IRRIGATION FACILITIES, PROBLEMS AND SOLUTIONS CONCERNING PISTACHIO GROWING IN SIIRT REGION

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Abstract

Growing of Siirt type of pistachio has a significant potential in the agriculture of Siirt province. As a result of the studies on this issue performed by public and legal institutions in recent years, while about 2000 tons of products were taken from the area in 4545.3 ha in 2002, these values reached about 11.000 tons of products in 25.000 ha by the end of 2014. Considering the climatic conditions of the region, the fact that summer is very hot and irregularity in the precipitation regime further increase the importance of irrigation and make it necessary for cultural practices in farming. However, pistachio orchards are not irrigated or tried to be contented with a little water due to the reasons such as the topographical structure of the area where farming is performed, irrigation water constraints, and any other reasons. The questionnaire study was carried out to determine the local farmers' tendencies on Siirt pistachio irrigation, problems faced, and the solution offers. For this purpose, the questionnaire form consisting of 40 questions was prepared, and data were collected using the Simple Random Sampling method. By this method, questionnaires were filled in by making face to face interviews with 177 farmers in 73 villages of 7 districts where farming is intensively performed. The obtained data were analyzed using MINITAB 16 statistical program. As a result of the statistical analyses, an attempt to contribute to the solution of the problems was made by developing solutions to identified problems.

Key words: Siirt pistachio, irrigation, questionnaire.

INTRODUCTION

Water, as in every area of life, is a strategic and logistic need in agriculture. Considering the fact that the water resources of our country are not infinite, it is evident that water has a strategic importance, and its unconscious use will cause negative effects on agricultural productivity and sustainability.

Furthermore, Siirt pistachios need irrigation water as all plants. The balanced distribution of water between the plant organelles causes the plant to maintain its life and also ensures its continuity through the production of fruits and seeds. Siirt pistachio is a hard shell fruit that has been cultivated mainly in the Southeastern Anatolia Region in our country for many years. It is cultivated in stony, rocky and hilly areas with less soil depth where any other crop plant cannot be cultivated economically mainly in the Southeastern Anatolia Region in our country. Due to the topographical structure of land and the fact that pistachio trees are abstemious plants (annual precipitation of 150 mm is sufficient to maintain the plant's life), they are not irrigated. However, the fact that it is drought-tolerant does not mean that a small amount of water is sufficient for the optimal plant growth. Irrigation to be performed without irrigation planning may prevent the plant from benefiting from the water at the optimum level and also may cause problems such as reduction in yield, deterioration of soil properties, salinity and sodium (Yıldırım et al., 1994), and likewise, the excessive water use leads to shortening life cycle of the soil causing ecosystem degradation, increase in erosion and water loss, and changes in the soil structure (Anonymous, 2012).

In our country, studies concerning the irrigation of pistachio were firstly initiated by Bilgen et al. in 1973 and 1982 and maintained by many
In recent years, some researchers have thought that yield loss and, therefore, periodicity, most important problems encountered in the cultivation of pistachios, are caused by water stress (Kanber et al. 1993). It is stated that water stress decreases yield about in half shares and causes deteriorations in fruit quality characteristics and that irrigation is a prerequisite to obtaining yield at the optimum level. Ak and Kaska (1992) divided periodicity into two classes as absolute and proportional and stated that the red type showed absolute periodicity and Ohadi and Siirt type showed proportional periodicity. They stated that pistachio tree increased the carbohydrate accumulation by more stooling and would lead to an increase in the yield of fruit if there were a sufficient amount of water in the soil. Arpaci et al. (1995) stated that Siirt pistachios give higher yields under irrigated conditions compared to dry conditions, and pistachio growing should be performed under irrigated conditions. 85.3% of Turkey's production of pistachio is performed in the Southeastern Anatolia Region (Gaziantep, Şanlıurfa, Adıyaman, Kahramanmaraş, and Siirt). However, there are differences among the provinces in terms of the varieties grown. The pistachios grown in Siirt region is Siirt type, which is round, big and flashy. The presence of 102.897 hectares of land used in the agriculture of Siirt province constitutes the 18.3% of the total area. Siirt pistachio is cultivated in approximately 25,000 hectares of land and has an annual production of around 11,000 tons (Anonymous, 2014).

Low yields, proportional periodicity, lack of cultural practices and the limited irrigation facilities due to geographical conditions can be considered as the most important problems of pistachio cultivation. However, despite the region's scarce water resources and the disadvantages of geographical conditions, pistachio farmers' approach to this issue is very important. In this study, it was aimed to determine the irrigation facilities in the area, farmers' tendency towards irrigation, irrigation problems, and their solutions.

