

## **INVESTIGATION ON HISTORICAL LESS- IRRIGATION MANAGEMENT METHOD UTILITY IN AGRICULTURAL PRODUCTION IN YAZD PROVINCE**

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### **ABSTRACT:**

Water is one of the important basements in the agricultural production. Shortages of water quality and quantities from the ancient in the kavir area of Yazd province caused utility of specific management method to increase profitability of irrigation .less-irrigation is one of the methods which has been used from the ancient . In this management method, its tried to maximize the profitability of pure profit due to unit volume of water, considering conditions and effective elements.

Biography of agricultural activities in Yazd province shows that less-irrigation method was used for the old times in surface irrigation. This method mainly include providing the best planting pattern and agricultural activities such as vegetation density , fallow and alternation for using precipitation and storing humidity, changing plant time to shorten growth period, planting resistant and tolerable plants to drought.

The quality of using this method in different parts of Yazd was studied. In Abarkooh to keep and preserve pistachio gardens, farmers take the latest water of wheat and irrigate pistachios. In Sadoogh to plant summer crops farmer use the latest water of wheat or barely.

Investigation showed that using this method may increase profitability and exceeding valuation of whole agricultural productions, because agriculture is mixed of different activities.

**Keywords:** Historical study, agriculture, kavir, less-irrigation (few-irrigation)

### **INTRODUCTION:**

Due to dry and ultra dry climate in Yazd province and little precipitation (mean annual about 105 mm) agricultural activities are difficult .Ground waters resources are the only resources which used for agricultural production. Despite of extended area of province which include 4.5% of whole country but agricultural lands are only 0.74%. This

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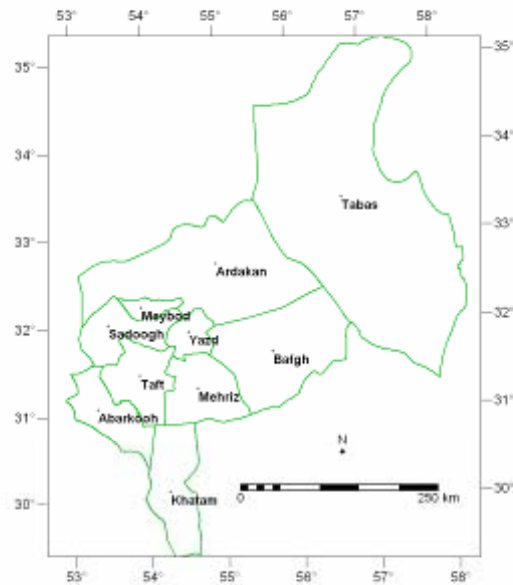
percentage of agricultural lands is based on utility of dry land agricultural methods using less irrigation and Qantas water. Basically less irrigation is a technique for irrigated vegetations (Faryab) to use maximum profit of water volume unit and maximum benefit of land unit to obtain maximum pure benefit. Shortage of water resources in agricultural section of province caused extension of using this method before drilling deep wells and 3000 Qantas are constructed.

This article is based on investigation as: Collection and record of native knowledge in agricultural section in Yazd province during 1382-1383(2003-2004)

In this study historical resources around water and irrigation water used .In addition , field study has been done anal , query forms was filled by qualified farmers and experts .Analysis of data and information fulfilled by SPSS software.



**Fig 1-** Situation of Yazd province in Iran



**Fig 2-** Map of Yazd province

### LITERATURE REVIEW:

Sharifi (2003) studied influence of minerals such as bentonite and soil mixture with mineral cartridge (5%) on little irrigation of vegetation and introduced them as increasers of vegetation tolerances facing drought. [9]

Dehgani Tafti (2005) introduced sand as mulch for preserve soil wetness and conserve root and curb. [4]

Silspour reported that applying of plastic mulch may improve efficiency of used water from 4.77 to 6.26 kg/m<sup>3</sup>. [8]

Solimani poor et al (2004) studied plastic mulch influences on cucumber production and found that benefits coefficient is 3.19 to normal production which is 2.11.

Campos et al (1992) studied red soil mulch effectiveness on cucumber production and report that production increased to 60 ton/ha rating to 47 ton/ha in normal way. [15]

Amiri Ardakani (2002) reported the using of khake-sokhteh (burned soil) in Vashanaveh of Kahak (Qom) to reinforce hazelnut gardens.

Naraya Nasami (2002) reported using of clay, red soil, salt and calcium carbonate in ancient India. [17]

Amiri Ardakani (2002) reported a kind of irrigation management to combat crack at pomegranates [1] which is confirmed by Hydary (2003). [2]

### **1-LITTLE IRRIGATION IN LIGHT LANDS DURING WINTER AND SPRING TO PREVENT DRYNESS IN SUMMER:**

Since, irrigation on level lands is more easy and exact, farmers tried to shape slope lands as small trusts and fix them with rocks (boulders), which prevent to soil leaching and waste of water(fig 1). Channel slope and erosion of walls and bed is decreased by constructing pads (clappers) to conserve more water in dry times. Karts (land section or partition) in village of Taft are around 25 to 35 m<sup>2</sup> and in slope lands 10 m<sup>2</sup>, length of karts normally decreased to 7 m (fig2).

