Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 3 [11] October 2014:153-156

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804

ORIGINAL ARTICLE

Locating Suitable areas for Pressurized Irrigation Systems using GIS

Ehsan Fatapour [1], Hossein Eslami[2]
[1] - Department of Water Engineering, Shoushtar Branch, Islamic Azad University, Shoushtar, Iran
[2-] Department of Water Engineering, Shoushtar Branch, Islamic Azad University, Shoushtar, Iran
Corresponding Author email: eslamyho@gmail.com

ABSTRACT
The purpose of the study is comparison of suitability of two methods of sprinkler and drip irrigation based on the parametric method. This study was performed in an area of 113649.4 hectares in Kouhdasht plain located in Lorestan province, in the west of Iran. Land properties (slope, drainage etc.) and physical and chemical properties of soil (lime, salinity and alkalinity etc.) were selected for the parametric method and after the spatial analysis based on GIS, the evaluation was done. The results showed that all of arable lands were considered suitable for drip irrigation and classified as class S1. The results of land evaluation for sprinkler irrigation parametrically showed that the land area of 13894.1 ha (approximately 12.13% of the land) placed in a suitable class (S1) and 29636.75 hectares of land area (approximately 26.7 percent of the land) in suitable class (S2). Also70223.32 hectares (approximately 61.8 percent of the land) are the miss lands including the highlands and eroded lands and rivers. It should be noted that the main limiting factors are slope parameter and soil physical properties. Finally results show Kouhdasht plain is very suitable for the implementation of pressurized irrigation.
Keywords**:** *Drip irrigation, Sprinkler irrigation, parametric method, GIS.*

Received 21.05.2014 Revised 02.07.2014 Accepted 22.09. 2014

INTRODUCTION

One of the main priorities of agriculture is proper use of valuable water resources and soil. In arid and semi-arid regions, water is the most important factor limiting agricultural development and selection of appropriate irrigation methods for efficient water management is one of the most effective ways to improve the efficiency of water resources and will have a significant impact on sustainable development.
In this regard, in addition to technical and economic issues, adoption of new practices and the use of appropriate technologies to increase the efficiency of irrigation water use efficiency should be considered. Due to the higher efficiency and other advantages of pressurized irrigation relative to gravity irrigation, necessitates the use of pressurized irrigation in advance to be felt. Obviously that is not the correct choice for a regional water system, a waste of time and money in the design and implementation of the scheme and may be uneconomical and thereby non-optimal utilization of water and soil will be an invaluable resource.
On the other hand, a comprehensive map of areas suitable for different irrigation systems in addition to reducing execution time of the initial studies, management and planning for graduate studies, policies and the allocation of credit and banking facilities and other provisions would have to choose the right system. Irrigation systems are designed according to the objectives that must be incorporated, such as soil science, agriculture, engineering, economics, sociology etc.
Given the cost of a feasibility study and preliminary testing of soil and water, to collect accurate and detailed information of all the factors affecting the performance of the pressurized irrigation system and using remote sensing and GIS methods (GIS), at a lower cost to implement the system studied.
Sys et al. [1] was proposed a parametric evaluation system for irrigation method, which formed the basis of the chemical and physical properties of soil. Dengiz [2] reviewed various methods of irrigation (surface, drip and local) according to the method of parametric estimation of farm land south of the center of Ankara (Turkey) and using analysis of soil properties, topography, salinity and alkalinity,

drainage and the use of geographic information systems (GIS) concluded that 13.1 percent of the land area suitable for surface irrigation and to drip irrigation 51.2percent of the land is suitable.
Gholami and Delavari [3] evaluated the land suitability for drip and surface irrigation methods at Shirin Abad, Shoushtar that located in the province of Khouzestan. The results of parametric evaluation system showed that 83.6 percent of land is suitable for surface irrigation and 90.8 percent is suitable for drip irrigation and 6.2% of the land is unsuitable for both irrigation methods and factor of restrictions were introduced in salinity and soil alkalinity.
The purpose of this research is to locate suitable areas for pressurized irrigation system in the Kouhdasht plain, Lorestan province using GIS according to the characteristics of the soils and provide a map of areas suitable for different systems.

MATERIAL AND METHODS

The Kouhdasht plain is located in Lorestan province, Iran. The study area is located between 33° 25' - 33° 45' N latitude and 47° 25' - 47° 50' E longitude. The total geographical area is 113649.4 hectare. The average annual rainfall is 418 mm and rainfall occurs in autumn and winter. Average annual temperature is around 14 degrees Celsius.
Soils of the study area defined into three physiographic units of the rugged piedmont plateau, the cut plateau, gravelly alluvial fans and piedmont alluvial plains. Four soil series were collected using semi detailed soil studies of Kouhdasht plain. Land valuation was determined based on soil characteristics and topography.
In order to determine weighted average, it is used of soil texture characteristics based on the depth and the weights coefficient to equal depths of soil. For every 120 cm of the soil profile was divided into 4 equal parts and it is used the weighting factor of 2, 1.5, 0.58, 0.89, respectively for each part [1].
To assess the suitability of various methods of irrigation water from the parametric evaluation system was proposed in 1991 by the sys and colleagues were used [1]. This method is based on physical, chemical and morphological characteristics of soil. Capability index for irrigation or Ci is calculated as follows:

$$A \times B/100 \times C/100 \times D/100 \times E/100 \times F/100 = Ci \quad (1)$$