MATERIALS AND METHODS

Questionnaires consisting of 40 questions to determine the tendency of local farmers concerning the irrigation facilities, approaches to the irrigation, problems and solutions in Siirt pistachio growing constituted the material of the study. Questions prepared in these questionnaire studies were asked by means of face to face interviews. The number of growers used to determine the number of questionnaires was determined based on the Siirt Pistachio Growers Association records, and the surveyed villages were determined in accordance with the recommendations of Food, Agriculture, and Livestock Directorate of Coordination and
Agricultural Data Branch Office. According to the basic data, the number of enterprises to which questionnaire would be applied in the districts and villages where pistachio farming is performed in the region was calculated using the following formula by the Simple Random Sampling method (Cicek and Erkan, 1996).

\[
N = \frac{N \times S^2 \times t^2}{(N - 1) \times d^2 + t^2 \times S^2}
\]

where,
- \( n \): the number of enterprises where questionnaires would be made,
- \( N \): the number of enterprises in the population (1097 enterprises),
- \( S^2 \): the variance according to the size of the area where Siirt pistachio is cultivated owned by the enterprises constituting the population,
- \( t \): table value, 10%
- \( d^2 \): the amount of error allowed by sample mean, 10*% \( X \)

\( X \): Average land size 3.157 ha

In the study, 10% margin of error and 95% confidence limits were used in the determination of the number of the enterprises where questionnaire would be applied. 133 questionnaires calculated using the Simple Random Sampling method were taken as the lower limit of the specified number of questionnaires despite the geographical conditions of Siirt, inability to perform questionnaire in some enterprises and the possibility of questionnaires to be inconsistent, and the questionnaires performed on this were evaluated to reduce the error margin and to reach more accurate information, and a total of 177 questionnaires was evaluated in this way.

In the study, the correlation coefficient \( (r) \) analysis was performed to determine the relationships between variables, and the correlation coefficient matrix \( (r) \) was calculated using Minitab 16 statistical package program. In this matrix, the correlation coefficients \( (r) \) and probability values \( (p) \) of variables with high statistical significance were determined. Whether the calculated correlation coefficient \( (r) \) gives a significant and reliable result is possible by measuring the significance of this coefficient. This significance was performed by the "t-test" which is a result test, and the amount of the relationship was determined by comparing calculation and table values (Helsel and Hirsch, 1997).

RESULTS AND DISCUSSIONS

Family Structure, Age, Education and Cultivation Experiences in Enterprises

Enterprises engaged in Siirt pistachio farming have families with more than one kid in general. Among the farmers to whom the questionnaire was applied, while the proportion of families with 7 and more children was determined to be 38.4%, this was followed by families with 3-4 children with 26.0%. While the number of individuals contributing to the production of pistachios in the family was 3-4 at the ratio of 48.6%, it was determined that they participated in the production with at least 2 people at the ratio of 39.5%. Thus, it can be said that at least 2 family members in the family made a contribution in terms of the labour force to the production including parents in the enterprises where pistachios production is performed.

Regarding the education levels of farming families, it was determined that 50.3% of them were primary school graduates, 37.3% of them were literate, and 7.4% of them have high school and university education. While 44.6% of the enterprises engaged in Siirt pistachio growing adopted farming as the main field of occupation or profession, the self-employed persons are engaged in cultivation at the ratio of 39.5%.

Land Size (LS), Usage Status (LUS), and Land Class (LC) in Enterprises

Generally, pistachio farming is mostly carried out in marginal agricultural lands without irrigation facilities that are rugged and barren where other products are not cultivated economically in all provinces in which farming is performed (Yükçeken, 1998). This situation does not change in the areas where Siirt pistachio is cultivated. While the average size of the areas where Siirt pistachio was planted was 3.157 ha, the ratio of the areas with 0-25 sizes was calculated as 53.1%. In addition, in the question posed to determine the product
pattern which is cultivated in the enterprise lands, while 81.4% of the growers answered this question as Siirt pistachio, the remaining approximately 13% of them stated that they performed almond, pomegranate, vegetable, and pistachio farming together. While 78.5% of the enterprises engaged in farming made production in dry and arid lands, the irrigated land ratio was determined as 1.1%.

**Enterprises' Reasons to Choose the Siirt Pistachio Growing (ERSPG)**

Agricultural enterprises are affected by many factors when deciding on the product pattern. The most important one of them can be the climate and topography of the region. Cultivation of different products in the same region is directly associated with the parameters such as farmers’ habits, product's market value, and profitability. Firstly, the region where the farmer lives, climate and topography of the land determine the main product pattern. Siirt region has a mountainous and rugged structure by its geographical structure. Therefore, while growers were sorting their preference reasons for pistachio farming, 53.7% of them stated the suitability of the land and climate conditions, 37.9% of them preferred the profitability option to transform the disadvantages of field conditions into a high proportion of benefits (Figure 1).