### **2-LITTLE IRRIGATION CONSTRUCTING SMALL SINK AROUND TREES (AGENE BANDY) TO DECREASE TRANSPIRATION OF SOIL SURFACES:**

In drought times or dry seasons, farmers are concentrated to irrigate trees. In this condition just trees are watered. Due to canopy cover area of each tree, circular basins (karts) are made and filled with water. The other parts of land are cultivated to conserve the soil wet and absorbed by trees. This kind of irrigation is named as Jabieh Bandy. Irrigation Jabieh is ploughed and fertilized by animal manure to minimized surface transpiration (fig3).

In this innovation, water need of garden is minimized according to:  $T_e = E_{terop} [P_s + 15(1-P_s)]$ . Which:

$T_e$ = need water in critical condition (Volume/ area unit)

$E_T$ = need water in normal condition (volume/ area unit)

$P_S$ : wet percentage of land

### **3-LITTLE IRRIGATION USING DIFFICULT MULCHES TO PREVENT SOIL SURFACE TRANSPIRATION:**

For old times , wind sand was used to conserve soil wet in Taft for production of cucumber and the other summer crops in Taft.(Yazd province),(fig 4,5,6).To conserve wet in farm, decrease soil surface transpiration and prevent grounding when harvesting of alfalfa and so keeping of its root. For small saplings which need more wet washed sands are added around the root to conserve wet in early years.

Black sand (Rig-e-Siah) which is a kind of shale is used to grow summer crops seeds in Nasrabad (Yazd).

Bentonite and minerals cartridge which is mixed with soil (5%) is introduced by Sharifi as increased of vegetation tolerance to dryness.

Straw, date's foliage, walnut leaves are used as soil wet keeper. Animal manure as a thin layer is applied to keep wet in alfalfa and orchard frees while water shortage.

In recent years, plastic foils are used to keep wet in summer crops. Before cultivation narrow partitions (kart) are formed and covered by plastic foil, then seeds are planted. In this way, water is consumed to  $\frac{1}{4}$  normal volume. Tunnel cultivation using plastic foil for cucumber, tomato, water melon, marrow is normalized, which decrease water consumption and protect weed growing and so to premature of product, accelerate germination of seeds due to high temperature under the tunnels and decrease damages of storm and hail.

Using mulches of tree's leaves, decayed animal manure, mineral materials may conserve humidity and cause strengthening of soil. Several kind of weeds are applied by farmers to cover the soil in front of sunlight, wind and storm to prevent of soil surface dryness. As farmer believe, garden weed or wild millet consume little amount of water and food but it has more advantage.

#### **4-LITTLE IRRIGATION WITH SOIL OPERATIONS TO PRESERVE SOIL MOISTURE:**

In dry season, around the trees are ploughed slightly after every irrigation to prevent soil surface transpiration, in this way without any damages for trees, duration of irrigation will increase to 2 times. To keep soil moisture and grow seeds in good condition, soil is scraped by rake after planting the seeds and primary irrigation, which preserve soil humidity for a long time, this way named as: <<Rehtah kashy>>. This method may break soil and prevent capillarity and deep transpiration to combat dryness and water shortage.

Black marl and red shale which are exposed in the area were used to modify the soil texture (30ton/hect) in Nasrabad named as: (Rige-siah) and Eslamieh, zainabad, Taft named as: (khak-e- sorkh).

Using a kind of soil by the name of khak-e-sokhteh (burned-soil) in hazelnut gardens of Washnovah village of Kahak (Qom) is reported by Amiri Ardakani.

#### **5-LITTLE IRRIGATION USING CANAL AND LEVEES (JOO AND POSHTEH):**

Summer crops planting are done in Joo and poshteh method, because it's believed that more water would be saved. In this way,  $\frac{1}{3}$  of soil surface or canals which is covered by gravel will be drowned and levees will keep water for crops, consequently transpiration is decreased to  $\frac{1}{3}$ . This method was named as: << Moreh kary>> (fig7).

#### **6-LITTLE IRRIGATION WITH BUILDING MOUND BETWEEN THE TREES:**

Soil mound with one meter width are made in Almond and pomegranate orchards, after spring time ploughing. The other way to prevent of stress to trees is using mound with 0.5-0.7 meter height and 1 meter diameter which is named as: << Band and pazman >>(residual soil) or (khak dehi paye derakht). The soil of mounds are exposal to the sun and changeable with land soil for next year which may reinforce fertility of soil (fig11).

This method may intense prevent of cold stroke of curb of pomegranates trees, transpiration stress in leaves before reaching water, and so crack of pomegranates [7].

