



# **Abstract of Research Reports**

# **Irrigation & Drainage Engineering**



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## Investigation of Major Factors in Water Users' Satisfaction in Management of Poldasht Irrigation and Drainage Network

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### Abstract

Satisfaction of water users is always influenced by network management and various factors in the irrigation and drainage networks. These factors can be affected by released water status, features of network management, network performance, individual and peripheral characteristics of water users in network. This study was conducted in order to study the factors which affecting the satisfaction of water users in irrigation and drainage network management in Poldasht city, West Azerbaijan province. Therefore, a questionnaire was prepared and by water users interviewing in the statistical population (383 people) was completed. By descriptive and correlational and analytical methods data were analyzed. The results of the analysis of effective variables showed that relation between water users' satisfaction from network management and the amount of water released by the network, the planning and actions of network administrators for the supply and distribution of water, the tendency of users to participate in management and operation of the network, fulfilling the promise of network officials, the willingness to work partnership among the users, the responsiveness of administrators, was not significant. On the other hand, relation between water users' satisfaction from network management and the fairness water distribution, water divide fairness in network, water divider difference with the users, the mutual understanding between network administrators with operators, management service's condition to the operators was significant at the level of 5%. Also, relation between water users' satisfaction from network management with current management of the network and the method of water distribution in the Poldasht network was significant at the level of 1%.

**Keywords:** Management, Poldasht, Irrigation and Network, Satisfaction, Water Users' Association

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## Challenges of Grape Production under Qana System in East Azarbaijan Province

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### Abstract

Grapes are the most important productions in the world. The country's cultivated vineyard is 277,000 hectares and its production is 3200,000 tons. East Azarbaijan province is one of the important regions of grape production in the Iran. Technical and environmental challenges have been recognized for the optimal production of this product in this province. Generally, grape cultivation methods are carried out in both modern and Qana. For Qana method, surface irrigation system and for modern method surface and micro irrigation systems are applicable. The challenges and technical problems of in East Azarbaijan province are small plots, lack of knowledge on grape production, excessive application of water and nitrogen fertilizer, removal of leaves, use of low quality irrigation water, grape planting in unsuitable lands, lack of potassium fertilizer, lack of attention to chlorosis of grapes leaves, lack of proper management for controlling plant pests and diseases, vineyard formation in plains. Suggestions include the use of healthy grape with a virus-free test certificate, the lack of use of contaminated, the use of new techniques, the cultivation of grapes on the slopes, the construction of suitable windbreaks, reducing the volume of irrigation water and the use of liquid fertilizers Reducing the use of nitrogen and phosphate fertilizers, application of potassium and sulfur fertilizers, management of various weeds, and repelling pests and plant diseases, proper management at the stage of growth and harvesting the production at optimal time.

**Keywords:** Optimal Production, Qana, Grapes, Qana Irrigation, Vineyard

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## Evaluation of the Performance of Iran's Sprinkles (SAROO, NOVARAN)

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### Abstract

This study was aimed to determine the effects of sprinkle type operating pressures and wind speed on water distribution uniformity of sprinkle irrigation system. The study was conducted in research satiation of Arak in Markazi province during 2015-2016. The experiment treatments were combinations of 4 sprinklers (Ambo, Vyr 155, Saroo, Noavaran), 2 operation pressures and 3 wind speed range (0-2, 2-4, 4-6 m/s). In order to determine the water distribution uniformity set of catch cans were set around the individual sprinkler in 3\*3 arrays. The volume of water in the catch-cans were measured after 1 hr operation for each treatment water distribution uniformity. Results showed that the sprinkler type, operating pressures and wind speed treatments had effect on water distribution uniformity. So that the average uniformity coefficient in the pressures studied, decreased with the increase of wind speed from slow to severe in the sprinklers of Saroo, Noavaran, Ambo and Vyr155, respectively, by 35, 45, 34 and 4%. In terms of research, based on the comparison of the uniformity coefficients, Vyr155 sprinkler with the operating pressure of 4 atmospheres had the best performance. According to the results, it can be concluded that the operating pressure and wind speed have a significant effect on the uniformity and uniformity of the distribution of the sprayers studied. From the wind speed test to the uniformity coefficient, it was found that with increasing wind speed, the uniformity coefficient decreased, so that the winding rate was less than 4 m / s. Based on the results of the Christians uniform coefficient in the velocity wind speed range, a spring spray with a pressure of 4.5 atmospheres, in an average wind pressure, a sprinkler with a pressure of 4 atmospheres operating in a strong wind zone, recommends a sprinkler with pressure of 4 atmospheres. Not be Also, based on the results of the uniformity distribution coefficient, in the quiet winding range of the air sprinkler with a pressure of 4.5 atmospheres, in the average wind pressure range of the air sprinkler with a pressure of 4 atmospheres and in a strong wind pressure range with a pressure of 4 atmospheres compared with sprinklers Ambo, Noavaran and Saro are selected. Due to the windfall of Arak, the use of two squirrel sprinklers and innovators in severe wind conditions is not recommended due to the low uniformity coefficient in the studied conditions and it is suggested that designers of pressurized irrigation systems in the Arak region use a new spring sprinkler Place in the next priorities. Saro sprinklers at wind speeds of less than 4 m / s are recommended, which will also limit the planning of irrigation. In general, Air sprinkling with pressure of 4 atmospheres and Ambo sprinklers with a pressure of 4 atmospheres in Arak region is recommended for use in classical rainwater irrigation system, respectively.

**Keywords:** Uniformity Coefficient, Operating Pressure, Sprinkler, Wind Speed

## Estimation of Evaporation Rate from Saline-water Resources

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### Abstract

In many cases, such as water balance of lakes and reservoirs, the design of evaporation ponds and solar pools, the effect of salinity on evaporation can be important. On the other hand, nowadays one of the most important environmental challenges in our country is the disposal of contaminated drains and preventing its discharge into natural water flows and contaminating them. One of the strategies used in advanced countries in drainage disposal is the use of evaporation ponds. Evaporation ponds are engineering structures, the most important component of their outflow is evaporation. Therefore, by accurately estimating the evaporation rate of these evaporation ponds, wastewater disposal can be better managed. The evaporation rate from fresh and saline water will be different in the same climate and evapotranspiration conditions. The main reason for this difference is the difference in the saturation vapor pressure of the surface layer of fresh and saline water, and, moreover, saline water is usually warmer than fresh water and the saturation vapor pressure in saline water is different with parameters of fresh water. As salinity increases, the saturation vapor pressure decreases at the top of the water. Water-soluble salts reduce the energy of water molecules, resulting in a decrease in water evaporation. In the present study, existing empirical relationships have been presented and discussed to estimate the evaporation rate of saline-water. Using these relationships, we can estimate the water balance of lakes, reservoirs and evaporation basins more accurately and use the capacity of these engineering structures better.

