

Article

Perceptions and Acceptance of Desalinated Seawater for Irrigation: A Case Study in the Níjar District (Southeast Spain)

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Abstract: In the context of increasing demand for irrigation water—but, at the same time, with the constraints in the supply from traditional resources—desalinated seawater has been recognized as one of the alternative sources of water to increase the supply for agricultural irrigation. However, its use among farmers has not yet started to expand. Policy makers need to understand what is causing the low acceptance levels of farmers, and how their attitudes could be improved. This is the first study that has conducted an analysis of farmers' perceptions and acceptance of the use of desalinated seawater for irrigation. The study is based on collected data from a survey completed by farmers in southeastern Spain who do not use desalinated seawater. The main results indicate that desalinated seawater as a water supply source has the lowest acceptance level for farmers. Barriers for its use are price, the need for additional fertilization, and the perception that it would negatively affect the yield and crop quality. The farmers' general level of knowledge about the impact of using desalinated seawater in agriculture is extremely low. Furthermore, farmers consider it a priority that their startup investment should be subsidized and that water prices should be reduced. Based on the study findings, this paper makes recommendations for the decision-making process in order to improve farmers' acceptance levels.

Keywords: water policy; community acceptance; community perceptions; assessment; survey; desalinated seawater; agriculture; irrigation

1. Introduction

Water scarcity is one of the most serious global challenges of our time, and is an increasing problem in many parts of the world [1]. This scarcity will especially affect the production of foodstuffs for human consumption, as the agricultural sector is the leading user of water. Around 70% of available world resources are estimated to be used for irrigation. In some countries and regions, this share can be even higher and may exceed 90% [2]. In order to address such increasing scarcity, alternative sources of water for irrigation need to be developed, particularly in arid and semi-arid regions. Seawater desalination has emerged as a feasible option for irrigation. Currently, desalination technology can provide an opportunity for generating quality controlled water for agricultural purposes [3]. Furthermore, because the cost of seawater desalination has been declining over the years and the conventional water treatment and distribution costs have been rising, in many regions throughout the world, desalination has become more economically competitive and attractive [4–6]. This trend is likely to continue in the coming years, since advances in technology and equipment are expected to reduce desalination costs [3].

Consequently, desalinated seawater is recognized as one of the alternative sources of water to augment the supply for agricultural irrigation. However, farmers' opposition to its use can be an obstacle to further developing desalinated-seawater projects as a source for irrigation [7]. As a result, although desalinated seawater may be available, the clients for this desalinated seawater are not easily found because they refuse to accept the shift in the water supply. The implementation of an alternative source of water must be technologically viable, economically affordable and socially acceptable for it to have any success [8]. The importance of a positive attitude of users for achieving the successful introduction and implementation of new water resources has been demonstrated [9–11]. One of the major barriers has often been the lack of community acceptance in adopting alternative sources of water [12], so it is crucial to understand factors influencing the acceptance and adoption of alternative sources of water in order to achieve their successful implementation [13].

Since the early 1970s, a significant amount of research has been conducted on community perceptions and acceptance of recycled water, but only a small amount of work has been devoted to desalinated water (e.g., [14]). In the case of agriculture, a limited number of studies has analyzed farmers' perceptions and acceptance of recycled water for irrigation (e.g., [15–18]). To our knowledge, there are no studies that have examined perceptions regarding seawater for irrigation. An increased understanding of farmers' perceptions on the use of desalinated seawater for irrigation has relevant implications for policy makers. It is crucial to better understand what is causing the lack of acceptance among the potential users, and how their acceptance levels could be increased. This information can help policy makers successfully implement desalinated-seawater projects. Additionally, this information may have a positive influence on policies, which can therefore be designed according to farmers' needs.

