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Investigation of different irrigation regimes on the morphological facors of *Aloe vera*.

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ABSTRACT: This study was done in order to evaluation different irrigation intervals on on the morphological traits of Aloe vera, a traditional medicinal plant. Plants was plnted in Greenhouse and irrigated according to Accumulative Pan Evaporation(APE). The treatments were included 20, 40, 60, 80, 100, 120, 140, 160, 180, and 200 mm APE which has been showed W_1,W_2, W_3, W_4, W_5, W_6, W_7, W_8,W_9 and W_{10} respectively. Determind parameters were the fresh and dry weights and morphological parameters of leaves and root, seperately. Results showed that in low irrigation condition, palnts undre W_6 showed the highest amount of Gel and leaf dry weight as well as gel and leaf frsh weight per plant was obtained under W_7 condition. Results showed that W_6 and W_7 were irrigation when APE reached 120 and 140 mm were led to suitable interval irrigation by Class A Evaporation Pan method in north of khozestan province in limited irrigation condition.
Keywords: Irrigation, Accumulative pan evaporation, gel production, morphological characteristics, Aloe vera.

INTRODUCTION

Aloe vera (L.) Burm. f., a perennial plant is a tropical or subtropical plant with turgid lace-shaped green leaves. This plant is a member of the Liliaceae plant family, has been widely cultivated in China and used as a traditional medicine to induce wound healing, and an anti-cancer and anti-viral agent (findings et al., 2007) . It is used in pharmaceuticals, folk medicine, healthcare, cosmetic products and food products (Jin et al., 2007) . Now a day A vera gel has been extensively utilized as function food in preparing food health drinks and beverages (Kaithwas et al., 2011) .

Plant is a rosette around a small portion of stem no greater than 5cm. The leaves are simple, triangular, succu- lent, thick, with narrow lanceolate mucro tip, 30–60cm long, and 5–12cm wide at the base and 0.8–3cm thick. The margins of the leaves have sharp triangular teeth about 2mm long. The main root has 4–10cm long and 4–5cm in diameter, the rhizosphere is concentrated at a depth of 15–20cm. Flowers 2.5–3cm long, yellow, grouped in clusters on a single erect stem about 1m long. Reproduction is primarily by asexual plantlets. Harvesting can be done 4–6 times per year. A vera, a CAM plant; CO2 absorbs at night exclusively regardless of the water status of the plant. A vera, an important industrial, is cultivated in order to gel value which proved pharmacological and medicinal properties. Different factors affect the amount of protein and morphological characteristics and gel of A vera. results of an experiment showed that the lower water availability produced the less new leaves and plantlets per plant (Silva et al., 2010) . The low soil water potential reduced leaf weight, plant growth rate, and leaf number(Rodríguez-García et al., 2007) . An experiment was resulted in increasing WUE with increasing water deficit in Aloe Vera. The most dry mass and gel was produsedwhen plants was irrigated after 75% FC. (Delatorre-Herrera et al., 2010). A. vera were submitted to different irrigation regimes in a greenhouse experiment to evaluate the response of the physiologic processes such as stomatal resistance and transpiration as well as leaf growth and yield, The results suggest that the low leaf temperature
increases stomatal resistance, decreases plant and leaf growth rates. (Rodríguez-García *et al.*, 2007).
Finally, can be resulted that physical properties of the soil, climatic conditions and irrigation timing affect on the quantity of yield.

MATERIAL AND METHODS

Experimental details

This study was carried out in green house of Agro Industry Shahid Beheshti Company, Dezfou, Iran during 2012. Seeds were planted in pots with 20 cm diameters in May 2012, then treatments were done 4

months after planting (October 2012) . Irrigation intervals treatments was done according to accumulative pan evaporation (APE). For this reason different treatments were done after reaching APE 20, 40,60,80,100,120,140,160,180, and 200 mm which has been showed W1,W2, W_3, W_4, W_5, W_6, W_7, W_8,W_9 and W_{10} respectively. Percentage of crude protein was calculated by Kjeldahl method(1883)

Soil and water analysis

The soil texture in profile is Sandy loam and other properties of soil and water of region were measured in laboratory, which results were showed inTabl 1 and Table 2 respectively.

Statistical analysis

Experimental design Was done with 3 replications that each replications had 4 plants and 6 levels ofwater salinity as treatments, under a completely randomized design. Data were statistically analyzed, using the SAS 9.2 software package, by one-way ANOVA. Significant differences between two means were determined by Duncan's test.

RESULTS AND DISCUSSION

Irrigation regimes did not affect on leaf number and roots length significantly (Tabel 3 and Fig.4,9) but other factors waere affected by different irrigation intervals significantly.