**Keywords:** Evaporation, Evaporation ponds, Saline-water

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## Feasibility Study of UPVC Pipe and Fitting Network Use in Irrigation and Water Supply Agricultural Project

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### Abstract

In order to development of pressurized irrigation system in country, it should be acknowledged that the technology of these systems has been developing in the country over the past decades. But in some cases, like making sprinklers and emitters, we still have not fully grasped its knowledge and this knowledge is available to other countries. In the field of other equipment, including pipes and fittings there is great potential in country. The use of pipes in the water transmission and distribution network in agriculture and pressurized irrigation systems has caused a lot of changes over the past two decades due to various technical, administrative, economic and environmental issues and is the most widely used type of polyethylene pipes. Due to the high price fluctuations of polyethylene pipes and fittings and its negative effects on the development of underwater irrigation methods, as well as attention to quality issues, the need for alternative identification for these pipes is highly felt. UPVC pipes are an appropriate replacement and it is necessary to investigate and analyze its limitations and potentials for use in agricultural water transfer systems and irrigation systems. The potential of the use of pipelines used for many years in different countries has been identified and analyze. The main objective of the project was technical and economic feasibility of using UPVC pipe and fitting joints in irrigation and water supply networks. In this regard, introducing these pipes, the application process of UPVC pipes in the water sector in the world and agriculture, the standard required for testing these pipes, design considerations, installation and maintenance, as well as the proper structure for controlling and ranking pipe manufacturers UPVC was reviewed and analyzed. The results showed that UPVC pipes are ideal for water transmission and and distribution networks. Considering the agricultural sector, the national standard 2-13361 is considered as the most suitable standard for tubes testing and ISO / TR 4191 standard for installing the. It turned out UPVC pipes have various advantages for use in the agricultural sector. The UPVC pipe has a lower wall thickness than PE80 and PE100. Also, the UPVC pipe in comparison with the PE80 pipe in PN 6 has an external diameter of  $\geq 50$  mm, PN 10 and PN 16 in all sizes of the outer diameter, and in relation to the pipe PE100 in PN 6, PN 10 and PN 16 of diameter size. The external  $\geq 110$ mm is less weight per meter than the UPVC pipe, which reduces the cost of the raw materials and cost of the system compared to polyethylene pipes. In order to evaluate the manufacturing companies, there were six criteria for investment, production and storage, quality, manpower, sales and after-sales services, and ultimately final customers.

**Keywords:** Irrigated Agriculture, Pressurized Irrigation, UPVC, Water Supply Network

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## **Effect Of Salinity on Grain Yield and Water Productivity of New Elite Barley (ES-92-5 ,ES-92-15, ES-92-16 and Khatam) on-Farm Conditions in Esfahan**

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### **Abstract**

Salinity is one of the major stresses in the arid and semi-arid regions of the world that restricts the production of the crops. The development of agriculture and sustainable production in the areas depends on increasing water productivity, especially in saline water. In the study area (roughly north part of Isfahan) farmers widely utilized from surface irrigation systems to irrigate barely farms. In the current situation due to the recent drought and water quality diminution, there is a necessity for replacing some promising barley genotypes. To select the superior salinity barley lines suitable for in Esfahan province moderate regions, this study was conducted with 3 promising barley lines (ES-92-5, ES-92-15 and ES-92-16) and ES-87-12 and Khatam barley varieties, as check in Ardestan region in cropping season (2016-17). The study was carried out in farmers' field in an extension research pattern. Experimental area implemented at 5000 square meter and plant density was 450 seed per square meter and consuming water with WSC phlom (type IV) measured. Electrical conductivities of irrigated water and soil in all regions were 8.8 ds/m and 45 ds/m, respectively. Grain yield and water consumption of each genotype measured. Some traits such as biomass and water productivity were noted down. In this way, feasibility of low water quality applying in surface irrigation system was examined to arid region. By determining the water consumption and at field levels, irrigation water productivity for the barley product was assessed. The results showed that in Ardestan, ES-87-12, ES-92-16, ES-90-15, Khatam, and ES-92-5 varieties had 7000, 6444, 6250, 5714, 4769 and 4706 kg/ha grain yield, respectively. ES-87-12 genotype produced the highest grain and nominated Mehr variety. Based on the results in study area, ES-87-12 and ES-92-16 genotype were chosen and suggested for farmers. Selection of superior barley lines in comparison to control for saline areas under in farmers' field, determination of water consumption and water productivity in salinity conditions were the objectives of this study.

**Keywords:** AquaCrop, Barley, Promising genotypes, Salinity

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## Utilizing GIS-Based Site Selection for Potential Area to Different Pressurized Irrigation Systems

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### Abstract

Geo location is an activity that, according to the talents, allows you to select the right place for a particular user. Soil factors, water and climate in decision-making and implementation of pressure irrigation at the regional scale and an area are important. Changes related to permeability, salinity, drainage condition, soil texture, and topographic will also be widely reported. Quality and quantity of available water resources in each region not be the same and also different together. Climate condition is the other important factors that are related to systems execution. Choosing incorrect system for every area, especially pressured irrigation, increase cost and cause to incorrect operation the systems. Shahreza is one the city from Esfahan province and divided to three hydrological subcatchments as south Shahreza, south and north Mahyar. The main water resources in this region are deep wells. In wet year the north region use canal that charge from Zayandehrud. The Geographic Information System (GIS) utility and effective is this type of investigation, which allowed collection and analysis and integration, and display information about layers in each region (soil, water, climate, cultivation of each product, irrigation network and underground water resources, economic conditions and ...) provides. In this study, using of the geographic information system for segregating these areas in order to appoint suitable and unsuitable for implementation of pressure irrigation. In this project for introducing suitable region that can applied sprinkler irrigation be used water salinity and sodium construction of irrigation water and soil texture and salinity factors, and for introducing suitable region that can apply drip irrigation be used soil and water salinity and TDS factors. Based on the results of suitable areas for implementation of sprinkler irrigation systems, about 191 hectares were estimated, and so far, there are over 2192 hectares of irrigated lands. The total area of land suitable for drip irrigation was estimated to be 2587 hectares. So far, there are over 1881 hectares of land covered by drip irrigation. Finally, the difference between the susceptible places and the implemented areas were identified in each of systems by maps, separately.

**Key words:** Geo location, GIS, Pressured Irrigation

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## Report of the Technical and Managerial Workshop on Haloculture Researches using Sugarcane Drainage Water

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### Abstract

With the beginning of scientific and research-counseling activities between Khuzestan Water and Power Authority (KWPA) and Agricultural Engineering Research Institute (AERI), indicative works were done in Khuzestan Province to overcome the agricultural drainage water issues. In this regard and with focus on drainage water discharge issues of Sugarcane Agro-Industries (SAI) located in south Khuzestan and for reducing the volume of drainage water (which is discharging to the border or Nasserri wetland) produced from Mirza Kuchak-Khan and Amir Kabir SAI units and with the cooperation of custodians, research programmes on haloculture in format of experimental farms has been started. So, in order to investigation of the first year activities and planing the future ones, a technical and managerial workshop on haloculture researches using sugercane drainage water was held on 2 Jan. 2019 with the hosting of KWPA in Khuzestan Province. In the workshop, representatives from all stakeholders, colleagues from university and provincial managers and experts were participated. In this technical report, while briefly presenting the important issues, results of the workshop are summarized and findings from planting of crops irrigated with drainage water such as cotton, jute, salt tolerant rice and kinova in Mirza Kuchak-Khan SAI and the next year research programme is presented.