In Spain, over 75% of the demand for water comes from irrigated agriculture and, in many regions of the country, water constraints and overexploitation of groundwater persist. This explains the search for alternative water sources and is why Spain is one of the first countries to experiment with desalination as a means of increasing the water supply for agriculture. The first desalination plant for agricultural use was installed in the mid-seventies on the Canary Islands, but it was not until the beginning of the 21st century that the so-called AGUA Programme was developed to foster water desalination processes. This programme promoted desalination as the best solution to solve water scarcity in coastal areas for agricultural and urban uses. It proposed the construction of 21 high-volume desalination plants, and planned an additional desalinated-water production of 1063 hm³/year (1 hm³ = 1,000,000 m³) [19]. The largest investment was located in southeastern Spain, where all seawater desalination plants devoted to agricultural irrigation purposes were constructed [20]. This area was the best suited to implement this kind of project for two main reasons: firstly, its high hydric deficit—water demand being much higher than the water offered in the region—as well as the aquifer over-exploitation of the region, and secondly, the development of an intensive high-return agriculture. In addition, the high added value of irrigated agricultural production could cover the cost of a seawater-desalination-based solution for water scarcity [21]. However, after a decade of using desalinated seawater for agriculture, this water supply option has not yet been generalized, and there is an underutilization of desalination plants that are operating at a reduced capacity [22]. The high desalinated-water prices often serve to explain this underuse of desalinated seawater for irrigation (e.g., [21,23–25]). Nevertheless, no study on farmers' acceptance of such projects has been previously conducted.

The aim of this paper is to bridge this gap by investigating the perceptions and acceptance of the use of desalinated seawater by farmers who refuse to irrigate their crops with desalinated seawater in southeastern Spain. Specifically, the following factors have been analyzed: (i) farmers' socioeconomic features; (ii) farmers' perceptions and support levels regarding desalinated seawater; and (iii) the assessment of possible measures to increase farmers' acceptance levels. Our study contributes to the understanding of farmers' acceptance of desalinated seawater for irrigation purposes and provides possible explanations for farmers' resistance to its implementation. The results have important practical

implications, as they provide guidance to policy makers about interventions that are likely to increase farmers' acceptance. Furthermore, the lessons learned from this study could be useful for other regions facing water shortages to consider using desalinated seawater to increase the water supply for irrigation purposes.

2. Materials and Methods

2.1. Case Study: Níjar District

The Níjar district in the Southeast of Spain was selected as our case study as it is highly representative due to the following reasons. Firstly, this region, located in the eastern part of the province of Almería (Figure 1), is one of the driest areas in Europe. Its Mediterranean climate is semi-arid, with mild winters and high solar radiation. Secondly, annual precipitation is very low, with sporadic torrential downpours that result in no permanent streams or barrages to collect and store runoffs [26,27]. Nevertheless, the region has significant aquifers. The existence of aquifers, along with the reduced availability of surface water, has led to irrigation water coming almost exclusively from the groundwater wells.

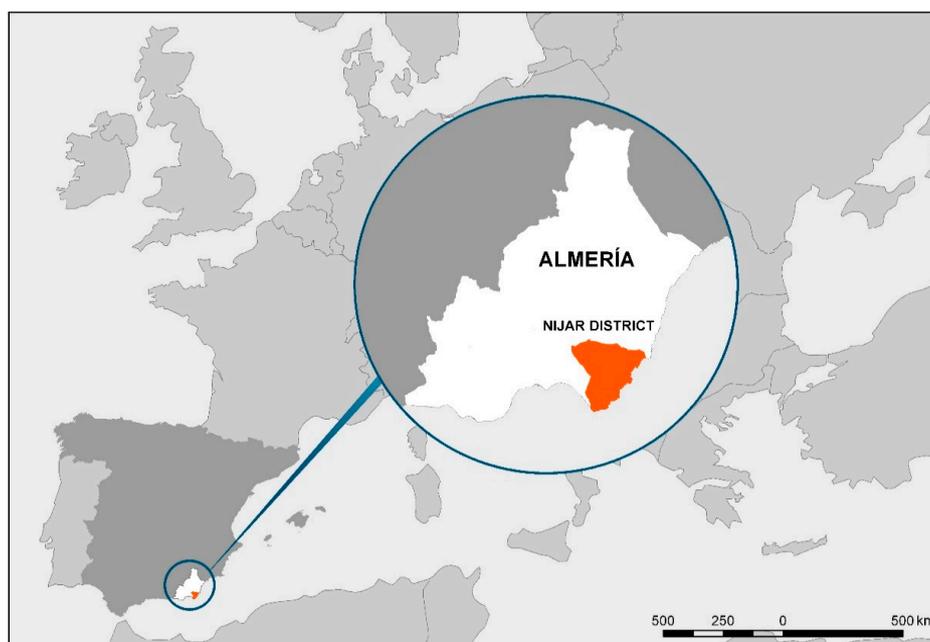


Figure 1. Location of Níjar District (Almería) in the Southeast of Spain.

