Girgin [14] reported that value as 80% for irrigation area managed by General Directorate of State Hydraulic Works (DSI) for 13 irrigation networks in Marmara region of Turkey. Nalbantoglu [15] determined such value as 70%-93% for Akıncı irrigation association in Turkey. Our finding is inline with the findings of those researchers.

There is a total of 31 staff employed in OWUA's. The distribution patterns of those staff are as follows: one Agricultural Engineer as a Director status graduated from the field crop department, one accountant, graduated from University as responsible for financial management of the association, one chief for water charge collector, two water fee collectors, one office secretary, one servant, one technician employed for management, maintenance-repair, ten operators, two men for security, two drivers, and nine water distributor staff.

In this study, unit area per staff was found as an average of 0.0012 staff/ha (31/25000 ha). If we consider the whole irrigated area, it is lower than such value. Nalbantoglu [15] determined that value as 0.007 - 0.012 for Akıncı Irrigation Association. Cakmak *et al.* [9] reported that value as between 83.1-105 staff/ha for Asartepe Irrigation Association irrigated land conditions. Our finding is lower than Nalbantoglu [15] and Cakmak *et al.* [9]. By comparative analysis of our result with the previous studies, the command area (about 25000 ha) in our research is higher than the study area (about 800 ha) of Cakmak *et al.* [9]. Just like the OWUA's, other reason could be that less but qualified staffs have been employed in water

management organizations due to the advents in technologies in the last decade.

Production Performance:

Yield and production values for irrigated crops under Ova Irrigation Association command area in 2014 were presented in table 3. In table 3, the highest income can be obtained from potato as about 25000 TL/ha or 8340 \$/ha and the lowest one from forage crops as about 300 TL/ ha or 100 \$/ha. Although the production value of cereals was as about 750 \$/ha, it is also a very beneficial farming activity since it has the greatest production area and has the positive contributions on efficient water use in agriculture.

In general average income was calculated as 3600 TL/ha or 1210 \$/ha in our study region. Cakmak [16] reported that value as 71-3994 \$/ha and 771-1711 \$/ha for Kızılırmak Basin and irrigation area of Ceylanpınar Water User Association of Turkey, respectively, and Nalbantoglu [15] stated that value as 1454-2970 \$/ha for Akıncı irrigation association. Our study finding is almost similar to those findings of Cakmak [16] but lower than Nalbantoglu [15].

As a result, in general current technical and financial status of Ova Water Use Association is sufficient for efficient irrigation water management. Soil or unlined canals resulting poor conveyance efficiency are also present for water delivery. They should be converted to the concrete lined canals for better performance of water delivery. Drip irrigation system has been used less common. The possible reason might be that almost all farmers have already sprinkler irrigation systems and they do not want to pay extra money for drip irrigation system installations. Water shortage is a very serious problem in our region. Well management of water resources is necessarily prerequisites for especially arid and semi-arid regions of the world such as our study region. Current crop patterns should be changed in favor of less water consumption. In that regard, the production areas of cereals, sunflower, squash, chickpea, lentil should be increased. Irrigation technique is important but the most important issue is correct irrigation water management for sustainable water uses in agriculture. Therefore, there should be good cooperation between all water user sectors for better performance in water management especially in water scant environments.

Crops	Area (ha)	Crop patterns (%)	Production (ton)	Average Yield (t/ha)	Average Selling Price (TL/kg)	Production Value (TL/ha)
Cereals	29851	62	89553	3	0.75	2250
Legumes	689	1	1723	2.5	2.50	6250
Sugar beet	4791	10	287460	60	0.16	9300
Sunflower	8327	17	24981	3	1.20	3600
Corn	2296	5	16072	7	0.65	4550
Potato	477	1	23850	50	0.50	25000
Forage crops	1129	2	565	0.5	6	300
Others	697	1	349	0.5	7	3500
Total	482570	100				3600

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