**Keywords:** Drainage water, Haloculture, Khuzestan Province, Sugarcane



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## Comparison of Bean Planting Methods by using Micro Irrigation (Tape)

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### Abstract

In order to compare the effect of planting methods and seed density on bean yield, a split split plot experiment in Randonized block design was carried out in Khomein Bean Research Station during 2016 and 2017 with 3 replication. The main plots were Kosha(, Semi bush type), Sadri(Climbingr type) and COS-16(Straight type). Planting methods considered as subplots and were: Flat planting, one row on a riddge, Two rows on a ridge and three rows on a riddges. Sub- sub plots were seed densities of 70,120 and 170 Kg/ha. Geiran Bazr Arya was used as grain driller. Ridge planting. Calibration operation was carried for each planting pattern and density. Seeding percentage, Effective field capacity of grain driller for each planting method, Yield and Yield components were measured. Dada of experiment were Analysed by mstat- C software. Mean comparisons were done by using Duncane test. Regardless of variety type, The results showed, the highest yield(2146kg/ha) in one row on a ridge was obtained at seed density of 70 kg/ha. In treatments of two and three rows on a ridge, the seed density of 120 Kg/ha suggested. Yield of dry grain was 2382 and 2262 kg/ha respectively. However in flat planting pattern the highest dry grain yield was related to seed density of 170 kg/ha with 2200 Kg/ha. Planting on a ridge can increase farmer income approximately 12/000/000 R.

**Keywords:** Bean, Planting method, Row planting, Planting on a ridge, Seed density



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## Estimating Water Consumption in Sugarcane Agro-Industry Company in Khozestan using remote sensing

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### Abstract

During the crop growth period, the amount of water usually applied to the field of Sugarcane Agro-Industry Company in Khozestan province is much more than the actual field requirement and it has caused the drainage water to be high. In the lower part of Sugarcane Agro-Industry Company, despite the plenty of water in the drainage networks waterlogging are major problems. Improvement of existing irrigation systems and management practices is necessary to save a considerable amount of water, decrease drainage water and ensure more efficient water use. Estimation of evapotranspiration (ET) is essential for irrigation management. Surface Energy Balance Algorithm for Land (SEBAL); a remote sensing-based technique for estimation of evapotranspiration has been used to estimation of regional evapotranspiration over sugarcane fields. The study area was AmirKabir Sugarcane Agro-Industry Company in Khozestan, Iran. From a time series of Landsat images during the one growing season, NDVI, SAVI and LAI indicators were established. The actual water use for each field was estimated by actual evapotranspiration from a time series of remote sensing data during the growing season. For this purpose, the ET of sugarcane and regional ET were estimated based on images of Landsat during the growing season of sugarcane. Based on these results, the average actual evapotranspiration of sugarcane in AmirKabir Agro-Industry Company was estimated 1660 mm in 2013. With considering, irrigation efficiency of 50 percent, total water consumption of sugarcane in Khozestan was 33200 cubic meters per hectare. The results showed that remote sensing was acceptable method to calculate actual evapotranspiration, irrigation management in extensive area.

**Keywords:** AmirKabir Sugarcane Agro-Industry Company, SEBAL

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## **The Report of Technical and Scientific Visit from Bio-Engineering Pilots and Advanced Contaminated Water Treatment Plants & All-Russian Research Institute for Hydraulic Engineering and Land Reclamation**

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### **Abstract**

In accordance with the agreement on joint scientific and technical cooperation in the framework of International Commission on Irrigation and Drainage (ICID), Protocol I which signed in Iran on November 1, 2017 between All-Russian Research Institute of Hydraulic Engineering and Land Reclamation (VNIIGIM), The Deputy Minister of soil and Water of Ministry of Jihad-e Agriculture, Iran (with scientific cooperation of Agricultural Engineering Research Institute, AERI) and Khuzestan Water and Power Authority (KWPA), the parties met on November 7-13, 2018 in Moscow, Russia. In these meetings and following the Protocol II which was signed on July 2018 in Iran, the parties confirmed their intentions to continue scientific and technical research on agreed issue between Iran and Russia as: development and creation of a pilot experimental site in Khuzestan province (Iran) with Bio-Engineering Structures on agricultural drainage water treatment for reusing in irrigation of agricultural crops and aquaculture. During the programs in Russia, scientific reports on related agricultural issues of experts from the Russian and Iranian sides were heard and discussed at the meetings and also, site visits were done from Bio-Engineering Pilots and Advanced Contaminated Water Treatment Plant System near Moscow. The bases of research project that would be performed in Khuzestan and general methodology have been confirmed. The parties agreed to formulate and finalize the scientific proposal, discuss on it and facilitate the implementations which is needed in both countries.

**Keywords:** Agricultural drainage water, Bio-Engineering pilot, Khuzestan, Russia, Scientific cooperation

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## Effect of Different Levels of Irrigation Water Salinity on Quality and Quantity of Saffron Yield

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### Abstract

In order to investigate the effects of different levels of irrigation water salinity on yield, water use efficiency and qualitative characteristics of saffron, a test was conducted in Torbat Heydarieh. The experiment was conducted in a completely randomized block design with three replications. The experimental treatments consisted of four levels of electrical conductivity of irrigation water (1, 4, 6 and 8 ds / m). The row spacing was 30 cm in each plot, the distance was 4 cm in row, and the size of each plot was 2 in 3 meters. The results showed that the effect of different levels of salinity in 2015 on flower yield, dry weight of spruce, corm and dry weight and efficiency of water use was not significant but in 2016 it was significant on seed yield and seed weight. In 2017 (third year), effect of salinity levels on all traits was significant. With increasing salinity of irrigation water, the traits were reduced. In this year, the amount of dried apricots in salinity levels 1, 4, 6 and 8 was 9.1, 8.2, 4.1 and 2.0 kg / ha, respectively. There was no significant difference between two levels of salinity of 1 and 4 dS / m but it was significant with two salinity levels of 6 and 8 dS / m the water use efficiency at 2 levels of salinity of 1 and 4 dS / m was 2.371 and 2.144 g / m<sup>3</sup>, respectively. Both levels were in a statistical group. As water salinity increased by 4 dS / m, water use efficiency decreased sharply. Water use efficiency at two levels of salinity of 6 and 8 dS / m was 1.064 and 0.523 g / m<sup>3</sup>, respectively, which were statistically analyzed in two separate groups. According to these results, it can be concluded that the threshold of tolerance to saffron salinity is 4 dS / m.

