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The laboratory Study of cubic roughnesses effect on the hydraulic jump length in each dimensions of roughness with classic jump in horizontal Stilling basin

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Abstract

from 5.03-12/7 were performed. Selected roughnesses with three heights and five widths were studied. Also comparison of obtained results with data obtained from hydraulic jump on the flat bed showed that hydraulic jump length in the rough bed rather the flat bed decreases significantly. Finally relationships were presented to obtain the secondary depth to first depth according to the Fraud number of the incoming supercritical flow for jumps created over rough beds.

Key words: Hydraulic jump, rough bed, hydraulic jump length

Introduction

A hydraulic jump is a common phenomenon in the downstream of hydraulic structures like spillways and gates. Rapid transition of supercritical flow to the under critical condition in a relatively short period increases flow depth and reduces the energy significantly. This phenomenon has been studied extensively by different researchers over direct and horizontal rectangular channels with flat floor(classic hydraulic jump). According to the Blanker offer (2) the secondary depth of the classic jump in the under critical area on the flat bed with rectangular section (y_2^*) is calculated as:

$$[\sqrt{1+8Fr^2}=1/2\frac{y_2^*}{y_1} \quad (1)$$

In this relationship $\frac{v_1}{\sqrt{gy_1}}Fr_{1=}$ is the Froud number of the incoming supercritical flow. y_1 and v_1 is respectively supercritical average depth and velocity in the beginning of

High losses of energy by the hydraulic jump caused this phenomenon be known as an energy dissipating phenomenon in water transfer systems. Roughness of the basin floor is an important factor in controlling, decreasing the secondary length and depth and also increasing energy loss by the hydraulic jump. In this study results of the laboratory study of hydraulic jump characteristics in the stilling basin with a bed with cubic roughnesses have been reported. 152 experiments in the range of Froud numbers the jump and g is gravity acceleration. The outline of the hydraulic jump over the flat bed is seen in the figure 1. y_1 وy_2^* Indicate the first and secondary depth of the hydraulic jump over the flat bed respectively and l_1 و l_r indicate length of the jump and length of the roller respectively. Stilling basins in the tailwater of hydraulic structures are refereed as a suitable place to provide, control and prohibit the hydraulic jump and blocks inside the basin guide the jump into it and dissipate a part of the kinetics energy of the hydraulic jump and finally increase efficiency of stilling basins. In the recent years rough elements have been used in the floor of basins. Some researchers like Eid and Rajaratnam(3), Eid(4), Gohari and Farhoudi(5), Mohammadali(9), Tokiaei(12) etc. have studied effect of roughnesses in increasing efficiency of the stilling basin and decreasing length of the hydraulic jump. The floor rough can be as potching, triangular, rectangular, sinusoidal and trapezoid waves in the width of the waterways.

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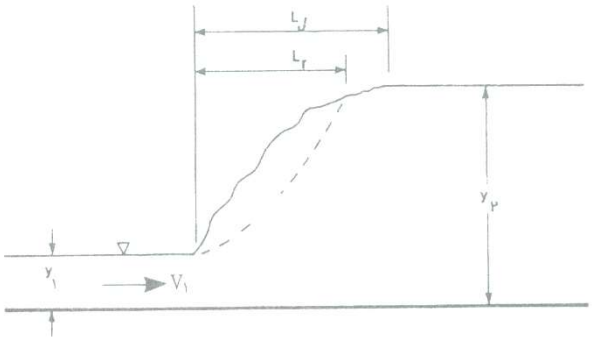