In this equation, A, B, C, D, E, and F show the degrees of soil texture, soil depth, lime, salinity and alkalinity, drainage and slope respectively.
The six layers Obtained for each unit of soil in parametric method that the layers in a GIS environment are spatially overlapped until final layer is obtained [2]. Irrigation capability index (Ci) was calculated for all land units and through using Table 1 land suitability has been determined for that unit and presented with a related sign on the map. These signs contain S1 (completely suitable), S2 (fairly suitable), S3 (partly suitable), N1 (unsuitable in present conditions), and N2 (permanently unsuitable).

Table 1- The classes of suitability for capability index of irrigation

Capability index	definition	symbol
> 80	Highly suitable	S_1
60 - 80	Moderately suitable	S_2
45 - 59	Marginally suitable	S_3
30 - 44	Currently not suitable	N_1
< 29	Permanently not suitable	N_2

RESULTS

4 soil series obtained using semi detailed studies of Kouhdasht Plains Soil. Soil map of the study area is shown in Figure 1.

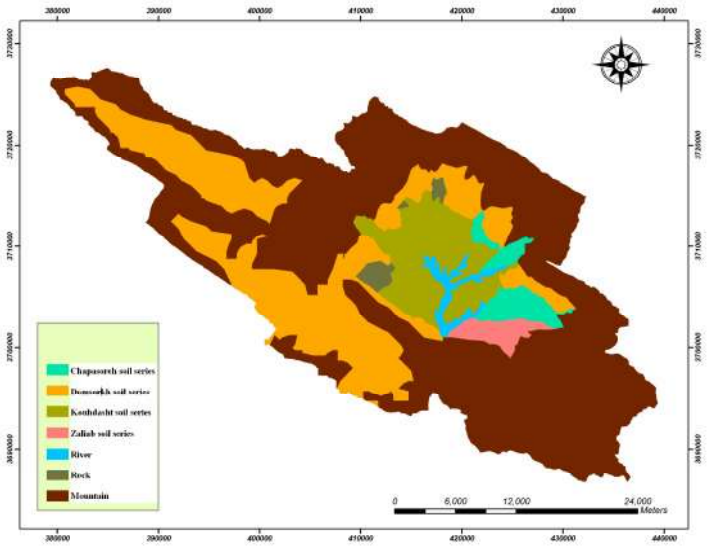

Figure 1- soil series of study area

Figure 1 show that from total area of 113649.48 hectares, 70223.32 hectares (approximately 61.8 percent of the land) are the miss lands including the highlands and eroded lands and rivers.
The results of land evaluation for sprinkler irrigation parametrically showed that the land area of 13,894.1 ha of 1unit (approximately 12.13% of the land) fall in a suitable class (S1) and Unit 2, 29,636.75 hectares of land area (approximately 26.7 percent of the land) in suitable class(S2) (Table 2, Fig. 2).

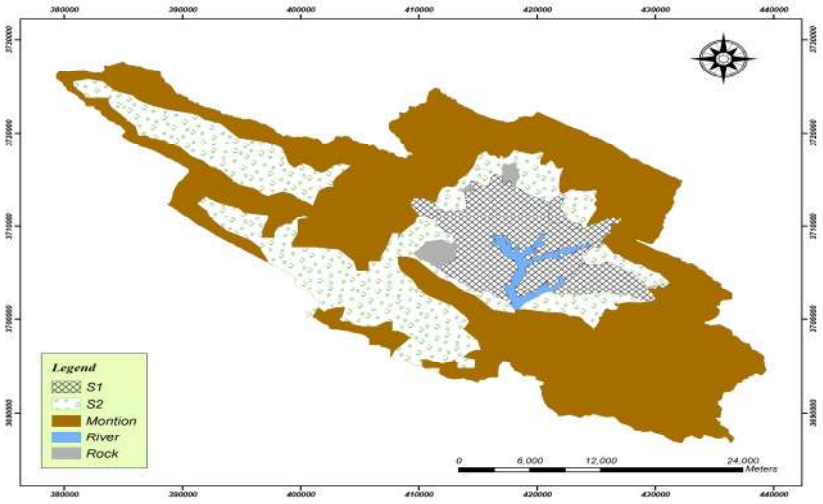

Figure 2- Distribution map of quality suitability for sprinkler irrigation

Land suitability evaluation for drip irrigation using the parametric method results show that land area of 43,426.16 hectares 1 units (approximately 38.2% of the total land area) classified in a suitable class (S1) (Table 2, Figure 3).