**Keywords:** Saffron, Irrigation water salinity, Yield, Water Use Efficiency



AERI

## **Technical Assessment of Traditional Porous Pipe in Subsurface Irrigation on Pistachio Orchards (Case Study in Rafsanjan County in Kerman Province)**

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### **Abstract**

Water scarcity and salinization are major threats to sustainable irrigation in Iran as well as other parts of the world. Thus the appropriate use of water resources and increasing water use efficiency in agriculture is necessary. Due to the fact that the much part of limited resource of water is used in agriculture, the policy of optimal management of water consumption is essential. Therefore recent researches in order to save water, increase irrigation and water use efficiency, has led to the pressurize irrigation. In order to optimize irrigation water use in a sustainable agriculture, require the use of different approaches of pressurize irrigation systems. Subsurface drip irrigation system has the least water losses as deep percolation and evaporation. Subsurface irrigation methods in terms of the potential for a solution ideally suited for use in high efficiency distribution of water resources are optimized. Traditional subsurface porous pipe irrigation method (using a perforated PVC pipe covered with plastic cloth) was recommended and using in Rafsanjan pistachio orchards of Kerman province to decrease applied water and increase crop yields and water productivity. In order to understand the strengths and weaknesses of this irrigation method, a farm assessment monitoring, include of water quality, soil quality, texture, and water distribution uniformity, installation depth, distance from each other was done during agronomic year of 2018. The result showed during the irrigation season, applied water reduces and increased water use efficiency, with subsurface irrigation using PVC pipe. These results show the acceptable water distribution uniformity and relatively higher preference for traditional subsurface porous pipe irrigation method compare to traditional surface method.

**Keywords:** Subsurface irrigation, porous pipe, PVC, Pistachio

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## Evaluation of Tape Irrigation in Salinity Prone Areas under Summer Maize Cultivation in Khuzestan Province

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### Abstract

Today, the importance of water and its shortage have led to the optimal use of water in the most countries of world, especially in developing countries and arid and semi-arid areas. So it is seems that saving water through using pressurized irrigation systems extension is necessary. Modern irrigation systems such as T-tape irrigation method is one of the best ways to optimal use of water. Using this system in saline and sodic prone soils needs soil quality monitoring over time. In present study, T-tape irrigation system efficiency and its effects on soil salts in fine texture saline and sodic prone soils have been studied. For this purpose, summer maize has been cultivated in the farm located at Khuzestan agricultural and natural resources research and education center in two years. In order to analyze variance and mean comparison, the least significant difference method was used. Results showed that there is no significant difference between first and second cultivation year yield. Also irrigation round in T-tape irrigation method had no significant effect on the dry aerial matter yield. Whereas grain yield in 4 days irrigation round were better than 2 days. Averaged grain yield for 2 and 4 days irrigation rounds were 8.2 and 9.2 tons per hectare, respectively and averaged dry aerial matter yield in T-tape irrigation method was 13.0 tons per hectare. In total, basin irrigation method had best grain and dry aerial matter yield which were 9.0 and 16.8 tons per hectare. T-tape irrigation method results indicated that water productivity for dry aerial matter was 1.7 kilograms per cubic meter and grain water productivity for 2 and 4 days irrigation round were 1.1 and 1.2 kilograms per cubic meter, respectively. Grain and dry aerial matter water productivity for basin irrigation method were 1.9 and 1.0 kilograms per cubic meter, respectively and for furrow irrigation method were 1.4 and 0.9 kilograms per cubic meter, respectively. In medium time term, soil salts analysis results showed that T-tape irrigation system, despite better water productivity, can endanger the farm's sustainable agriculture. This behavior increases soil salinity, probability of chlorine and sodium poisoning and converting the soil from saline to saline and sodic. So that non-saline and non-sodic soil before cultivation is converted to saline soil after cultivating in two seasons and it's going to be saline and sodic soil. At a depth of 50 cm of soil, ratio of salinity, sodium and SAR, to their initial amounts have increased 4.6, 8.8 and 5.0 times, respectively, for T-tape irrigation system, 1.4, 2.4 and 2.6 times, respectively, for basin irrigation and 1.6, 1.9 and 2.5 times, respectively, for furrow irrigation.

**Keywords:** Least Significant Difference (LSD), Maize yield, Randomized Complete Block, Saline and Sodic soils, Soil Salts

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## Energy Productivity in Irrigated Wheat Production via Groundwater Resources under Conservation and Conventional Tillage Systems

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### Abstract

The evaluation of the energy balance and efficiency in agricultural production is one of the very useful techniques in the analysis of the sustainability of the agriculture. In the current research, energy balance and its productivity were evaluated to produce irrigated wheat via groundwater resources under conservation and conventional tillage practices by measuring and collecting the necessary data for two years of 1391-92 (2012-2013) and 1392-93 (2013-2014) in Tabriz-Azarshahr Plain, Iran. Direct and indirect energy consumptions were estimated for land preparation, cultivating, irrigation, wheat nutrition, crop protection, harvest and transportation of the product. The amount of the energy consumption to produce wheat under conservation and conventional tillage practices were respectively 21.5 and 24.5 GJ ha<sup>-1</sup>. The produced energy by wheat grain was 51.4 and 50.0 GJ ha<sup>-1</sup> for mentioned tillage systems. The energy efficiency was respectively 2.4 and 2.0 and energy productivity were 160 and 140 g (MJ)<sup>-1</sup> for conservation and conventional tillage practices. The share of renewable energy from input energy was respectively 45 and 40 percent under conservation and conventional tillage systems. In two mentioned systems, about 83 and 73 percent of consumed energy were belong to irrigation water, nitrogen fertilizer, wheat seed and weight machines and pumping equipments, respectively. Proper scheduling for deficit and full irrigation, application of high yielding varieties of wheat, selection the appropriate amount of seed wheat, proper scheduling of fertilizer and application of combinative tools are effective strategies to increase energy productivity to produce wheat in Tabriz-Azarshahr plain, Iran.

**Keywords:** Energy Balance, Conservation Agriculture, Energy Efficiency, Irrigated Wheat

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## Determine the Applied Model of Irrigation Water – Wheat Yield in the Northern Province Khuzestan

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### Abstract

Water is one of the factors that has a special place in the production of agricultural products and due to the limited quality and quantity of water resources, research that leads to optimal use of water is of particular importance. Khuzestan Province is one of the important agricultural production areas that has the first or second place in the quantity and quality of wheat production among the provinces of the country. The province is located in a warm and dry climate, and the characteristics of such areas are the limitation of water resources and the growing competition for the use of these resources. Therefore, in order to prevent the loss of water resources and optimal irrigation planning under restricted / no limitations of water, providing appropriate solutions based on adequate knowledge of growth stages and wheat water requirements during the growth period is essential. For this purpose, an experiment was conducted using Single Branch Rainfall Irrigation at Safi Abad Research Center for three years from 1393 to 1396. In this experiment, using split strips in the original design of a randomized complete block design with three replications, the main plots consisted of six cultivars / lines of commercially available wheat bread (Chamran, Chamran 2, S-87-20 with Mehrgan and S 18-87 with the name of Susa) and Durum (D-79-15 with Behrang brand and D-81-10) and in sub plots four treatments of 13.1, 1, 0.78 and 0.43 times the need for water They were exposed to evaporation pan and a control treatment without supplementary irrigation. The combined analysis of three years showed that in terms of seed yield, 1, 2 and 3 irrigation treatments were in a statistical group, indicating a 19% reduction in supplementary irrigation water of wheat without significantly reducing yield. Durum cultivars have less water requirement than bread varieties, while durum cultivars are more susceptible to more irrigation and will suffer from reduced yields in more irrigation. Between durum cultivars of Behrang cultivar and Bread varieties of Mehrgan cultivar was the best cultivar for wheat production. Also, the results showed that grain yield and seed yield of cultivars was second to second order functions. The water use efficiency attribute is affected by annual rainfall, and by applying additional irrigation, the water use efficiency decreases.