Figure 1: overview of the hydraulic jump

Rajantam(11) was of the first researchers that studied extensively characteristics of the hydraulic jump over channels with rough bed. He showed that the length of the roller and length of the jump and the secondary depth of the jump over the rough bed(y_2) compared with their corresponding values over the flat bed decrease significantly. He defined the parameter named relative rough (k=k_e/y_1) wherein k_e is the equivalent roughness height and y_1 is the first depth of the hydraulic jump over the rough surface and showed that y_2 is a function of the Froud number of the incoming supercritical flow (Fr_1) and the relative roughness. He suggested that the energy loss in the hydraulic jump composed on the rough bed is 1.64 times more than the classic hydraulic jump. Hiv and Felak(6) approved decrease in the secondary depth and length of the jump based on studies they performed on rough beds. Mohammadali(9) showed in his studies that the hydraulic jump length decreases significantly using cubic roughnesses. Eid and Rajaratnam(3) stated in their studies that the secondary depth of the hydraulic jump on the wavy bed is less than the flat bed and to show the difference between these two depths they defined a non- dimensional coefficient named depth decrease parameter D = $(y_2^* - y_2)/y_2^*$). They obtained value of D equal to 0.25 and explained that reason of decrease in the jump secondary depth is increase in shear tension of the bed that is about 10 time more in the rough bed than the flat bed. Length of the jump in the wavy bed also was obtained half of the flat bed. Izadjoo and Shafaei Bejestan(8) studied characteristics of the hydraulic jump on beds with Trapezoidal strip roughnesses. They reported that t/y_1 and s/y_1 ratios have not significant effect on the secondary depth. Results of studies showed that the non-dimensional length of the jump (l_j/y_2^*) is equal to 3 and average of D values is equal to 0.2. Eid(4) used three wavy beds of sinusoidal, trapezoid and prismatic and concluded that the relative roughness (t/y_1) of the waves shape has not significant effect on the relative conjugate depth. Also y_2/y_1 ratio is almost 80% of the Froud number. Gohari and Farhoudi(5) studied characteristics of the hydraulic jump on beds with rectangular strip roughnesses in the range of Froud numbers from 3-10 and observed that the secondary depth of the jump on rough surfaces compared to flat surfaces has the significant decrease and this decrease becomes more when distance between roughnesses increases. Also the change of roughnesses height has not significant effect on characteristics of the hydraulic jump. They concluded that shear stress coefficient of the floor on rough beds also is more than flat beds and is about 9 times .Abbas pour and Hoseinzadeh(1) surveyed characteristics of the hydraulic jump in the range of Froud numbers from 3.8-8.6 by creating wavy bed with the wave slope range of $1 \leq t/s \leq /33$. They showed that values of the secondary depth and the hydraulic jump length are respectively 20 and 50 percent less than the flat bed. In this research for non-dimensional length of the jump (l_j/y_2^*) two constant values of 3 and 3/5 were obtained respectively for Froud numbers smaller and larger than 6.

Materials and methods:

Experiments were performed in a channel with length, width and height of 8m, 0.35m and 0.4m respectively in the hydraulic laboratory. Some cubic roughnesses with a width of 35 were studied. As regards the crest of roughnesses and the upstream bed are on the same level, waves act like cavity and the change of their height has not significant effect on characteristics of the hydraulic jump in a way that generally four values was obtained for roughnesses distance to height ratio. Created false floors were placed in the channel in a way that they were in the downstream of the ogee shape spillway and 130m distant from the spillway claw. In this state roughnesses act as some cavities in the floor of bed and increase *Reynolds* shear stress at the floor. 152 experiments were performed in the range of Froud numbers from 5/03-12.7. To create supercritical flow and first depths of the jump a ogee spillway made of galvanized sheet was installed at the beginning of the channel and a sliding gate was installed at the end of the channel to turn the jump back. To provide desirable roughnesses cubic elements (cubic and triangular) made of poly amine that were cut with developed cutting machines according to required dimensions were used. Used cubes are seen as roughness in the figure 2. In order to prevent flow lines separation and the cavitation phenomenon, upper surface of the roughnesses and underside of the ogee spillway that the supercritical flow is created in it were place at a same level. These roughnesses in the bed acts like a sink and provide eddy flow.

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Issue 3(4), May 2014, pp. 62-66

Figure 2: Roughnesses made of polyamine

Relative height of the hydraulic jump

In order to study comparison of changes of the jump length in each dimensions of the bed roughnesses, curve of the jump relative length changes ($\frac{L_j}{y_2}$) against first Froud numbers were drawn. Above changes for the classic hydraulic jump that were calculated from the equation $Lj = 6y_2$ and different dimensions of the bed roughness obtained from experiments are illustrated in the figure 3. In this figure points relating laboratory data and prolonged lines indicate the classic hydraulic jump.

