

## EFFORTS AND CHALLENGES OF ONE DECADE WATER CONSERVATION PRACTICES IN THE IMPERIAL VALLEY

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**Introduction.** There are likely to be significant shortfalls between water supply and demand in the Colorado River Basin in the upcoming decades. Therefore, implementing impactful agricultural water conservation tools and techniques for the resiliency of agricultural systems becomes a common concept among irrigation/water districts and growers in the low desert of California. Knowing water related issues in the Colorado River Basin and to support environment and neighboring urban areas, Imperial Valley growers have been remarkably investing in water conservation measures over a decade, even years before initiating On-Farm Efficiency Conservation Program (OFECP) by Imperial Irrigation District (IID) in 2013.

The OFECP is being implemented to provide incentives to local growers to install and apply water-efficient irrigation measures in their farms. The program supports growers to achieve efficient conservation goals in their agricultural operations as well as IID to meet the QSA (Quantification Settlement Agreement) water transfer requirements. As part of the QSA and related agreements, IID agreed to a long-term transfer of water to the San Diego County Water Authority and the Coachella Valley Water District. Nearly two-thirds of IID's water transfer obligations is planned to be accomplished by on-farm water efficiency and conservation practices.

On-farm water conservation is not an easy task. Technologies, tools, and management strategies along with incentive programs are required to accomplish a successful and impactful conservation program. The University of California Cooperative Extension - Imperial County (UCCE) partnered with the Imperial Valley Agriculture Community to document water conservation experiences in the Imperial Valley and to undertake an economic feasibility assessment of regional on-farm water conservation practices. As part of this ongoing study, this article presents some of the efforts and challenges of conservation measures implemented in the Imperial Valley over the last decade. The article particularly summarizes the findings of Imperial Valley Water User Survey conducted from April through July 2020.

**Imperial Valley Water User Survey.** The Imperial Valley Water User Survey was developed as a web-based survey questionnaire through the UC ANR Survey Tool. The survey aimed to document the overviews of Imperial Valley growers and to explore the real-life values and adaptability of water conservation measures over the last decade. The survey can be found at this link: <https://ucanr.edu/survey/survey.cfm?surveynumber=29840>

While the survey is still open to growers to provide information and share concerns, the results reported in this article are based on the information provided by 23 growers (agricultural operations). In this survey, information was collected regarding 10 specific on-farm water

conservation practices and any other innovative practices performed by growers. The water conservation measures and the assigned names to each practice are provided in Table 1. Additional information was collected on growers' investment in water conservation and efficiency improvement programs, where water conservation materials and equipment were purchased, number of jobs created from water conservation program, and potential changes in water conservation activities of the agricultural operations to accommodate the current OFECP solicitation.

Table 1. List of water conservation measures in this study.

<b>Water conservation practice</b>	<b>Assigned name</b>
Irrigation Scheduling Technology (i.e. soil moisture sensors, ET*/weather stations)	WCP1
Surface Irrigation Optimization (land leveling, field reconfiguration)	WCP2
Sprinkler Irrigation (full season sprinkler system or sprinkler-flood system)	WCP3
Drip/Micro Irrigation	WCP4
Portable Tailwater Recovery System	WCP5
Permanent Tailwater Recovery System	WCP6
Cascading Tailwater Recovery System	WCP7
Automated Surface Irrigation	WCP8
Deficit Irrigation	WCP9
On-Farm Reservoir	WCP10
All other types of conservation methods (even if not currently recognized conservation method by IID's OFECP)	WCP11

\*ET stands for crop evapotranspiration.

**Adopted water conservation practices by growers.** The results illustrate that all water conservation measures presented in Table 1 were adopted by Imperial Valley growers over the last decade, while there is significant difference in the favorability of each practice (Figure 1). Surface irrigation optimization (WCP2) is the most common water conservation practice (adopted by 87% of the responders) followed by sprinkler irrigation (adopted by 73.9% of the responders) and irrigation scheduling technologies (adopted by 65.2% of the responders). Forty-three (43.5) % of the responders reported adopting drip irrigation, portable tailwater recovery system, and deficit irrigation. On-farm reservoir is recognized as a water conservation measure adopted by 34.8% of the responders followed by permanent and cascading tailwater recovery systems (adopted by 26.1% of the responders). Automated surface irrigation was the least adopted practice (8.7% of the responders), however, there is an increasing interest among growers utilizing this irrigation technology specifically since gravity irrigation (surface irrigation) dominates irrigation systems in the low desert region and that it reduces labor cost .