The Níjar district currently has the second largest concentration of greenhouses in the province of Almería, covering more than 6000 ha [28]. The rapid development of this greenhouse-based, intensive vegetable-production system since the mid-1960s is due to two main factors: electrical pump-fed irrigation of water from aquifers, and the emergence of plastic greenhouses, which provide high-value horticultural products [29]. Due to the need to administer the scant water resources available, the Níjar district has been intensively modernized, and has become a reference for water saving technologies [30]. Due to advanced technology, irrigation in Níjar has been more efficient than in other agricultural districts around the world, including Mediterranean areas [26,31]. However, the water saved by this efficiency cannot compensate for the increased water demand caused by the increased number of greenhouses [32]. This increase exerted pressure on aquifers, and caused serious availability and quality problems—a severe aquifer overexploitation and a reduction of groundwater levels [33]. On the other hand, an increasing salinization of aquifers was observed. Groundwater had, at the time, been affected by nitrate pollution [34–36].

As a result, this development model, based on the exploitation of groundwater, began to show serious problems and a high probability of collapse. In this context, desalination was seen as a logical and relatively quick solution to meet the needs of this district. In 2002, the seawater-desalination plant in Carboneras was opened, with the first—the largest in Europe—built through the AGUA Programme in Spain. It had a net capacity to produce 120,000 m³ of water per day, the equivalent of 42 hm³/year, and could be enlarged to 84 hm³/year. With the construction of this desalination plant, it was expected that desalinated water would play an important role as a water source used by farmers in the district, due to the scarcity of renewable fresh-water resources and the deterioration of groundwater aquifers [37]. However, the current usage level of desalinated seawater is lower than expected at the beginning of this project; in 2016, the use of desalinated seawater for irrigation was only 8 hm³/year.

Recycled water could be an alternative water-supply source to desalinated seawater, and could enter into direct competition. However, there is currently no treatment plant in the Níjar district that processes sewage water from the urban centers. The population dissemination in this region is a relevant obstacle for its installation. In a 601 km² area, there were only 28,579 inhabitants in 2016. There is a plan to build a sewage treatment plant with a capacity of 1.2 hm³/year. However, this option would have marginal significance regarding the other water-source supplies.

As far as the current irrigation water management in the Níjar district is concerned, farmers are organized in irrigation communities, which manage the groundwater supplies. These communities have rights to pump groundwater and supply it directly to the farmer's land. For this service, the farmer pays the community an average water-price of around 0.25 €/m³. The community monitors the farmer's water consumption through individual water meters. The farmer buys the water supply measured in hours. The water supply for the total number of hours is proportionally distributed to the community members according to their land surface. A farmer is a member of the irrigation community that manages the well nearest to his/her farm. There are farmers who also use desalinated seawater from the desalination plant in Carboneras for crop irrigation, in addition to groundwater. For this reason, farmers are also members of the corresponding management community (Comunidad de Usuarios de la Comarca de Níjar). Since there is currently no surface water available for irrigation in the district, the nine irrigation communities that are operating are key actors for the proper management of the groundwater supply.

2.2. Questionnaire Design

The research was firstly conducted as a qualitative study. A focus group was made up of eight farmers of the study area who did not use desalinated seawater for irrigation. They discussed the advantages, disadvantages, risks and alternatives of using desalinated seawater. From the information obtained from this focus group, it was possible to formulate all of the forced-choice questions for the questionnaire to be posed to our target farmers. The advantage of this approach was that the qualitative phase assured all critical answer options were included. On the other hand, the simple survey format made it possible for valid quantitative information to be obtained from a representative sample of farmers [38]. The first version of the questionnaire was doubly reviewed. Firstly, a group of three experts in intensive agriculture in Almeria stated the relevance and completeness of all questions. After all suggestions made by experts were considered, the questionnaire was tested in the study area by a pilot survey among 10 farmers thoroughly experienced in the intense cultivation of vegetables. The questionnaire included 15 questions and its structure was divided up into three blocks according to the pursued objectives:

1. Featuring of desalination non-user farmers. Four groups of questions were included in the questionnaire: socio-economic features of farmers (age, experience as farmer, and level of education); agricultural holding characteristics (type of soil, greenhouse type, dimension, construction year, climate monitor system, and percentage of farmer family-bounded labor); crop characteristics (level of monoculture, yield differences, and trading channel); and water use