Figure 3: comparison of Lj/y_2 to F_{r1} ratio curves of different dimensions of the bed roughnesses with the hydraulic jump on the flat bed

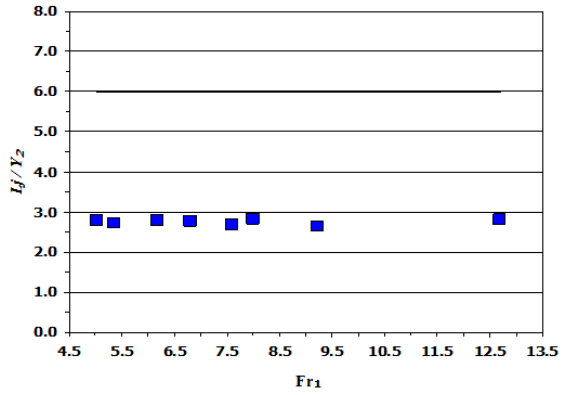

Figure 3: Roughnesses height equal to 8m roughness equal to 8m

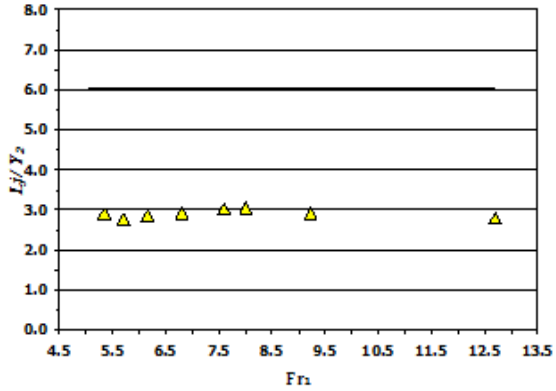

Figure4: Roughnesses height equal to 8m roughness equal to 16m

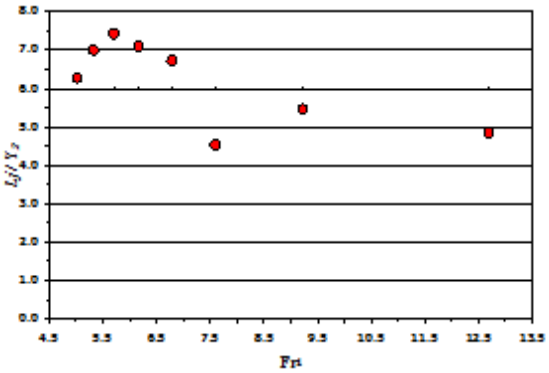

Figure5: Roughnesses height equal to 8m roughness equal to 24m

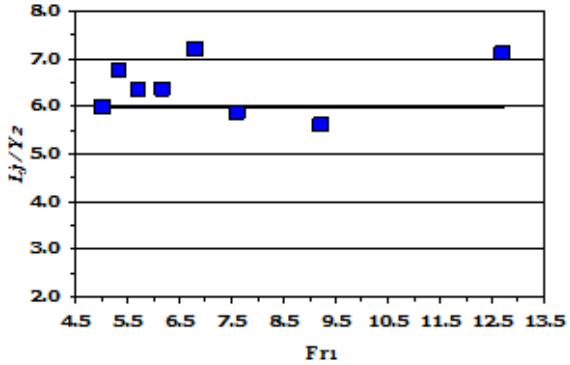

Figure6: Roughnesses height equal to 16m roughness equal to 16m

ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 62-66