In addition, 26.1% of the responders implemented other innovative water conservation measures (WCP11) including sequential irrigation, switching alfalfa crop fields to low water use olive trees, reduce water use in fields through cutting off one acre-foot in each water order and educate irrigators on when to shut off water, conversion of aluminum sprinkler pipe to Certa-Lok PVC pipe with drain checks and regulators (leak proof), and utilizing soil amendments and water conditioning.

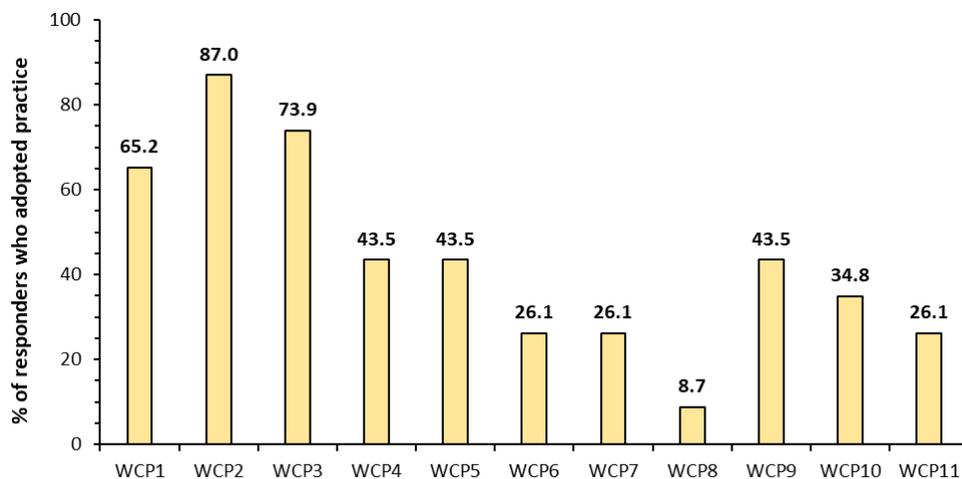


Figure 1. Percentage of the responders who adopted different water conservation practices. There are growers who adopted several conservation measures in their agricultural operations.

**Water conservation practices over time.** The survey results demonstrate that growers continuously conducted various water conservation practices over the last decade (Table 2). Insignificant or no change in some practices was reported by the responders, for instance, in automated surface irrigation, cascading tailwater recovery system, deficit irrigation, and on-farm reservoir. Utilizing sprinkler and drip irrigation systems; and portable tailwater recovery systems have increased in terms of the total acreage and the number of growers who adopted these measures since 2013. There was an average increase of 13% for growers who adopted these three technologies over the period of 2013-2019 when compared with the period before 2013. However, reductions were observed in sprinkler irrigation and portable tailwater recovery systems in 2020 compared to the period of 2013-2019. The reductions observed in sprinkler irrigation in 2020 could be due to the reduced IID OFECP payment and/or the COVID-19 pandemic. Slight increase of adopting permanent tailwater recovery system has been occurred since before 2013.

Table 2. Percentage of the responders who adopted different water conservation practices in various period since before 2013 (See Table 1 for descriptions for water conservation practices)

Water conservation practices	Period			
	Before 2013	2013 -2016	2017-2019	2020
WCP1	43.5	47.5	52.2	52.2
WCP2	73.9	78.3	78.3	65.2
WCP3	52.2	52.2	69.6	56.5
WCP4	30.4	43.5	39.1	39.1
WCP5	21.7	30.4	34.8	30.4
WCP6	17.4	17.4	17.4	21.7
WCP7	13.0	13.0	13.0	13.0
WCP8	8.7	8.7	8.7	8.7
WCP9	34.8	34.8	34.8	30.4
WCP10	26.1	30.4	30.4	30.4
WCP11	13.0	21.7	30.4	30.4

**Growers’ investment in water conservation program.** The 23-surveyed agricultural operations invested a total of nearly \$25 million on their water conservation programs over the last decade ranging from less than \$100,000 to greater than \$5,000,000 per agricultural operation. There was a wide range in the grower’s contribution in each of the investment categories (Figure 2). For instance, 21.7% of the respondents invested less than \$100,000 in their water conservation programs. However, 4.3% of the responders invested in each of the category from \$750,000-\$1,000,000, \$4,000,000-\$5,000,000 to greater than \$5,000,000. The percentage of the respondents who invested \$250,000-\$499,999 and \$1,000,001-\$2,000,000 was the same (17.4%). Similarly, 8.7% of respondents invested for the categories either \$500,000-\$749,999 or \$2,000,001-\$3,000,000. A 13.0% of the surveyed farms invested \$100,000-\$249,999 in their water conservation programs.

The average annual investment in water conservation program for all surveyed agricultural operations was about \$165,000 over the study period. The average annual investment of the surveyed farms varied from \$20,000 to \$650,000 per year.

