

# Development of Modern Irrigation Systems in Arid and Semi-arid Area -A case study in Iran-

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## 1. Introduction

Increasing demand for water has created a whole set of issues and problems now confronting irrigated agriculture. New water laws; optimization of water according to monetary value, increased pressure to transfer agricultural water supplies to other users, scarcity of water in arid and semiarid regions has forced many irrigators to more precise methods of irrigation to improving the water use efficiency and reduce associated environment impacts. Pressurized irrigation methods including microirrigation and sprinkle irrigation systems are one of the technologies, which offer many unique advantages to address the challenges for irrigated agriculture. The growth in the usage of microirrigation in the world showed an increase of more than 633% over the past 19 years, which demonstrates the confidence of users in this method of irrigation (Reinders, 2000). Pressurized irrigation systems are becoming more and more popular because of its advantage: increasing the water use efficiency, lead to increases in crop yields, reduces nutrients and agrochemical application, and other advantages on irrigation control, irrigation in sandy soil, irrigation in slope area, etc. This methods have many requisite verses other irrigation systems and also several problems are associated with this methods. The clogging, and salt concentration in the soil caused by water quality degradation is the important factor for microirrigation. Iran is one of the arid and semi-arid area in the middle east. Although, more than 50 million hectares of land in Iran possesses various degrees of capability for the production of agricultural crops, but a large portion of this area is not arable for lack of water. Increasing the efficiency of water use is a major challenge faced by Iran and is a top priority for Government. The pressurized irrigation systems developed more than 200% in Iran during the last decade. In this paper the necessity of development of pressurized irrigation systems, potential of development and various kind of pressurized irrigation systems in Iran as a pattern for other arid and semi-arid area was considered.

## 2. Agricultural water

Agriculture sector is among the most important economic departments in Iran and amidst this, water, which is considered as the most important limiting factor of production, possesses considerable importance. But unfortunately due attention in respect to its importance is not furthering as a result of which improper use has caused considerable wasting of this God given gift.

Average annual rainfall in the country is 252 mm, annually 71% of the total rainfall (179mm) is directly evaporated, due to high evaporation prevalent in the country. Presently the total water use in Iran is approximately  $88.5 \times 10^9$  (m<sup>3</sup>) out of which more than 92% ( $88.5 \times 10^9$  m<sup>3</sup>) is used in agriculture, while less than 8% is allocated for urban and industrial consumption. Increasing demand in the industry and drinking sectors and ensuing discussion regarding new demands, such as supply of minimum water requirement, for conservation of environment and water supply for fisheries, has increased its need and intense competition between applicants for water with water for agriculture will come to existence. According to investigations have taken place in the preparation and formulation of long-term policies in water management, although water requirement in the agricultural sector will increase by 65% in comparison with the prevalent condition till the year 2025, but will due attention to the total supply of extractable water, it is necessary that major sections of agricultural development requirements is met through reconsideration of pattern of water consumption in agriculture, implementation of deficit irrigation and improvement of irrigation efficiency.

### 2.1 Irrigation

On-farm application rates in Iran are rather high and in general irrigation has a low efficiency, 32% on average at national level. Major causes of inefficiency include: careless operation, poor maintenance, negligible water prices, and fragmentation of responsibilities among different governmental agencies and inadequate training of farmers. Surface irrigation techniques are used on 98.75% of the area equipped for irrigation and 1.25% benefits from a pressurized irrigation system. The average price of water delivered to farmers by government is \$US 0.2 to 0.8/ 1,000 m<sup>3</sup>, while the cost of withdrawal of groundwater by the farmer is \$US 5 to 9/1,000 m<sup>3</sup> and the cost for regulating surface water in existing projects is \$US 3 to 5 per 1,000 m<sup>3</sup>. This means that the Government heavily subsidizes delivered water, which is probably one of the main reasons for the low irrigation efficiency throughout the country.

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## 2.2 Modern irrigation systems

Increasing the efficiency of water use is a major challenge faced by Iran and is a top priority for government. The two ministries involved in water management for agriculture (Ministry of Agriculture and Ministry of Energy and Water) are coordinating efforts in the formulation of a 20 years program to reach the objective of 32 to 45 percent efficiency. Two parallel issue need to be addressed; (i) the technical problem of irrigation efficiency (ii) irrigation management related to the empowerment of water users associations and to cropping intensification. On the technical aspect, important efforts are currently under way to promote the use of pressurized irrigation systems, for which the country has acquired good engineering capacities and self-reliance. Modern irrigation systems based on sprinklers and microirrigation are being developed. According to the Agricultural Ministry reports, the pressurized irrigation systems used by some persons that, know about the perquisite of these irrigation systems before revolution (before 1978). After that (1978-1994) according government policy, inference of increase of population, felling down the water level in wells and droughts recently, increased the process of using of pressurized irrigation systems in country. The increasing processes were improved during 1995-1999 and pressurized irrigation landing arrive to 287,547 ha in 1999 (**Table 1**).

**Table 1.** The agricultural land area equipped by pressurized irrigation systems in Iran.

Period	Sprinkler irrigation (ha)	Micro irrigation (ha)	Total (ha)
Before 1978	37,500	12,500	50,000
1978-1988	300	100	400
1989	282	94	376
1990-1994	24,200	8,067	32,267
1995-1999	153,378	51,126	204,504
Total	215,660	71,887	287,547

The sprinkler irrigation has an efficiency of 75 to 79 percent, while microirrigation reaches 90 percent efficiency on average in exiting irrigation systems. This kind of irrigation system not only improved the irrigation efficiency but also increased quality and quantity of some kind of agricultural production in some area.

In Iran, the microirrigation systems used common for orchards and greenhouse, only in special cases it used for row crops in the field until 1995. But in recently years by increasing of researches on using of micro irrigation systems on row crops and acceptable results, the policies prepossess to promote of farmers to use of micro irrigation systems for annual crops. The sprinkler irrigation systems use for more kind of annual crops including; wheat, barley, corn, cotton, potato, vegetables, clover, forage corn.

The microirrigation systems use most on the soil surface by using the on-line and in-line emitters. The sprinkler irrigation have more variety and is including, Hand-move lateral system, Side-roll lateral system, Gun system, Center-pivot system, Linear-move system. The national industry, principally with in the private sector, is already fully operational in producing the required pressurized irrigation equipment. In totally, 38 company producing the complete set of the pressurized irrigation systems, and 48 company produce the polyethylene pipe and relative connation of pressurized irrigation systems in standard level.

According to the latest information on lands under agricultural cultivation, from all of the under full irrigation area ( $8.0 \times 10^6$  hectares), about 2.0 million hectares are under orchards planting and about 6 million hectares under crops planting. Whereas, 13% of cultivated area under annul crops are vegetables and summer crops, the total potential of expansion of microirrigation and sprinkle irrigation estimating about 2.7 and 5.3 million hectares respectively (Ministry of Agriculture, 1999). This estimate is an approximately number and surely a lot of technical and experiential evaluation is necessary to determination of district number.

## 3. Conclusion

Use of pressurized irrigation systems was not success in some area caused by low quality water, limitation of water resources, climatic condition, crops, etc. As most part of the Iran country, located in arid area the quality of water is low. Low quality water in microirrigation has some limitation about salt accumulation in the soil and emitter clogging. In sprinkler irrigation it will be appeared with effects on leafage of crops. It seems improvement of low quality water managing in arid and semi-arid area must be considerate on a parallel situation with improvement of water use efficiency.

## References

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