Sizes of leaf

Results showed that sizes of leaf including length, width and diameter Decreased with increasing interval irrigation significantly The plants growing in W_6 and W_7 resulted in the largest of leaf length, width and diameter in limited irrigation condition, but in W_1 treatment showed maximum size of leaf length, width and diameter (Fig 1,2,3). An increase in leaf thickness of aloe plants with moisture and a corresponding increase in gel production have been reported (Paez *et al.*, 2000) .

Leaf and plantlet number

Although the least and most number of leaves obtained from W_9 and W_1 respectively, but these changes were not significant.
(Fig.4).

Plants submitted to the low water availability produced less new leaves and plantlets per plant. The greatest number of new leaves was produced by the plants in high water availability and the greatest number of plantlets in an intermediate treatment (Silva *et al.*, 2010).
Leaf numbers increased significantly at 15 and 30 ESP as compared to control and 45 ESP (Rahi *et al.*, 2013) .

Fresh and dry weight of leaf

According to results this experiment, W_1 was resulted in the most biomass and W_6 and W_7 conditions were caused suitable biomass. (Fig 5,6) .

Some reaserchers reported that dry matter percentage increased in two Aloe vera cultivars irrigated with 60% seawater. beacause A. vera known as a xerophil can also continue to growand reproduce in such stressed environments owingto characteristic 'adaptive physiologies' (Jin *et al.*, 2007). The low soil water potential reduced leaf weight and plant growth rate, during the experiment confirming the sensitivity of new leaves to water stress(Rodríguez-García *et al.*, 2007) .

Fresh and dry weight of gel

Gel fresh and dry weight showed significant difference So plants grown in W_1 and W_6 had the most and less dry weight respectively (Fig 7).

The plants irrigated with 75% of FC presented the bestWUE in terms of dry mass and amount of gel produced by a litre of supplied water(Delatorre-Herrera *et al.*, 2010).In 15% of the reference evapotranspiration. This condition gave themaximum aerial biomass and gel production for unit of water utilized, and thus the greatest water use efficiency for Aloe Vera(Silva *et al.*, 2010).

Root length

This factor changed significantly with levels of irrigation(Fig. 9).

Root development and characteristics of the root system depend on the species, however this can be altered by environmental conditions, including soil water conditions (Acevedo *et al.*, 1979) .

Under normal conditions, roots receive the oxygen needed for respiration from the soil. However, when the soil has some salt with water, gas exchange is reduced to only the most superficial portion of the soil,

leading to a situation of root anoxia. The available oxygen is quickly consumed by the microbial flora of the soil, stopping the absorption and transport of water and salts into the root (Richards, 1983).

Tabel 1. Characteristics of Elements and Chemical analysis of the soil regions

K(Av.) Mg/kg	P(Av.) Ppm	O.C %	Ph	E.C Ms/cm	Class
100	5	0.214	7.82	1.414	Sandy lome

Tabel 2. Elements and Chemical analysis of water regions

Mg^{2+}	Ca^{2+}	K^{+}	Na meq/l	Cl meq/l	So4	No3 %	Hco3	S.A.R %	T.D.S %	Ph	E.C Ms/cm
32.4	42	2.42	46.92	195.25	12.48	0.0725	279	1.316	460.8	6.55	0.72

Tabel 3. Analysis of varians of measurement factors *aloe vera*

Source	DF	Mean Square								
		Leaf width	Leaf length	Leaf diameter	Leaf number	Leaf fresh weight	Leaf dry weight	Gel fresh weight	Gel dry weight	Root length
Treat	9	24.25	44.01	17.22	2.40	589.9	35.64	724.1	0.08	51.75
Error	20	12.18	6.55	1.50	1.56	36.30	2.24	1.03	0.00	25.24
R^2	-	0.47	0.63	0.83	0.40	0.91	0.87	0.99	0.99	0.47
C.V	-	12.08	7.85	10.19	14.96	7.39	33.89	2.19	1.95	12.56

CONCLUSION

The plant has a crassulacean acid metabolism(CAM) that allows water conservation within the tissue, and therefore, resistance to highwater stress(Rodríguez-García *et al.*, 2007). The low water potential of soil reduces fresh leaf yield, plant growth rate, and the leaves production (Rodríguez-García *et al.*, 2007).

Our results confirm that high interval irrigation by Class A Evaporation Pan method may be associated low leaf biomass and gel production. The results showed that Aloe vera can be tolerated water stress and produce high yield of leaf biomass and gel production in stress conditions.