**Keywords:** Production Function, Water Consumption, Wheat, Water Productivity, Yield

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## Solutions for Increasing the Efficiency of Evaporation Ponds

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### Abstract

The rapid development process around the world in some cases has led to the implementation of projects that their negative environmental impacts not only provided a lot of side-effects, but at times even made the project useless. Disposal of contaminated drains and preventing their discharge to natural currents is one of the most important problems facing the country's environment. The use of evaporation ponds is one of the solutions used in the advanced world countries to solve this problem. Evaporation ponds are closed ponds, where contaminated drainage water is discharged into them and stored there to reduce the amount of water in the pond during evaporation. However, since the construction of ponds requires a lot of land occupation, providing solutions to increase the efficiency of evaporation ponds leads to a reduction in occupied land and finally, reduces the costs of constructing, operating and maintaining these structures. Since the most important component of the output of these engineering structures is evaporation, the purpose of this research is to provide innovative solutions to increase the efficiency of evaporation ponds by increasing the evaporation potential. The results of these study showed that the four methods of wind-aided intensified evaporation (WAIV), wetted floating fins, salt-tolerant plants and droplet spraying can be desirable complementary methods for increasing the efficiency of evaporation ponds and their success depends on the climatic conditions, available facilities and the quantity and quality of drainage water entering the evaporation ponds. Meanwhile, since the use of salt-tolerant plants has a good performance in a wide range of quantities and quality of drainage and climatic conditions, and the complexity of implementation and the cost of construction, operation and maintenance of it is lower than the other methods, this method can be the best option for increasing the efficiency of evaporation ponds.

**Keywords:** Agricultural Drainage Water, Evaporation, Evaporation Ponds, Salt-tolerant Plants

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## Determination of Pistachio Water Consumption in Iran

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### Abstract

Pistachio production in Iran has a long history. Iran's pistachio is unique among the world's producing countries. Increasing water use efficiency for this strategic product is essential. The water consumed for pistachio in Iran has not been determined. In some parts of the country, researches have been carried out and quantities for pistachio water consumption are reported. In order to measure the actual water consumption of pistachio under farmer's conditions and compare it with water requirement and national document, this research was conducted in Khorasan Razavi, Semnan, Kerman and Yazd provinces. This research was carried out from October 2016 for one year in gardens of Khorasan Razavi, Semnan, Kerman and Yazd provinces. In these provinces, 88 gardens were selected and in each of them, water consumption (without intervention in their program), water productivity, yield and some other parameters were determined. The results showed that water consumption and water productivity in the studied provinces were significantly different. The yields of the gardens of the four provinces were close to each other. The average yield of pistachio, water consumption and water productivity were 1764 kg/ha, 8057 m<sup>3</sup>/ha and 0.26 kg/m<sup>3</sup>, respectively. The average of water consumption in the traditional irrigation method in Khorasan Razavi, Semnan, Kerman and Yazd provinces were 5816, 7936, 7806 and 11711 m<sup>3</sup>/ha respectively. The average of water consumption in drip irrigation systems were 5165, 6853, 5965 and 8290 m<sup>3</sup>/ha in Khorasan Razavi, Semnan, Kerman and Yazd provinces, respectively. The average yield (dry pistachio) was obtained in the provinces of Khorasan Razavi (2506 kg/ha), Semnan (1708 kg/ha), Kerman (1534 kg/ha) and Yazd (1750 kg/ha). The average water productivity of pistachio, regardless of irrigation method for Khorasan Razavi, Semnan, Kerman and Yazd provinces was determined as 0.37, 0.25, 0.27 and 0.16, respectively. The provinces of Khorasan Razavi and Kerman, ranked as the first and second in terms of water productivity, respectively. The results showed that the amount of water consumption in all pistachio gardens were less than the pure irrigation requirement. Comparison of water productivity in pistachio gardens of Iran shows that they were much lower than the global mean of water productivity. The main reason for this is associated to the management of the pistachio gardens. The studies showed that the yield potential of pistachio gardens in Iran is much higher than the current yield. Therefore, effort to improve agricultural management is the most important way to increase the yield of pistachio. Also, training of the management strategies of water application in pressurized irrigation systems are important ways to improve the water productivity of pistachio in Iran.

**Keywords:** Pistachio, Water Consumption, Water Productivity, Yield

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## **Evaluation of Irrigation Water Productivity and Adaptability of Bread Wheat Cultivars in Different Tillage Methods in the North of Khuzestan**

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### **Abstract**

In addition to increasing energy consumption, the excessive use of tillage machines has caused soil compaction, increasing water runoff and decreasing irrigation water productivity in irrigation and drainage networks. Therefore, this study was conducted for two years of 2016 and 2017 to investigate the effect of direct drilling of wheat in maize residues on yield, irrigation water productivity (IWP), and adaptability of wheat cultivars to this method. For this purpose, the research was conducted as split plots with a randomized complete block design experiment with three replications in the Safiabad Agricultural Research and Education and Bioresource, Center located in the north of the Khuzestan province. The main plot treatments were no-tillage (NT), minimum tillage (MT), and conventional tillage (CT) and sub plots treatments were Chamran 2, Mehregan, Shoosh, Falat (susceptible to Fusarium cluster disease), and Darab 2 (sensitive to leaf Septorius disease) cultivars. The results showed that although there was no significant difference between tillage methods, the average yield of cultivars in the NT (4.83 t / ha) was more than MT (4.6 t/ha) and CT (4.68 t/ha). On the other hand, the average yield and IWP of both Mehregan and Chamran 2 cultivars (5 t/ha and 1.25 kg/m<sup>3</sup> respectively) were more than of three other cultivars. Considering number of the tillage and planting machines passes was reduced from 5 to 6 times in MT and CT to only 2 times passes (spraying and planting in maize residues). The use of NT did not significantly change the cone index and bulk density of soil. In spite it increased soil organic matter compared to CT and MT as much as 16 to 32 percent. No signs of existence of Septorius and Fusarium diseases in all cultivars were observed, Specifically Cultivars sensitive to these diseases. Hence, the use of Mehregan and Chamran 2 wheat cultivars under direct drill planting conditions in maize residues is recommended that without yield reduction increases 3 - 4 percent IWP in similar areas.