![Figure 1. Reasons to Choose the Siirt Pistachio Growing (ERSPG)](image)

**Water Resources Usage Status in Enterprises and Irrigation Facilities of Siirt Pistachio**

The areas, where cultivation is performed, are poor in water resources, have no wells (96%), no irrigation water sources and are the enterprises where production is made under waterless conditions (78.5%). Hence, the growers’ knowledge, experience, and training concerning the irrigation are very limited. A question was posed to determine whether making production under dry conditions was an obligation for enterprises or to determine their tendency concerning the irrigation of Siirt pistachios when they get the irrigation facilities.

In the correlation analysis performed between the fact that Siirt pistachio is irrigated or not irrigated (INSP) and the fact that irrigation is necessary for plants (INP), it was determined that there was a moderate positive linear relationship with \( \text{INSP} = 0.654 \times \text{INP} + 0.323 \) equality and \( R^2 = 0.363 \) coefficient.

According to this result, it was observed that the vast majority of farmers (68.9%) thought that irrigation was necessary for the plants and still behaved timidly concerning the irrigation of Siirt pistachios. Although 39.5% of growers stated that Siirt pistachios should be irrigated, 14.7% of them stated that they were doubtful, and 45.8% of them stated that they should not be irrigated (Figure 2).

Regarding the fact that whether Siirt pistachios are damaged with irrigation, it was observed that a large part of the growers (65.6%) thought that they would not be damaged, 14.7% of them thought that they would be damaged, and 19.8% of them were still doubtful.

In order to confirm this, when farmers were asked which plant they would prefer to irrigate if there were irrigation facilities, about 52.0% of them stated that they would irrigate the Siirt pistachios, 17.5% of them stated that they would irrigate the vegetables, 4.0% of them stated that they would irrigate the vineyard, and 25.4% of them stated that they would irrigate all plants (Figure 3).

Based on the assumption that growers have irrigation facilities, non-execution of irrigation may be caused by many reasons. Farmer’s tendency is a decisive factor in this regard. For the reason of non-execution of irrigation in the Siirt watershed where water is insufficient and expensive, a very large proportion of growers (61.0%) stated that they were concerned about the irrigation costs, 18.6% of them stated that they were concerned about the lack of water,
and 5.6% of them stated that they were concerned about the fact that irrigation would damage the pistachio tree. When the frequency of consulting public institutions or the relevant and competent people about irrigation is examined, 59.9% of growers stated that they sometimes consulted, 25.4% of them stated that they rarely consulted. However, 8.5% of them stated that they had never consulted (Figure 4).

Figure 2. Irrigation Necessity for Plants (INP) and Siirt Pistachio (INSP)

Figure 3. Damage anxiety due irrigation and Priority plants in Irrigation

Figure 4. Reasons for non-irrigation and Consultation Frequency
In the correlation analysis performed between the fact on what basis you decide on irrigation (DI) and how often you benefit from written and visual media concerning the irrigation of Siirt pistachio (BWVM), whether they intend to use newly developed technology or tool immediately for the irrigation of Siirt pistachio (UNT), while a positive and moderate correlation which is expressed with DI=-0.3272*BWVM+1.4913; R²=0.2533** was determined between deciding on irrigation and the frequency of benefiting from written and visual media, a negative and moderate correlation which is expressed with DI=-0.4335*UNT+3.5761; R²=0.2671** equality was determined between deciding on irrigation and whether they intended to use a new technology immediately for the irrigation. In this case, it could be said that environmental factors and the technical agricultural organizations with which they were in close contact affected mostly the growers' decision on irrigation. 54.80% of farmers are agricultural engineers; 30.5% of them decide on irrigation according to the fading or shrinkage of the plants’ leaves, 8.5% of them decide according to temperature increase, and 5.6% of them decide according to soil dryness; regarding the irrigation of Siirt pistachio, 58.8% of them stated they sometimes used written and visual media, 24.4% of them stated they never used written and visual media, and 9.6% of them stated they rarely used written and visual media. Regarding the fact whether they considered using a newly developed technology or tool immediately concerning the irrigation of Siirt pistachio, 37.3% of farmers said they would use it immediately, 25.99% of them said they would not use it immediately, 21.5% of them said they would wait until others used it, and 9.04% of them said they preferred to see the results (Figure 5).