Table 2 - Comparison of land suitability for drip and sprinkler irrigation and using parametric method

	Drip irrigation			Sprinkler irrigation		
Suitability	Soil series	)ha(Area	Ratio (%)	Soil series	)ha(Area	Ratio (%)
S1	1,2,3,4	43426.16	38.2	2,4	13894.1	12.13
S2	2	-	-	1,3	29636.7	26.07
S3	-	-	-	-	-	-
N1	-	-	-	-	-	-
N2	-	-	-	-	-	-
Mis. land	-	70223.2	61.8	-	70223.2	61.8
Total	-	113649.4	100	-	13649.4	100

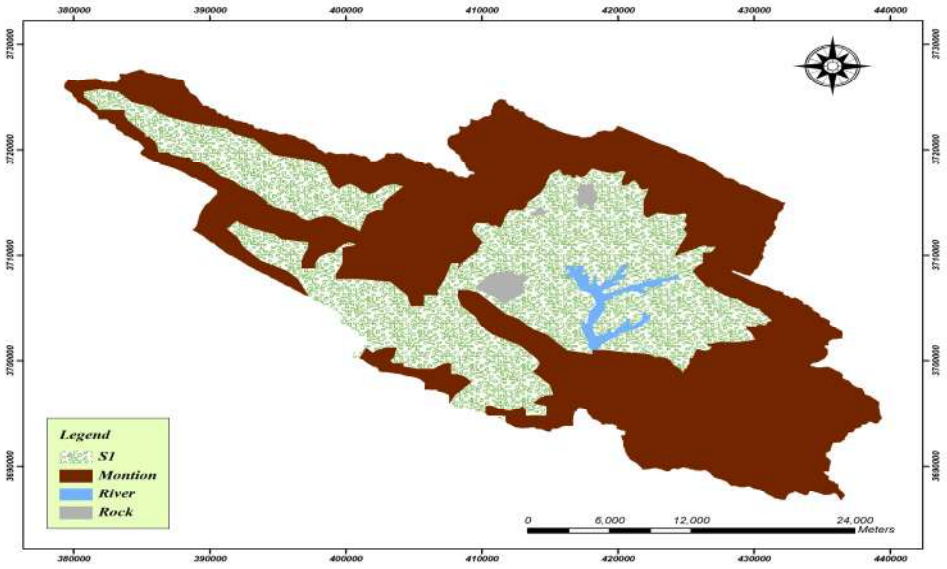

Figure 3- Distribution map of quality suitability for drip irrigation

Comparison of irrigation methods show that in examining the suitability of drip irrigation an area of 43,626.16 hectares, i.e. 38% placed in class S1 that is all of arable land.
In evaluating the suitability of sprinkler irrigation placed 13894.1 hectares of land area i.e. 12.13 percent in S1 and 26636.75 hectares, i.e. 26.07 percent in Class S2. As a result, drip irrigation than sprinkler irrigation to show much greater suitability and in other words, the use of drip irrigation in this unit is to increase and improve fitness classes.

CONCLUSION

The results showed Kouhdasht plain is very suitable for the implementation of pressurized irrigation so all lands are placed in S1 and S2 that are suitable for Sprinkler and drip irrigation although relating physical characteristics, the region are more suitable for drip irrigation. Slope parameters and soil physical properties that can be modified to implement this system are enforced. Because of the large roughness, slope of land, failure of traditional irrigation and fragmentation of arable lands, using deep and semi-deep wells and pressurized irrigation system is given in advance to seem inevitable. Locating suitable areas for the pressurized irrigation by studying all the factors of quantity and quality of soil, topographic and drainage with the use of GIS and spatial analysis leads to an understanding of the region
Because of resource constraints in the agricultural sector and preventing the loss of soil and water resources, areas that are more capable to run the irrigation system pressure is determined
In the present study, according to information available only to locate land based on soil parameters is considered and by incorporating parameters such as quantity and quality of water, air and climate, suitable areas can be determined by considering additional factors.

REFERENCES

1. Sys, C., E. Van Ranst, & Debaveye, J. (1991). Land Evaluation. Part 1: Principles in land Evaluation and Crop Production Calculation. International Training Center for Post Graduate Soil Scientists. Ghent University, Ghent. 247 p.
2. Dengiz, O. (2005). A comparison of different irrigation methods based on the parametric evaluation approach. Turk. J. Agric. 30: 21- 29.
3. Gholami, A., & Delavari, A. (2012). Evaluation of the two methods of Surface and Drip Irrigation Based on the Parametric System. J. Basic Appl. Sci. Res. 2(6): 5988-5992.

CITATION OF THIS ARTICLE
Ehsan F, Hossein E. Locating Suitable areas for Pressurized Irrigation Systems using GIS. Bull. Env. Pharmacol. Life Sci., Vol 3 [11] October 2014: 153-156