**Keywords:** Conservation Agriculture, Irrigation Water Productivity, Septorius and Fusarium Diseases, Wheat Cultivars

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## **The Monitoring of Soil and Water Use Efficiency in Micro and Sprinkler Irrigation Systems for Wheat Cultivation in Soils with Heavy Texture Susceptible to Salinity and Alkalinity Southern Khuzestan Lands**

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### **Abstract**

Today, the importance of water and its shortage have led to the optimal use of water in the most countries of world, especially in developing countries and arid and semi-arid areas. The use of traditional irrigation with regard to water resources constraints in all areas is not rational and appropriate and the use of new irrigation methods such as irrigation system (rainy and drip) for crops that eliminate deep losses and runoff. It can greatly increase water use efficiency, it is recommended. Agricultural lands of southern province of Khuzestan are lands with saline and sodium prone soil texture, with Depth of groundwater is salty and deep. The use of pressurized irrigation system in this area due to the limited water resources required to conduct research and its results can be useful in implementing or not implementing this irrigation system in the central and south of Khuzestan. For this purpose, Water use efficiency and soil and plant monitoring for wheat in the farm located at Khuzestan agricultural and natural resources research and Approximately 1.5 hectares. For this purpose, In order to evaluate the sprinkler irrigation system, a part of the land with 10 days irrigation was irrigated according to the design studies and another part with a 5 day irrigation. Also, in the drip irrigation system, a split plot design was used in a randomized complete block design in which strain strips were used as 3 main treatments with spacing of 40, 60 and 75 cm and drop spacing. 20 centimeters per row and 3 replicates were randomly run. In addition to water quality, system efficiency and irrigation water volume, Sampling of soil farm was generally performed in 5 times before the time of cultivation up to the time of harvesting with the aim of testing the physical and chemical properties at 4 depths of 25-0, 50-25, 75-50 and 100-75 cm Done. Tedium of water distribution in droplets (EU), evaporation and windfall losses in sprinklers, Changes of moisture onion in different treatments of drip irrigation system, the development of root depth and, finally, the measurement of yield and its components for water use efficiency in each system compared with the surface irrigation system as a control of the area were analyzed. The results showed that the volume of water consumed during the growth period of the wheat plant in the drip irrigation system of 5445 cubic meters per hectare, a sprinkler water irrigation system of 6400 cubic meters per hectare and a surface irrigation system of 7950 cubic meters per hectare. Also, grain yield per unit area in irrigation intervals of 5 days was 27% higher than that of irrigation system and 38% in comparison to drip irrigation system (T-type). This increase was 10% in the sprinkler irrigation system compared to 10 days. As a result, water use efficiency for wheat was increased by 5% in sparing irrigation systems compared to the other two, with a drip (T-tape) of 16% and surface irrigation of 57%. Monitoring salinity in the soil surface layer (0 to 50 cm, which is the depth of root development of the plant), Showed that the rain irrigation system increased the salinity of the soil saturation extract by 67% compared to the first season of cultivation, The drip irrigation system was

up to 113% and the surface irrigation system was up to 17%. also These qualitative changes showed that the irrigation system, Sprinkler, surface and drip irrigation systems with 40 cm strips have been able to maintain soil quality in the first state of salinity While the drip irrigation system was applied to treatments at intervals of 60 and 75 cm with soil ditching and focus on leaching in early stages, The middle and the end of the season are important for shortening the distance between irrigation tapes.

**Key words:** Soil salts, Saline and sodium soils, Irrigation system under pressure, Wheat yield, Water Consumption Efficiency



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## Challenges and Measures of Improving Livestock Water Productivity

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### Abstract

Livestock water productivity (LWP) is defined as the ratio of net benefits from products and other services of livestock to the consumed water for such products. The LWP is affected by or is a sub-set of agricultural water productivity (WP). It should be noted that the estimated values of LWP have no firm bases and there are some exaggerations on reported low values of LWP. The current estimated values of LWP have some limitations and problems. If nutrition values, type of feed (crop residue based feed), and multiple use of livestock are considered in evaluations, the LWP values are comparable with the WPs of common crops. For instance protein-content based LWP (dry matter) of livestock products, i.e., 41 gr/m<sup>3</sup> (egg), 40 gr/m<sup>3</sup> (milk), 33 gr/m<sup>3</sup> (poultry), 21 gr/m<sup>3</sup> (pork meet), and 10 gr/m<sup>3</sup> (red meet) are comparable with the WPs of crops, i.e., 150 gr/m<sup>3</sup> (potato), 77 gr/m<sup>3</sup> (maize), 76 gr/m<sup>3</sup> (bean), 74 gr/m<sup>3</sup> (wheat), 49 gr/m<sup>3</sup> (rice), and 14 gr/m<sup>3</sup> (groundnuts). Therefore, some studies underestimate LWP from its real value and this is confusing. Livestock production has great potentials for efficient and economic use of water in agriculture. Factors affecting livestock productivity including size and composition of livestock, health, reproduction, and feeding and watering are well recognized in animal science. However little are known and or are studied on the subject of the link between these factors with the water consumption and water resources developments. Therefore sufficient research studies on the role of livestock in the integrated water resources management are required. Consequently global and multi-disciplinary efforts are required to comprehensively evaluate this index throughout the world. In this report based on the review of scientific literature on the subject of LWP, it is attempted to elaborate definition and concept of LWP, its relation with the agricultural WP, and its apparent values reported in the different sources. It then deals with the challenges and issue regarding real values of livestock products and LWP and compares the WP of common crops with LWP in regard to the economic values gained against water consumed. Some issues regarding water accounting (WA) of livestock production are discussed and its components are described. At the end some strategies and measures for the enhancement of the LWP are elaborated.

**Keywords:** Agriculture, Farming system, Livestock production, Measure, Virtual water, Water productivity

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## Determination of Nitrate Transfer to Different Depths and Up to Subsurface Drain in Application of Coated Fertilizer Compared to Conventional Ones

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### Abstract

In today's agriculture, the use of different chemical and organic fertilizers and pesticides is inevitable via to adding the amount of production. Application of fertilizers usually results to introduce of some pollutants such as nitrates into the environment and water and soil resources. In such a condition, the application of coated fertilizers or slow released may cause less pollution. In this research, the amount of nitrate transport in soil profile was investigated due to the application of three common types of fertilizers and its comparison with sulfur coated urea fertilizer (SCU). For this purpose, 15 PVC columns of soil and water, with a height of 150 cm and a diameter of 10 cm were used. The columns were filled up to a height of 120 cm with a sandy loam soil. For drainage discharge and sampling of it (for determination of nitrate concentration), drain pipes were installed at different depths of columns. In this research, a statistical factorial with completely randomized design was used to study the factors including: type of fertilizer (no fertilizer as control treatment, urea, ammonium nitrate, coated urea and poultry manure); sampling depth of drainage water (30, 60, 90 and 120 cm from the soil surface); irrigation interval (5 times) and sampling intervals in each irrigation (5 times based on specific volumes of drainage water discharge of a complete purvolum of soil) with three replications. The results showed that nitrate transfer to soil depth was the highest in ammonium nitrate application (with a mean of 51.67 mg/l) and was the lowest in control treatment (with a mean of 38.39 mg/l). Also, Urea fertilizers (with a mean of 48.16 mg/l), poultry (with a mean of 40.70 mg/l) and coated urea (with a mean of 39.88 mg/l) were placed in between them, respectively, and the differences were statistically significant at one percent level. Therefore, application of SCU fertilizer could have a clear effect on reducing nitrate leaching to soil depth, especially in this study, which simulates the early stages of plant growth (with an undeveloped root system).