**Current Problems and Solutions Related to Irrigation in Enterprises**

**Problems related to irrigation**

One of the important reasons for empty fruit formation in Siirt pistachio farming is known to be the fact that there are more rainy days in the flowering period, and, therefore, the pollen of pistachios that are pollinated by the wind slows down by being affected by moisture in the air and cannot reach female flowers. The increase in the air humidity which causes insufficient pollination not only occurs by precipitation but also by an increase in reservoir surfaces and evaporation. Because of these concerns, growers in the areas where pistachio farming is performed think that the increase of dam will have negative effects on farming, fruit yield will decrease, and disease and pests will increase.

In the questionnaire performed, the presence of a positive, moderate and linear relationship which is expressed by the equality and coefficient of IYI= 0.4719*EDPP+0.9884 and R²= 0.2879** was determined between the questions posed in the form of what kind of effect the construction of dams in the region has on Siirt pistachio production (EDPP) and whether you would think there would be yield increase in Siirt pistachios with irrigation (IYI). According to this result, while 41.2% of growers stated that dams would have a positive effect on Siirt pistachio production, 52.0% of them stated that they would have a negative effect, and 6.8% of them stated that they had no idea. However, regarding the question whether there would be yield increase in Siirt pistachios with irrigation, 71% of them answered yes, 18.0% of them answered no, and 11% of them said that they had no idea (Figure 6).

**Farmer Training Problems**

In the correlation analysis performed between on which subject you want to get information at the most on Siirt pistachio farming (WISPG) and participate in the training if training on irrigation is provided in agricultural organizations (PIT), a moderate, positive and linear relationship which is expressed by WISPG=0.1314*PIT+0.8726, R²=0.2777** equality was determined. In the analysis performed between on which subject you want to get information at the most on Siirt pistachio farming (WISPG) and whether the technical staff giving training on irrigation had sufficient knowledge on irrigation (KLTS), a negative, moderate linear relationship which is expressed by WISPG=-0.4688*KLTS+4.4529, R²=0.2854** equality and coefficient was determined and compared with Table values.
Based on this conclusion, it was determined that the enterprises engaged in production made waterless production under dry conditions at the high level of 78.5% and that they had not received any training on the irrigation of Siirt pistachios (91.5%) but were in need of information on this subject. The ratio of willing to participate in the training in which irrigation is mostly desired (44.1%), and all subjects such as cultivation, pruning, and spraying that are other cultural practices along with the irrigation will be given by public institutions, competent institutions and organizations and universities is quite high (77.4%) (Figure 7).
of the technical educational personnel. 34.5% of the growers stated technical personnel was well informed, 27.1% of them stated they had sufficient information, 22.0% of them stated they had information at the intermediate level, and 13.0% of them stated they had quite enough information (Figure 8).

**Pistachio Grower’s Expectations**
The vast majority of growers want to expand the irrigation applications within the extent facilities, and, therefore, to increase the amount of product and improve the business economics. However, when asked what should be done for this, 85.9% of them suggest the increase of state support to irrigation projects.

The expansion of the irrigation networks is in the second rank at the ratio of 5.6%, and the other suggestions following this are the improvement of the awareness of farmers, increasing the farmers' training and increasing the extension activities of irrigation cooperatives.

Similarly, growers' expectations from training organizations related to irrigation are compatible with the results above. Pistachio growers expect financial support from institutions at the ratio of 81.4%. Their request for information is in the second rank at the ratio of 9.6%, and they stated that they wanted to get applied irrigation training at the ratio of 5.6% (Figure 9).

![Figure 9. Irrigation Dissemination and Pistachio Growers’ Expectations](image_url)

**CONCLUSIONS**

Regarding Siirt pistachios irrigation, growers make production under dry conditions due to the fact that water resources are insufficient and scarce. Both inadequacy of water resources and the irrigation costs adversely affect production under irrigated conditions or the irrigation of Siirt pistachios.

Generally, growers, having stated that plants should be irrigated, have negative thoughts at the undeniable level (45.8%) concerning the irrigation of Siirt pistachio. However, they also stated that they would not be damaged if irrigation was performed (65.5%).

Thus, the abstention on irrigation is believed to have resulted from the factors such as cost and labor rather than damage.

It is seen that growers’ abstention on this issue results from the lack of information related to irrigation, however, technical organizations, competent public or private sector organizations providing irrigation training are less consulted (59.9% sometimes consulted) in order to eliminate the deficiency, and this is believed to resulted from the fact that they think technical personnel providing irrigation training do not have enough knowledge about irrigation.

Whereas growers want to participate in the training sessions, in order to be provided by a very large proportion (77.4%) and to receive information about irrigation at the most (44.1%) in cultural practices.

Growers state that, regarding their greatest expectations concerning the extension of irrigation, they expect an increase of state contribution for irrigation projects (85.9%), the development of water resources, training and extension activities and financial support from educational institutions.
REFERENCES