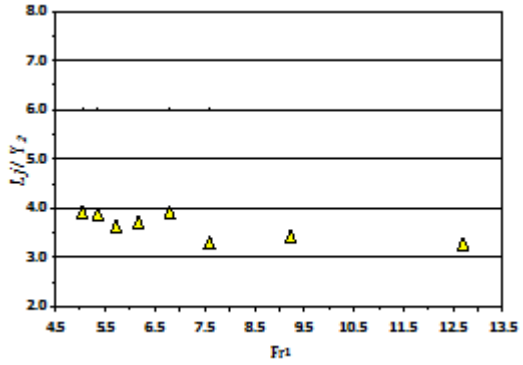

Figure7: Roughnesses height equal to 16m roughness equal to 32m

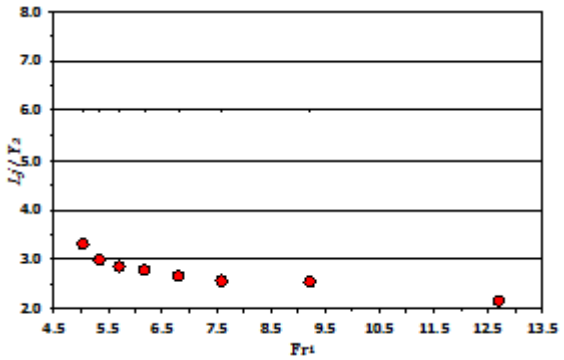

Figure8: Roughnesses height equal to 16m roughness equal to 48m

R	Relationship	Roughness width	Roughness height
/۹۹	L_j/y_2=۲/۷۰	۸	۸
/۹۹	L_j/y_2= ۲/۹۰	۱٦	
/٥۷۲۳	L_j/y_2= /۰۴۲۱Fr_1^2-۱/۰٥۰٦Fr_1+۱۱/۳٥۴	۲٤	
/۲۳۷۱	L_j/y_2= /۰۴٥Fr_1^2-/۷۴۷Fr_1+۹/۲۱	۱٦	۱٦
/٦۷۳۳	L_j/y_2= /۰۱۲۳Fr_1^2-/۲۹۷Fr_1+٥/۰۸۸	۳۲	
/۸۸٥٥	L_j/y_2= /۰۱٥۳Fr_1^2-/۳۹۰۴Fr_1+۴/۶۷٥	٤۸	
/۹۹	L_j/y_2=۳/۱٥	۱٦	۳۲
/۸٤۷۲	L_j/y_2=-/۰۰۸۲ Fr_1^2+/۰۳۶۸Fr_1+۲/۴٥۶۹	۳۲	
/۹۰٦۳	L_j/y_2=/۰۰۶۳Fr_1^2-/۲۱۴۳Fr_1+۳/۷۷۷	٤۸	