A.vera may synthesize greater CO2 during night at high pH in water stressed environment compared to neutral pH soils through the Phosphoenolpyruvate carboxylase mechanism (Rahi *et al.*, 2013) .

It is feasible that osmotic adjustment, in higher levels of interval irrigation, can increase the resistance of these plants to water stress.

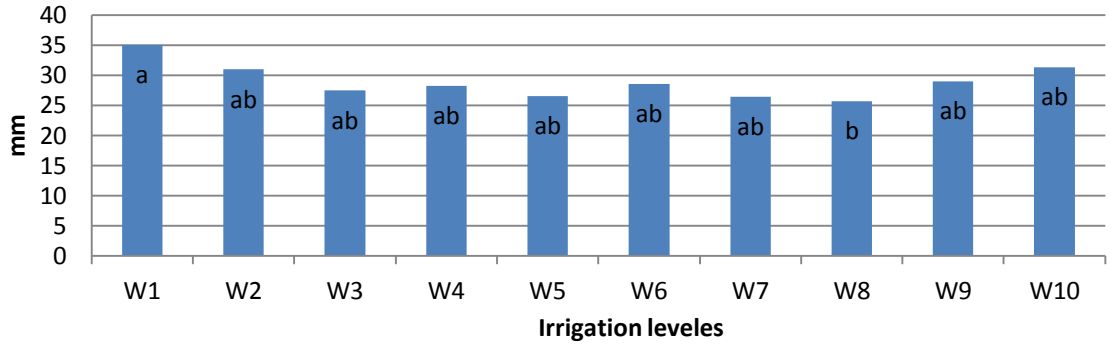

Figure 1. Leaf width

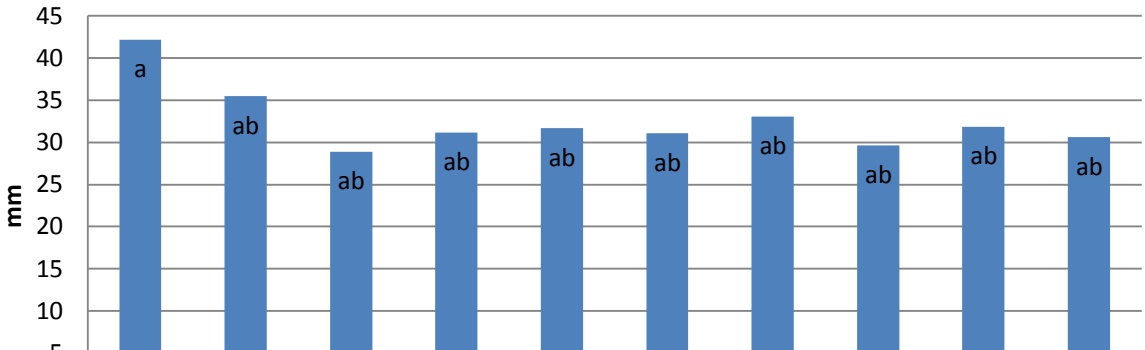

Figure 2. Leaf length

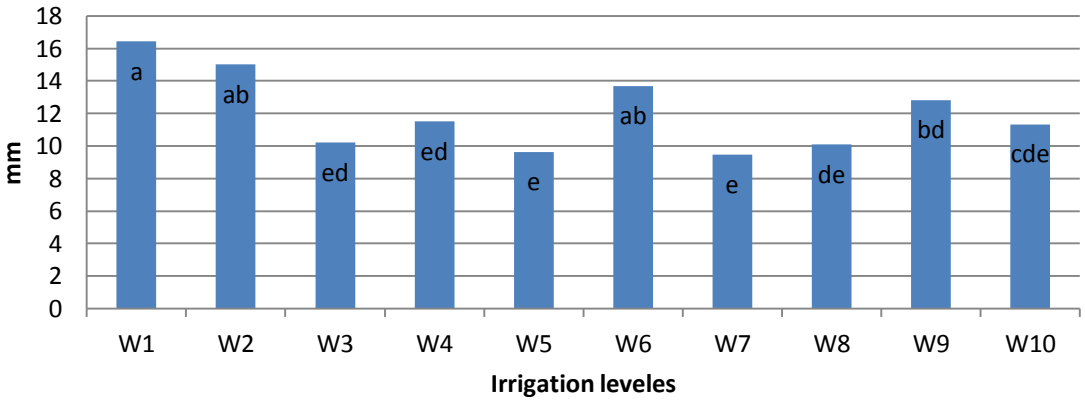

Figure 3. Leaf diameter

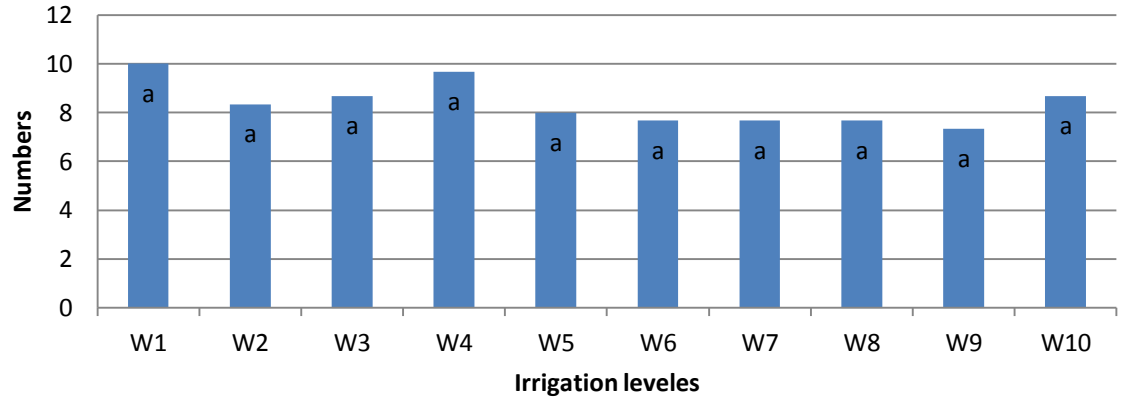

Figure 4. Leaf number

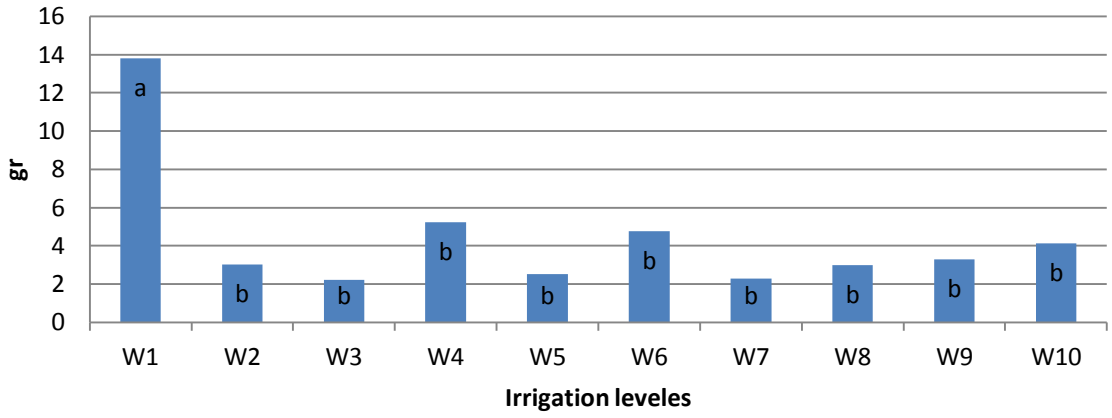

Figure 5. Leaf dry weight