- (technological irrigation level, electrical conductivity level of irrigation water, and percentage of average water consumption per hectare).
2. Acceptance and perceptions regarding desalinated seawater. Within this block, two questions were asked. In the first, farmers were asked to rank different water-source supplies for irrigation under the same price conditions: surface water, groundwater, recycled water, and desalinated seawater. Farmers had to indicate in which order they would utilize the sources of water listed above. Based on information drawn from the focus group, in the second question, farmers had to assess the factors they perceived to be relevant for their acceptance of desalinated seawater: price, availability, crop yield, crop quality, water consumption, additional fertilization, crop diversity, and soil quality. Farmers were asked to rate each factor with a 6-point Likert scale based on the Juster scale from -3 to 3 , where -3 represents no agreement (the range from -3 to -1 is considered disadvantageous), 3 represents complete agreement (the range from 1 to 3 is considered advantageous), and 0 represents a neutral position.
 3. Measures for increasing the acceptance level for desalinated seawater. The farmers were asked about five policy measures identified in the focus group. The following measures were proposed to encourage farmers to better accept the use of desalinated seawater: subsidies for startup investment, price reduction for all users, tax reliefs for its use, volume discounts—the larger the consumed volume of desalinated seawater, the lower the water price per m^3 , due to an offered discount—and information campaigns. The policy measures were rated on a 3-point Likert scale (1 representing not important, 2 representing important, and 3 representing very important).

2.3. Survey Methodology

To determine the study sample size, a maximal error level of 5% and a trust level of 95% were established. The representative sample was obtained from the cultivation surface devoted to each type of crop in 2015, with report-based data [28]. In a greenhouse area of 4140 ha where no desalinated seawater was used, 100 farmers were interviewed. This accounted for 333.8 ha of cultivated surface without the use of desalination. This showed a representative sample of intense agriculture in Nijar District, as the sample error amounted to $\pm 5.14\%$.

For the sample selection, the crop type and its usual cycle were taken into account. In the case of non-users of desalinated seawater, tomato was the most common crop type as it was the least demanding regarding water quality (measured by its level of conductivity). Tomato cultivation in all its cycles made up 75% of the total cultivated area studied. The type of crop distribution of the selected farmers was in accordance with the area distribution, as 77% of respondents cultivated tomato (Table 1). The locations of farmers were chosen specifically to ensure the maximum heterogeneity of the socioeconomic and physical characteristics of their agricultural holdings. The selection of each respondent was undertaken with the collaboration of the Irrigation Communities that manage groundwater supplies. Interviews were conducted by the authors between September and December 2016. The interviews lasted forty minutes each on average.

Table 1. Sample distribution per crop type.

Crop Type and Cycle	Cultivated Surface (ha)	Survey Surface (ha)	Conducted Surveys
Tomato (long cycle)	2153	180.6	54
Tomato (autumn) and watermelon (spring)	1656	138.5	41
Tomato (autumn) and courgette (spring)	207	11.7	4
Pepper (long cycle)	41	0.0	0
Other crops	83	2.7	1
Total	4140	333.8	100

2.4. Data Analysis

The information obtained from the surveys has allowed for a general characterization of farmers as non-users of desalinated seawater for irrigation and their agricultural holdings. Taking into account the statistical data, the analysis of the variation coefficient (VC) has proved to be relevant. These statistical data are used to measure data dispersion regardless of variable units: the lower the level, the lower the heterogeneity of data found. Subsequently, a detailed analysis of the agricultural holding type enabled a more accurate approximation regarding farmers' preferences when selecting sources of water supplies for irrigation, and their perceptions and attitudes towards desalinated seawater, as well as their priorities regarding the proposed policy measures to increase their acceptance level of desalinated seawater use for irrigation. Answers to the questions asked using a Likert scale were represented using a spider graph.

3. Results and Discussion

3.1. Features of Non-User Farmers of Desalinated Seawater

From the data analysis of the survey conducted on 100 farmers, 15 typifying variables were considered and grouped into four main descriptive fields: the farmer's features, the agricultural holding characteristics, the crop characteristics, and the water use (Table 2). It is worth mentioning the observed high degree of homogeneity (except for variable V₉), measured by the variation result coefficient (percentage of farmer's family-bounded labor).

Table 2. Variables and descriptive statistic data.