**Key words:** Chemical Fertilizer, Drainage, Leaching, Nitrate Pollution, Organic Fertilizer, Sulfur Coated Urea

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## Future of Wheat Evapotranspiration in East of Urmia Lake

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### Abstract

Considering the current and prospect situation of Urmia Lake, the future study of variables of irrigation scheduling and management is one of the priorities of agricultural research to improve the cropping pattern in the east of lake. In this study, the time series of wheat evapotranspiration in sixteen regions of East Azarbaijan located at the east of Urmia Lake was determined using the Penman-Monteith FAO-56 method with the regional crop coefficient. The analysis period was 80 years, which 50 years was applied for the time series modeling, 17 years for testing and 13 years for future studying up to 1410. Among the eighteen possible models, the appropriate time series model for wheat evapotranspiration in cold climate regions such as Azarshahr, Osko, Bonab, Tabriz, Jolfa, Maragheh, Malekan, Marand and Miyaneh was acquired as ARIMA (0, 1, 1) and for very cold climates such as Ahar, Bostanabad, Sarab, Shabestar, Kaleibar, Harris and Hashtrood was obtained as a exponential trend model. The wheat evapotranspiration in East Azerbaijan in the past 67 years averaged 478 mm and for the next 13 years averaged 500 mm. The findings of this study are valuable and practical for irrigation scheduling in full and deficit irrigated conditions and reduction of drought damage in east Urmia Lake.

**Keywords:** Cropping Pattern, East Azarbaijan, Irrigation Management, Penman-Monteith, Water Requirement

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## Technical and Economical Evaluation of Drip Irrigation Systems (Tape) on Wheat under Farmer's Management

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### Abstract

Water scarcity and salinization are major threats to sustainable irrigation in Iran as well as other parts of the world. Thus the appropriate use of water resources and increasing water productivity in agriculture is necessary. In order to increase water productivity and decrease the effects of shortage in water resources, change of traditional irrigation method to modern irrigation methods with the priority of local irrigation has been placed on the agenda of the Ministry of Jihad-e-Agriculture. Drip irrigation is one of the most advanced techniques to increase water productivity. So this method is gradually replacing the other traditional irrigation methods, especially in arid and semi-arid regions of Iran. Therefore, the present study was conducted to evaluate technical and economical of drip irrigation (Tape) on wheat at fields managed by farmers in different regions of the country without interfering with their irrigation scheduling. In order to understand the strengths and weaknesses of surface and drip irrigation method on wheat under farmer's management, a farm assessment monitoring, include of water quality and quantity, soil quality, texture, yield and water productivity was down during agronomic years of 2016-2018 in Provinces of East Azerbaijan, Lorestan, Markazi, Zanzan Khuzestan and Fars of Iran. Analysis of the results obtained from farmers' farms showed that the yield difference, volume of water consumed and the water productivity of wheat production under drip and surface irrigation in different provinces of the country was significant. The highest and lowest yields were obtained from drip and surface irrigation, respectively. This is statistically significant at 5 % level. The average volume of water consumed in the drip irrigation and surface irrigation was measured 5010 and 6718 cubic meters per hectare. Although drip irrigation has reduced the consumption of water by 25% compared with the surface method, But average soil salinity changes during the growing season increased at the end of the growing season compared to the early irrigation season, Especially in the between and below drip line. Drip irrigation can maintain suitable root-zone salinity, but surface salt accumulation will occur unless there is adequate leaching due to rainfall or supplemental surface irrigation. In climates with >300 mm of annual rainfall, leaching from rainfall will probably be sufficient to maintain soil salinity below harmful concentrations, except when very saline irrigation water is used. Thus, with appropriate of water for leaching in drip irrigation, the average volume of water consumed in the drip irrigation increased to 5667 cubic meters per hectare and significant differences were found between average volumes of water consumed in surface irrigation (6718 cubic meters per hectare). The average water productivity (irrigation, effective rainfall and leaching) in drip and surface irrigation was 0.79 and 0.63 kg/m<sup>3</sup>, respectively. In this regard, drip irrigation increased water productivity by 25% compared to surface irrigation method. Although drip irrigation had the highest yield and increased water productivity, but its cost was much higher than the surface irrigation methods. As a result,

the net income of drip irrigation system was lower than surface irrigation. Therefore, drip irrigation system is not recommended for winter wheat in arid and semi-arid regions of Iran.

**Key words:** Drip Irrigation (tape), Salinity, Wheat, Water Productivity



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## **Investigation of Effective Deficit Irrigation by Using Drip Tape and Furrow Irrigation Methods for Alternative Mechanized Planting on Water Use Efficiency and Bean Yield**

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### **Abstract**

The purpose of this study was to investigate the effect of deficit irrigation on bean yield under two types of irrigation systems and two different cultivation methods. The experiment was conducted as a split split plot in a randomized complete block design with three replications at Khomein Bean Research Station of khomein during two consecutive years 1395 and 1396. Irrigation method treatments (furrow and drip Tape irrigation) were selected as the main factor and different amounts of irrigation water (Full irrigation, 75% full irrigation and 55% full irrigation) were selected as sub-factor treatment. Also, planting method treatment as sub-factor consisted of either two or three rows of crop on each stack. The measured traits were number of seeds per pod, number of pods per plant, plant height, weight of 100 seeds, grain yield, biological yield and plant harvest index. Analysis of variance was performed using SAS software and means were compared by Duncan test at 1% and 5% levels. The results showed that the effect of irrigation methods on yield and its components had no significant difference at 5% level. However, irrigation with 55% treatment reduced yield and its components. However, deficit irrigation by using of 55% full irrigation water reduced yield and its components significantly. Application of two rows on each stack could be recommended as a suitable planting method.

**Keywords:** Drip Irrigation, Mechanization, Beans, Water Consumption



AERI

## Evaluation of Conveyance Efficiency in Irrigation Networks of Khuzestan Province

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### Abstract

The main purpose of the construction of irrigation networks is to prevent water losses in the conveyance and distribution routes, as well as to control and optimize water use. A significant part of water losses in irrigation and drainage networks is related to the conveyance and distribution sector. Irrigation canals as one of the most important parts of irrigation and drainage networks have an effective role in reducing losses and increasing the conveyance and distribution efficiency of water. Water losses are due to water penetration in the channel walls, deep penetration and evaporation. In this research, in order to determine the conveyance efficiency, the input-output flow method was used with the use of a molecular device and flow cross-sectional segmentation. In order to influence the dimensions of the canal and the volume of water through the channel, and to achieve a better understanding of the leakage losses, the percentage loss per meter channel length was used compared to the inlet flow. There are 85 irrigation channels of grade 1 and 2 with concrete, earthy, concrete-earthy and earth-concrete types with trapezoidal, rectangular, canal and irregular shapes in Khuzestan province were studied and evaluated. 29 of these channels were grade 1, 40 channels of grade 2 and 16 distribution channels under farm management were evaluated. The range of conveyance efficiency varies from 60.98% to 98.3% in Behbahan city and the average was 89.99%. The range of changes in the leakage loss index varies from 0.22% to 38.38% in the Behbahan city and the average was 6.72%. To prevent water losses in irrigation canals, there should be some cases such as weed growth in canals, sediment accumulation in the canals, accumulation of waste in the canals, cracking of the canal cover, crushing or displacement concrete components in canals, destruction caused by inappropriate quality of used materials, destruction caused by executive issues, destruction caused by cultural and social issues, issues of exploitation and maintenance were eliminated.