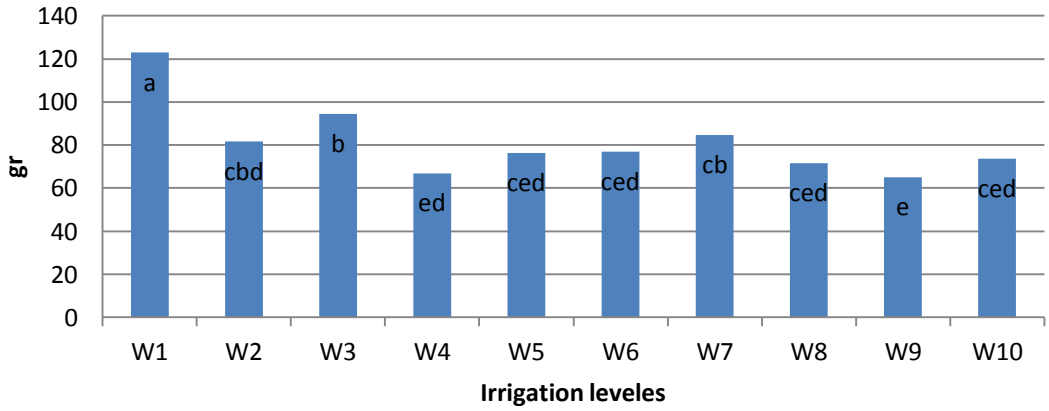

Figure 6. Leaf fresh weight

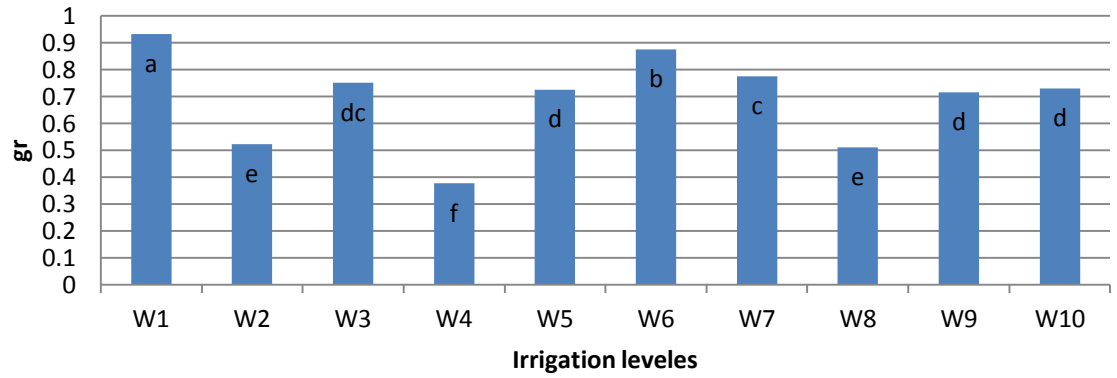

Figure 7. Gel dry weight

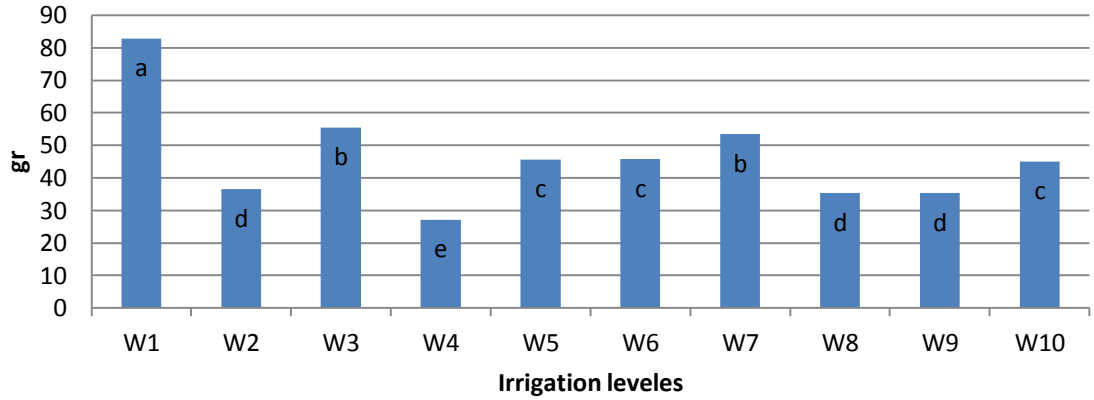

Figure 8. Gel fresh weight

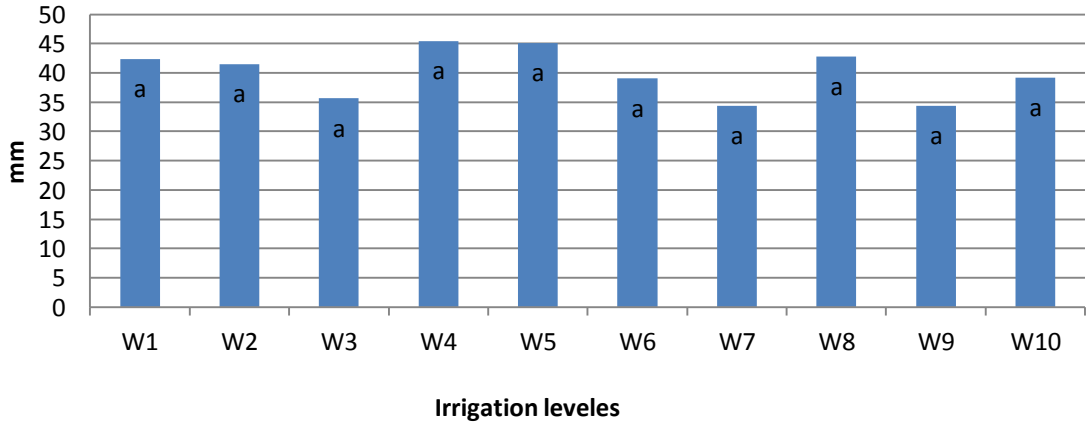

Figure 9. Roots length

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