### **7-LITTLE IRRIGATION USING MANURE PIT (CHAL KOUD OR KOUD DEHEE) IN SUMMER CROPS:**

There was a method in planting of watermelon and marrow which used holes(50\*40cm<sup>2</sup>) filled with soil , 1/3 decayed animal manure and 1/3 range bushes such as Peganum Harmala, Ephedra Strobilacea, Hertia Angustifolia and amount of garden leaves and chips. Using this way may preserve water in holes due to high permeability and reinforce soil fertility caused by manures which leads to prolog irrigation duration.

### **8-LITTLE IRRIGATION USING PLANTING MANAGEMENT:**

There were found several plantation management in village of study area:

a- Discipliner plantation to adapt with drought.

A cultivar land is divided to: a strip around (1/3 area) for fruit trees and the inner part (2/3 area) for farming which is named as:

Derakht kary va Sadeh kary (fig 8).In wet years whole land is planted, but in dry years or summer just trees are irrigated and inner part is fallowed. Spring planting inclusive: wheat, barely, cucumber in middle, part and after harvesting would be ploughed immediately. This manner is managed to control fluctuation of water resources (Qantas and springs) and maximize water utility.

B: selection of adaptable plants

Pomegranates, Almonds, Berries, walnuts are selected trees which are adapted with dryness.

Alfalfa, turnip, carrot, summer crops and cereals are planted in wet years but irrigated spring barely or wheat and peas are cultivated in dry years. Off course in ultra drought these kind of culture are fulfilled under the shadow of trees, solely (fig...).

Considering to harvested water from Qantas or spring more area of surrounding lands of village would be selected for farming or managed to be left.

In drought, just closest gardens to water resources would be irrigated and the others would be left. In this way, peach, hazelnut, pear and cherry trees are planted in the closest gardens to the water resources, almonds are cultured in far gardens, almonds, and berry and oleaster are planted, sparsely.

Vegetables, cucumber, marrow and tomato are cultured around the pool. In some villages, every family has a small land around the pool or Qantas to be able to supply its needs.

Special irrigation duration selection is a kind of management which is allocated for vegetables and summer crops, for example if duration is 16 days its increased to 18 day , but in every 8 day one time water is used for vegetation and summer crops. This is named as : Ab-e-tar(faster irrigation) Alfaalfa,cotton.summer crops , wheat , barely and pomegranates , pistachio are cultured in separate lands in plain village which have more stable water condition oleaster ,pedeh,berry,willow are planted in

the margin of water canals. Wheat, barely, alfalfa, cotton, madder and beet are cultivated in the pistachio gardens of Ardakan, solely and marginal trees are pedeh, oleaster and tamarisk. In more dry areas, pistachio are selected to be cultured in salty and alkaline soils of Chahafzal (Ardakan).

#### **9-LITTLE IRRIGATION USING WATER ABSORBING MATERIALS:**

Red soil (Gel-e-sorkh or khak-e-sorkh), Black gravel (Rige-e-siah), salty soil (khak-e-shoreh or gel-e-yogheh) are used material to modify soil texture. These kinds of soils include marl or clay which keep water and were used with animal manure to reinforce the soil. In Taft, Nasrabad percentage of water absorption and absorbable potassium ratio of some samples were tested in lab that is 38% of weight and 292 ppm.

Salty soil named as shoreh which is a kind of clay and evaporational sediments including K, Fe and Mg were used for pomegranates, wheat, barely, cotton, alfalfa, beat and poppy, mixing 1/3 animal manure.

#### **10-LITTLE IRRIGATION WITH ELIMINATING LAST WATER:**

In dry years, farmers plant wheat and barely in fall and winter, and irrigate it. In spring that orchard trees and vegetables need water last irrigation would be eliminated. In Abarkouh, last eliminated water is given to pistachio orchards and summer crops.

#### **SUGGESTION:**

- 1- Publication of valuable experiments of kavir area farmers such as Yazd and as native knowledge.
- 2- Support of village to use native knowledge of little irrigation or providing new methods to keep village stand up.

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**INDICES:**

**Fig 1:** less irrigation with terrace building for wheat growing (Sanij)



**Fig 2:** less irrigation with partitioning (little partitions 3\*4 m<sup>2</sup>) (Sanij)



**Fig 3:** less irrigation with making sinks around the trees.



**Fig 4:** less irrigation using sandy mulches (Aliabad).





**Fig 5:** less irrigation using black sandy mulches (Aliabad).



**Fig 6:** less irrigation using plastic mulches (Hemmatabad).



**Fig 7-** Little Irrigation with building mound between the trees (Nir).



**Fig 8-** Discipliner plantation to adopt with drought.





**Fig 9**-Discipliner plantation to adopt with drought, potatoes and beans within almonds garden (Sanij).



**Fig 10** -Nasrabad black sand mine.



**Fig 11-** Ephedra Strobilacea is used in manure pit.