Field	Variable	Description	Min	Max	Average	Standard Deviation	Variation Coefficient
Farmer's features	V ₁	Farmer's age (years old)	45	58	52.1	5.4	10.3%
	V ₂	Experience as a farmer (years)	16	24	20.7	22.0	16.5%
	V ₃	Level of education: (1) no schooling, (2) compulsory education, (3) upper secondary school, (4) university, (5) specific vocational training programmes, and (6) others	2	2	2	*	*
Agricultural holding characteristics	V ₄	Type of soil: (1) local ground, (2) sanded soil, (3) hydroponic soil, and (4) others	2	2	2	*	*
	V ₅	Greenhouse type: (1) flat arch, (2) sloping roof, (3) asymmetric, (4) cylindrical multi-tunnel, (5) raise dome multi-tunnel, (6) venlo, (7) mesh, and (8) others	2	2	2	*	*
	V ₆	Dimension of the agricultural holding (hectare)	1	1.6	1.24	2.7	21.4%
	V ₇	Construction year (four-digit year)	1994	2003	1999	3.7	0.2%
	V ₈	Climate monitor system: (1) yes, or (2) no	1	1	1	0.0	0.0%
Crop characteristics	V ₉	Percentage of farmer family-bounded labor	26.0%	80.0%	51.8%	0.2	42.9%
	V ₁₀	Level of monoculture: (1) non-repeated cultivation, (2) repeated cultivation due to holding limits, (3) repeated cultivation due to market conditions, or (4) repeated cultivation for other reasons	2	4	2.7	*	*
	V ₁₁	Yield differences (differences between exploitation yield and the regional average yield according to cultivation type and cycle)	0.7	1	0.9	*	*
	V ₁₂	Trading channel: (1) agricultural cooperative, (2) local market, (3) direct sale, (4) wholesalers, and (5) others	2	3	2.3	*	*

Table 2. Cont.

Field	Variable	Description	Min	Max	Average	Standard Deviation	Variation Coefficient
Water use	V ₁₃	Technological irrigation level (the higher the number, the higher the technological irrigation level; min: 16, and max: 31)	16	18	17.3	0.9	5.5%
	V ₁₄	Electrical conductivity level of irrigation water (dS/m)	2.5	5	3.6	1.1	29.8%
	V ₁₅	Percentage of average water consumption per hectare, crop type and cycle, compared to the regional average (100%)	110%	115%	112%	0.1	2.2%

Note: (*) No data are given since these are qualitative variables.

Farmers who are non-users of desalinated water are characterized by having a wide experience in the sector (20 years on average) and a low level of schooling, embracing only compulsory education. Their agricultural holdings are small (a little more than one hectare) and the greenhouses are at least 15 years old. A reduced number of workers are employed since the main laborers are the farmer and his family. They cultivate mainly tomato as this crop type tolerates the high level of salinity in groundwater well, and the technological requirements are few. Their crop yield is under the average regional yield. They sell their produce through traditional channels such as local markets. Irrigated water consumption is higher for agricultural holdings, which do not use desalinated water due to the low level of irrigation technology and the need for the soil to be washed in order to eliminate salt concentrations from the groundwater. Studies on the acceptability of recycled water for irrigation in Crete [16] and in Greece [17] report that the more educated the farmers are, the more likely they are to use recycled water on their cultivations.

3.2. Acceptance of and Perceptions on Desalinated Seawater

The acceptance level for desalinated water for irrigation is very low. In a theoretical context, where water price is the same for all considered supply sources, desalinated water has the worst value. The two preferred water supply options chosen by farmers were surface water and recycled water (Figure 2). As a third option, farmers chose groundwater, despite its high level of salinity, and as a final water supply option, farmers chose desalinated seawater. These findings are in line with those obtained in urban areas [39,40], where recycled water ranked higher than desalinated water when used for garden watering (flowers, trees, shrubs, vegetables and herbs).