**Keywords:** Channels 1 and 2, Canals, Leakage Losses

AERI

## **Determination of Net Water Requirement of Crops and Gardens in order to optimize the Management of Water Demand in Agriculture Sector- Esfahan Province**

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### **Abstract**

As the main consumer of water resources in Iran, restriction of water resources has caused the agricultural sector, to face a shortage of water for food production. The most important challenge for the agricultural sector is now to increase water productivity by calculating the exact amount of water consumed by the agricultural sector using new technologies. Awareness of need for the amount of water needed for irrigation of field crops and horticultural crops are the basic requirements of any irrigation project. In this regard, this research project in sponsorship of the Esfahan jihad-e-agriculture organization designed to determine net water consumption in Agricultural sector (autumn and spring plants) in 24 districts and 5 defined climates of the Isfahan province. To do so, the reference evapotranspiration (ET<sub>o</sub>) was calculated using FAO Penman-Montieth equation via coding in visual basic software and then zoning them in the Arc GIS environment. In this regard, by establishing the relationship between the physiographic units with the climatic parameters of each synoptic and climatologic meteorological station ET<sub>o</sub> amount was calculated in rasterized ACZ map units. It is notable that the clustered maps of meteorological data involved in the calculations are presented as raster maps and graphic figures. The rasterized pixels of the maps are prepared to show UTM, capability class of soils, soil texture and, EC, reference evapotranspiration and net irrigation water requirement when each pixel is pointed. To manage water demand in the agricultural sector under current conditions, crop evapotranspiration (ET<sub>c</sub>) was calculated according to the physiological characteristics including root depth, canopy cover, planting methods, planting date, variety, plant height and crop coefficient (K<sub>cb</sub> and K<sub>e</sub>). Rasterized map of soil parameters including salinity - texture - moisture content and arable lands were included in project performance map. In the end, the net water requirement amounts and related maps were provided for each crop to be used by policymakers in the agricultural sector. Intelligent computing algorithms, creation of proper database were prepared to establish a database in this study. For instance for the two template field and horticultural crops of wheat and pistachio, according to the graph outputs of the ET<sub>o</sub> amounts, annual reference evapotranspiration varied between 1219 mm in western part to over 2027 mm in the eastern part of the Isfahan province. The minimum and maximum evapotranspiration for wheat crop were 342.7 and 552.6 mm, and for pistachio were 665 and 770 mm, respectively.

**Keywords:** Crop Coefficient, FAO Penman-Montieth, Isfahan, Net Water Requirement



## Study of Furrows Width of in-furrow Grain Drill on Wheat Yield and Water Productivity

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### Abstract

With increasing soil salinity in fields due to recent droughts, there is a need to design a suitable grain drill for these fields. The factors influencing the efficiency of grain drills are like width of furrows. This study was a randomized complete block experimental design with four treatments and four replications to determine the suitable furrows width for in-furrow grain drill and also wheat yield. Treatments were planting wheat by in-furrow grain drill with furrows width of 60, 75 and 100 cm and planting wheat on raised bed with conventional grain drill (control). In this project, the effect of in-furrow grain drill on EC, seeds germination percent, 1000 seeds weight, crop yield, water consumption and water productivity were studied. Results indicated that in-furrow grain drill affected distribution of salinity (EC) in soil profile, seeds germination percent, and wheat yield and water productivity. The salt concentration at the top-center of beds and at the sides of the beds increased by 50.7% and 17.1% compare to mid-furrow, respectively. In-furrow grain drill with furrow width of 75 cm increased seeds germination (43.1%), 1000 seeds weight (5.9%), crop yield (39.3%) and water productivity (45.3%) compare to planting wheat on raised bed. Also, the highest water productivity was obtained by in-furrow grain drill with furrows width of 60 and 75 cm which there is no significant difference between them. The finding show potential for in-furrow grain drill machine in soil salinity to reduce salt concentration at the mid-furrow compare to the top-centre of beds, therefore, improving crop yield and water productivity.

**Key words:** Furrower, Grain drill, Salinity, Wheat



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## Study of Interceptor Drain Effectiveness on Vegetation Changes in Qazvin Plain Salt Lands by Remote Sensing

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### Abstract

Climatic conditions and soil characteristics such as salinity are important factors influencing the vegetation of each region. The salinity of groundwater flow and the accumulation of salts in the surface layers of the soil due to evaporation and edging of the capillaries caused the drought in the part of the Qazvin plain that has affected the growth of plant species in the range of 60,000 ha. Based on this study, the effects of construction of drainage on vegetation in Shohyarzar area and vegetation cover affected by drainage in the region using satellite imagery and remote sensing technique were studied. Results of analysis of variance of soil salinity data showed that soil salinity changes were not significant during sampling years, although soil salinity decreased from 96.88 dS / m in 2013 to 67.37 dS / m in 2016. Results of t-test showed that drainage construction had no significant effect on soil salinity changes. However, soil SAR index had significant changes before and after drainage. Results of analysis of variance percentages of vegetation cover in exclosures also showed that drainage construction had a significant effect on vegetation changes in exclosures during the studied years. The results of correlation test of remote sensing indices and ground data showed that in the salinity range of SI index there was a significant correlation with soil salinity data. Accordingly, bands 5 and 7 of satellite images also showed a significant correlation with EC and SAR changes in the study area.

**Keywords:** Interceptor Drainage, Qazvin, Remote Sensing, Soil Salinity, Vegetation Index



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## Evaluation of Sprinkler Irrigation Systems in Semnan Province

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### Abstract

Pressure irrigation methods have been considered as one of the options to improve irrigation efficiency and water productivity in Semnan province. In this study sprinkler irrigation systems were evaluated in alfalfa, sugar beet and wheat fields in Semnan province. The volume of actual water consumption in the farm and its comparison with the water requirement and the national water document were conducted as well as the water productivity was determined. For this purpose 8 sprinkler irrigation systems including wheel move, classic with portable sprinkler, linear move and center pivot systems in Semnan province were evaluated. Potential and actual application efficiency (PELQ and AELQ) and distribution coefficients (DU) for wheel move systems were 66.2%, 66.2%, and 76.2%, respectively and for classic systems were 44.8%, 36.3% and 57.8%, respectively. For linear move systems these parameters were 82.8, 80.6% and 91.2% and in center pivot system these parameters were 72.8%, 70.1% and 80.8% respectively. The operation of linear move and center pivot systems were easier than other sprinkler systems, due to the mechanization of these systems. Adjustable sprinklers height and placing them at low height were from other advantage of linear move and center pivot systems. The results showed that the volume of water consumption in the two farms of alfalfa and sugar beet was less than net irrigation requirement and deficit irrigation was done. The use of irrigation planning table and paying more attention to educating farmers on proper operation of sprinkler irrigation systems) such as using appropriate volume of water (were important factors in increasing water productivity.

**Keywords:** Efficiency, Center Pivot, Linear Move, Uniformity

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