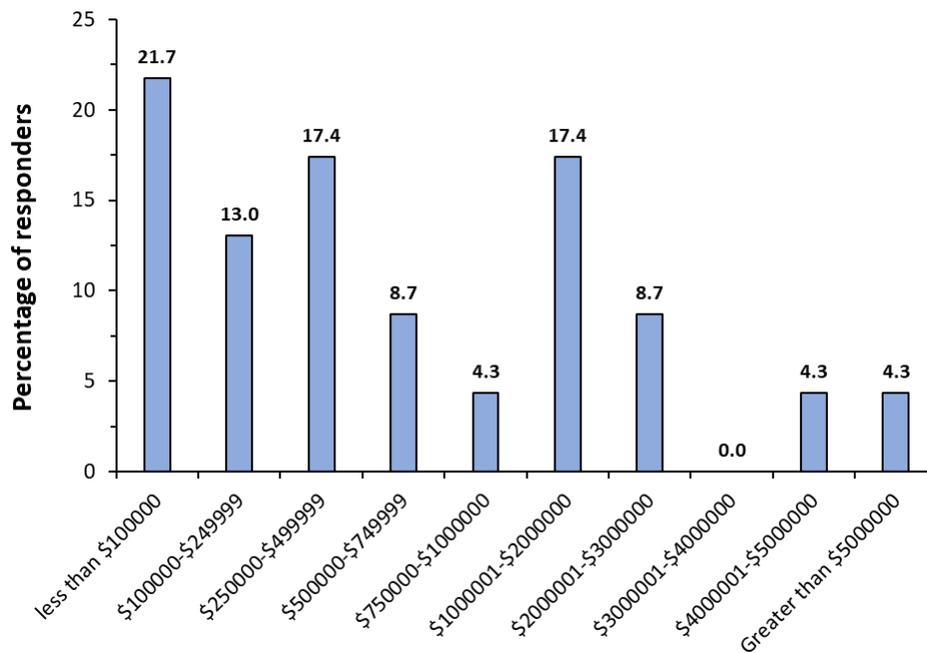


Figure 2. Percentage of the responders who invested in different investment categories (capital investment) for their water conservation program. Other expenses, such as system operating, maintenance, and labor costs were not included in this investment analysis.

**Purchased water conservation materials and equipment.** The survey shows that 78.3% of the responders purchased all their water conservation materials and equipment within Imperial County. While 17.4% of the agricultural operations purchased the majority of their water conservation supplies and equipment needs within the County, the remaining 4.3% of the responders purchased about half within the County and half outside of the County (Table 3). The

survey results clearly indicate that water conservation practices implemented in the Imperial Valley have had a significant contribution into the marketing of irrigation-water supplies over years.

Table 3. Percentage of the responders associated with where they purchased water conservation materials/equipment from.

Where the responders purchased water conservation materials/equipment	Percentage
All purchased within Imperial Valley	78.3
Majority purchased within Imperial Valley	17.4
About half purchased within Imperial Valley and half outside of Imperial Valley	4.3
Majority purchased outside Imperial Valley	0.0
All purchased outside Imperial Valley	0.0

**Jobs created from water conservation programs.** The number of additional jobs created through water conservation programs varied among surveyed farms (Figure 3), ranging from no job created (34.8% of the responders) to more than 20 jobs created (8.7% of the responders). About 65.2 % of the agricultural operations reported creating additional jobs in their farms over the study period. A total of nearly 125 jobs were created by the surveyed farms to implement and manage water conservation programs.

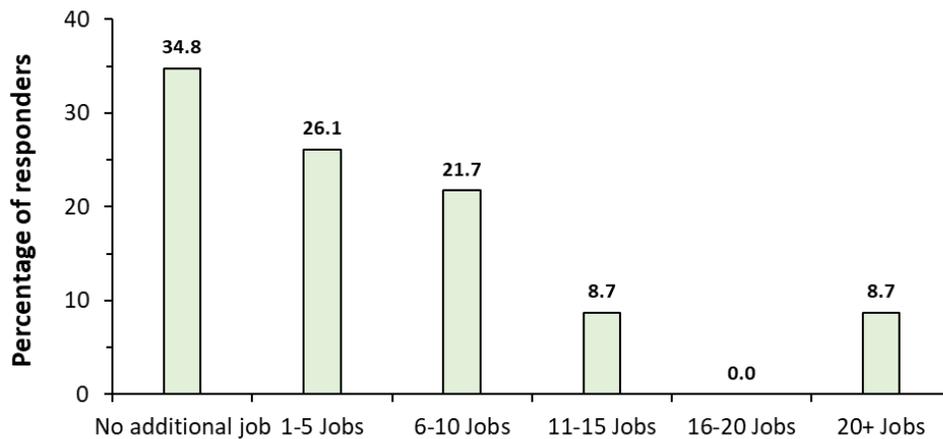


Figure 3. Percentage of the responders associated with different additional jobs created from water conservation programs.