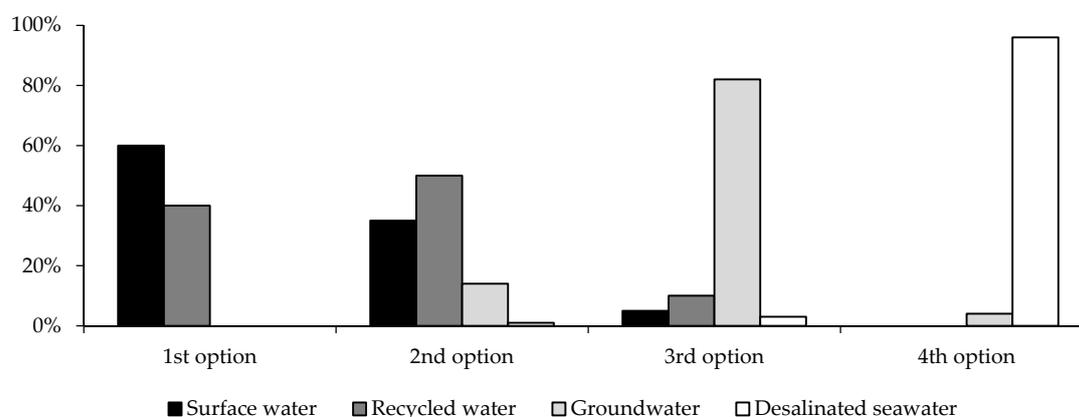


Figure 2. Order of water supply options regardless of price.

When the farmer was asked about the different factors relating to the use of desalinated seawater for irrigation, he perceived a number of advantages and disadvantages (Figure 3). The two main

disadvantages were the following: firstly, its high price, double that of groundwater; and, secondly, the need to add more fertilizers to irrigated water, due to its poor composition of basic nutrients such as calcium, magnesium, and sulphates that are essential to plant growth. Farmers also considered the use of desalinated water for irrigation to negatively impact on the crop yields and the produce quality. However, they did not know how it could affect the level of water consumption or soil quality. The main perceived advantage was its high level of availability, since it can be used at any time and in any season. The possibility of cultivating other crop types sensitive to water salinity (such as peppers, courgette, aubergine, etc.) was also considered an advantage.

Results are very interesting as they show that the main concern among farmers was not only the price but also the quality. This finding coincides with findings for recycled water [41] and for desalinated water [42]. However, it contradicts other studies indicating that the price is the only explanatory reason for the low use of desalinated seawater for irrigation (e.g., [21,23,24]).

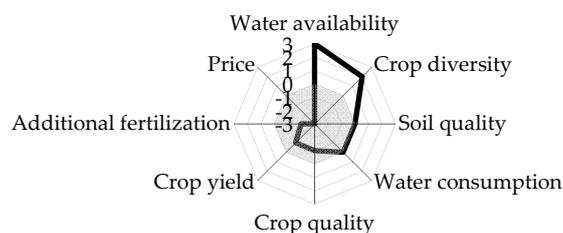


Figure 3. Ranking of factors related to desalinated water use.

The farmers' negative perceptions regarding the need for additional fertilization is justified as extra costs are involved that make irrigation management more complicated. This is a key factor for farmers' acceptance, since deficiencies in essential minerals have significant effects on productivity and plant growth [43,44]. The negative perception contrasts with perceptions of the farmers on recycled water. In other areas, the high nutrient content of recycled water is recognized by most farmers to be an important advantage for reducing the amount of chemical fertilizers needed to obtain profitable crop yields [18].

The negative perception of farmers regarding the impact on crop yield and quality does not seem to correspond to what happens in practice. Valera et al. [45] report for this study area that tomato crops give higher yields when irrigated with desalinated seawater than with groundwater (around 44%). Desalinated seawater also gives better crop quality regarding diameter, weight, firmness, dry matter and soluble solids content. Therefore, there appears to be a significant discrepancy between the farmers' perceptions and the findings of scientific studies. This should be pointed out when designing measures to increase farmers' acceptance levels of desalinated seawater for irrigation.

These findings have important implications for policy makers. It is not enough to introduce measures that reduce desalinated-water prices, it is also necessary to focus on questions regarding quality, which are crucial for farmers. The general level of knowledge about the impact of desalinated seawater on agriculture is extremely low among farmers. This lack of knowledge and information negatively affects their acceptance level. Most studies analyzing the factors that affect community acceptance of alternative water sources found that information dissemination had a positive influence on attitudes (e.g., [14]). That is why policies devoted to information campaigns among farmers on the quality and benefits of the use of desalinated seawater for irrigation are crucial. There are various methods that can be used to design an information campaign. Experience with recycled water for irrigation shows that short, informative sessions and demonstration practices have strong, positive impacts on the willingness of farmers to use a different source of water [46,47].

3.3. Measures for Increasing the Acceptance Level for Desalinated Seawater

Several measures can be introduced in order to increase the acceptance level for using desalinated seawater for irrigation; economic measures are the most common. These can be a direct subsidy, such as for a startup investment or discounts on the price of water, or an indirect subsidy, such as tax relief or volume discounts. Furthermore, information campaigns have proved to be very efficient. Among all proposed measures, farmers consider direct subsidies the most important (Figure 4). Their preference for the startup investment subsidy can be well explained, since the connection to the main supply system represents a significant outlay for small-scale farmers. This finding is in line with the ability of households to adopt an alternative water system, which seems to be typically limited by their income [8]. The lower valuation of indirect subsidies can be justified by the small dimension of agricultural holdings, so that volume discounts or tax reliefs are not such attractive measures. These preferences should be taken into account when designing a successful subsidy policy.

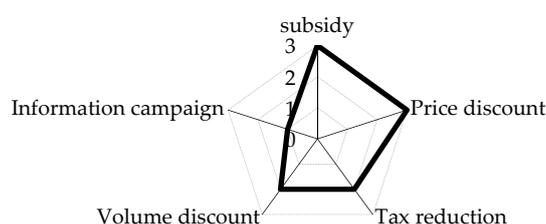


Figure 4. Assessment of measures to increase the use of desalinated seawater for irrigation.

The least-valued measure is the implementation of an information campaign to increase farmers' acceptance level of desalinated water for irrigation. This result agrees with that obtained for recycled water irrigation [47]; non-users showed the lowest acceptance level regarding informative sessions. This negative feeling of farmers toward information campaigns should be considered when promoting these kinds of measures. To increase the efficiency level of the information, campaigns should concentrate on this group of farmers as they are the most reluctant, and they should also deal with critical issues such as price, the need for fertilization, crop yield and quality, water consumption, and soil quality. Moreover, information campaigns should use the most appropriate dissemination channels, such as those employed when farmers learn about the technical aspects of cultivation. Neither information nor dissemination campaigns have been conducted so far in the study area. The implementation of such campaigns should be fostered by the "Comunidad de Usuarios de la Comarca de Níjar" (Water Users' Community of the Níjar District), which manages the desalinated seawater supply for crop irrigation, in collaboration with the "Sociedad Estatal de Aguas de las Cuencas Mediterráneas—Acuamed—" (Government Enterprise for Water in the Mediterranean), which manages the seawater desalination plant in Carboneras.

4. Conclusions

A survey of 100 farmers (non-users of desalinated seawater) was conducted in Southeast Spain to provide current data on: (i) farmers' socioeconomic features; (ii) farmers' acceptance levels and perceptions regarding desalinated seawater for irrigation; and (iii) farmers' assessments of possible measures to increase their acceptance levels. The results indicate that farmers have a low level of schooling, their greenhouses are small and use low-technology equipment, their main crop type is tomato, crop yield is low, water consumption is very high, and they trade their produce through traditional marketing channels. Desalinated seawater is the water supply with the lowest acceptance level among farmers. The following two main disadvantages were highlighted: its high price and the need for additional fertilization. They also perceive that desalinated water negatively affects crop yield and quality. Only two advantages were highlighted: water availability and the option to cultivate further salination-sensitive crops. Farmers' general level of knowledge about the effects of irrigating

with desalinated seawater is extremely low. Furthermore, they prefer a direct subsidy, such as for startup investments, and a price reduction in order to increase their acceptance level.

These findings have interesting policy implications. If policy makers are interested in increasing the farmers' acceptance levels of desalinated seawater for irrigation, they have to consider not only pricing policies, but also information and communication campaigns. These should target the factors considered to be negative by farmers and their main concerns, such as crop quality and yields, through suitable communication channels. Moreover, the following measure cannot be ignored: the subsidy of the initial investment for farmers to connect their irrigation systems to the desalinated water supply network.

This study is the first effort to understand the acceptance of using desalinated seawater for irrigation. It was conducted only in southeastern Spain, and the perceptions and acceptances are strongly linked to local conditions; the transfer of specific results from this study to other regions can be somewhat problematic. There are different economic, physical and institutional contexts that strongly influenced the farmers' responses. Future replications of this study in other regions could be extremely interesting; our findings could be contrasted, and a deeper understanding of why farmers accept or reject desalinated seawater for irrigation would be achieved. It would also be interesting to analyze the attitudes of farmers who are using desalinated seawater. This would help to complement the results of the current study. In any case, the findings of this study can serve as a reference for those areas where desalinated seawater is used for agricultural irrigation, or for where it is planned to be used.

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