**Potential changes in water conservation activities in the future.** A 35% of the agricultural operations declared that if they knew about 2019 OFECP solicitation (the payment rate drops from 285/acre foot to \$125/acre foot), they would have changed their conservation practices. These desired changes were clearly observed in water conservation practices suggested by the surveyed farms for the 2020 OFECP solicitation (Table 4). An 80% of the agricultural operations reported that they will keep their existing conservation practices without implementing previously planned practices. Several other changes are performed by growers to accommodate

the current OFECP solicitation including cancelling any planned purchases (60% of the responders), divesting conservation equipment and sold previously purchased conservation materials (13.3% of the responders), decreasing the amount of time spent on irrigation scheduling and management (40% of the farm surveyed), and reducing hours of employees (53.3% of the responders). A 13.3% of the responders seek other ways to address the economic complications created by the current OFECP solicitation.

Table 4. Percentage of the responders associated with the different changes made to water conservation practices due to the current OFECP solicitation. Each grower uses multi-approaches to address the economic complications created by the recent OFECP solicitation.

<b>Changes made to water conservation practices</b>	<b>% of the responders</b>
Kept existing conservation practices, but did not implement previously planned practices	80.0
Stopped all conservation practices	6.7
Cancelled planned purchases	60.0
Divested conservation equipment/Sold previously purchased conservation materials (sold pipe, etc.)	13.3
Decreased amount of time spent on irrigation scheduling and management	40.0
Reduced hours of employees	53.3
Other	13.3

**Conclusions.** Most surveyed farms participated in IID’s OFECP for 2 to 8 years. The survey results revealed that 78% of the surveyed agricultural operations have proposed and implemented conservation measures through this program. Consequently, the findings from this study represent both the experiences of the Imperial Valley Agriculture Community with water conservation measures recognized by OFECP and conducted voluntarily beyond the program. The following conclusions are made from this study:

- While various water conservation measures were adopted by Imperial Valley growers over the last decade, surface irrigation optimization, sprinkler irrigation, and irrigation scheduling technologies have been the most commonly adopted practices. Drip irrigation and portable tailwater recovery systems, and deficit irrigation management strategies with a similar adaptation rate were adopted latter.
- The number of agricultural operations that adopted surface irrigation optimization, sprinkler irrigation, and irrigation scheduling technologies over the period of 2013-2019 increased by an average of 13%, when compared with pre- 2013 practices. In the meantime, acreage of sprinkler irrigation systems in 2020 was considerably reduced (by about 14%) compared to the period of 2013-2019. Reductions observed in sprinkler irrigation in 2020 could be due to the reduced IID OFECP payment and/or the COVID-19 pandemic.
- The average capital investment in water conservation programs from surveyed agricultural operations was about \$165,000 per year over the last decade. The average annual investment of the surveyed farms varied from \$20,000 to \$650,000. Other expenses, such as system operating, maintenance, and labor costs were not included in this investment analysis.

- Most surveyed agricultural operations (95.7%) purchased all or majority of water conservation materials and equipment within Imperial County.
- A 65.2 % of the agricultural operations reported creating additional jobs because of continuous water conservation activities. Nearly 125 jobs were created by the surveyed farms to implement and manage water conservation programs.
- The findings of this study illustrate that the current OFECP solicitation has brought significant concerns to Imperial Valley growers who remarkably invested in water conservation measures for more than one decade. The Imperial Valley agriculture community sees the current OFECP solicitation as a new challenge in the coming years. Most growers are seeking for better approaches to address the economic complications created by the recent OFECP solicitation.
- Changes in water conservation activities are expected to accommodate the current OFECP solicitation by growers including keeping existing conservation practices, but not implementing previously planned practices, cancelling planned purchases, divesting conservation equipment and sold previously purchased conservation materials, decreasing the amount of time spent on irrigation scheduling and management, and reducing hours of employees.
- Incentive programs may enhance successful conservation programs in the low desert region. The incentives provide the support required by agricultural operations for capital investment of costly water conservation measures. The findings of this survey clearly demonstrate the importance of a study highlighting the cost of generating conserved water and the economic multiplier of farm community efforts, specifically to assess the economic feasibility of water conservation measures under current and future OFECP solicitations.

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**Note:** If you have any question or concern about this article and/or this ongoing study, please feel free to contact Ali Montazar at (442) 265-7707 or [amontazar@ucanr.edu](mailto:amontazar@ucanr.edu).