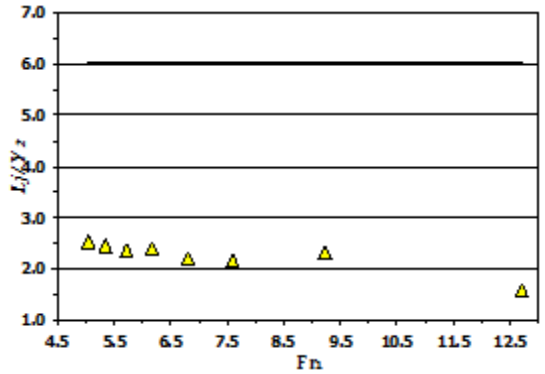

Figure9: Roughnesses height equal to 32m roughness equal to 32m

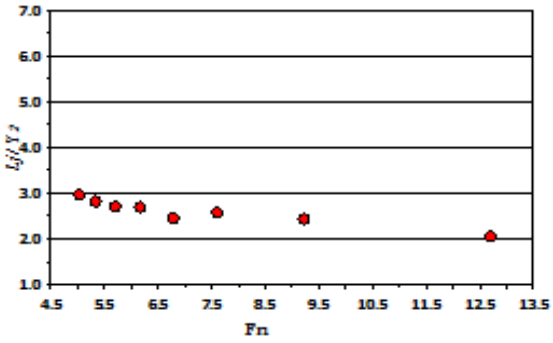

Figure10: Roughnesses height equal to 32m roughness equal to 48m

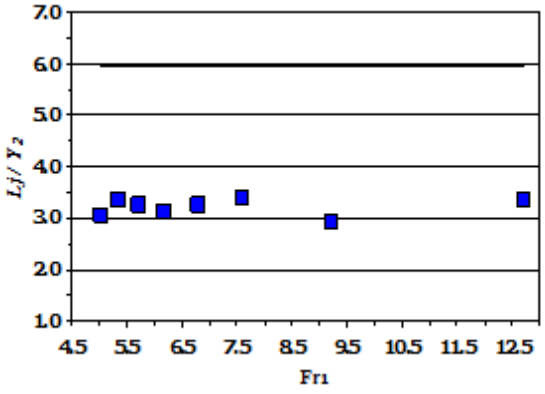

Figure11: Roughnesses height equal to 32m roughness equal to 16m

Results

Developed comparisons show that the procedure of changes of jump relative length is similar in each dimensions of the bed roughness that is the relative length of the jump increases as linear following increase of the first Froud number. This condition is observed in the

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hydraulic jump on the flat bed but this increase of the relative length in the hydraulic jump is higher on the flat bed than the rough bed.

1- In comparison with the classic hydraulic jump results show that roughnesses can decrease length of the jump up to 50%.

2- For roughness with constant height and width the $\mathbf{Lj/y_2}$ ratio has not significant decrease by increase of the Froud number.

3- For a Froud number and constant width the $\mathbf{Lj/y_2}$ ratio decreases by increase of the roughness width.

4-- For a Froud number and constant width the $\mathbf{Lj/y_2}$ ratio decreases by increase of the roughness height.

Source

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Some physical and mechanical properties of Mozafati date fruit and nut

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***Abstract*—** The various physical and mechanical properties of date fruit (Mozafati variety) and its nut were evaluated. Date samples mean values of length, width, thickness, projected area perpendicular to length, width and thickness were measured as, 34.60mm, 22.73mm, 18.15mm, 411.32mm^2, 710.78mm^2, 732.21mm^2 respectively. Arithmetic mean diameter, geometric mean diameter, sphericity, surface area, porosity, mass, volume, bulk density and true density were also measured as: 25.16mm, 24.21mm, 70%, 1840.80 mm^2, 48.67%, 13.10kg, 11.23 cm^3, 0.63gr cm^{-3}, 1.17gr cm^{-3}. In mass modeling, results showed that date volume has the highest correlation (0.88) with mass, and then the arithmetic mean diameter has the highest correlation of (0.82). Date thickness correlation index was very low with mass (0.22). With comparison between friction coefficients on different surface for date. ,Totally concluded that the rotation coefficient of friction was more than static coefficient of friction and static coefficient of friction was more than dynamic coefficient of friction. Highest coefficient of friction was on the rubber surface and lowest on the galvanized steel surface. The maximum and minimum deformation force for date samples was found perpendicular to length and thickness direction by average values of 11.52N and 8.02N. Deformation force showed decline procedure with its pressure in direction of length, width and thickness.

***Keywords*—** Date fruit, nut, physical and mechanical properties, Mozafati variety.

I. INTRODUCTION

Iran is the second world producer with 31% date production. Mozafati is the most valuable variety [1]. To develop appropriate equipment for harvesting, handling, conveying cleaning, delivering, separating, packing, storing, drying and processing of agricultural products, the detailed knowledge of physical properties of crops are essential [2, 3]. Most of the date fruit post-harvest processing methods employed is still traditional. Therefore there is a need for a full study of the physical properties of the dates to develop appropriate technologies for its processing. Some physical properties have been studied for various agricultural products fruits and crops by other researchers such as soybean [4], bambara groundnut [5], caperfruit (Capparisspp) [6], cocoa bean [7], pigeon pea [8], locust bean seed [9], plum [10], gumbo fruit [11], wheat [12], nutmeg [13], pistachio nut and its kernel [14], arigo seed [15], and palm fruit, kernel and nut [16].

Tabatabaeefar [17] determined the physical properties of common varieties of Iranian grown potatoes and the relationships among their physical characteristics. Topuz et al. [18] compared several properties of four orange varieties. Tabatabaeefar and Rajabipour [19] used 11 models for predicting mass of apples based on geometrical features. Asoegwu et al. [20] determined some physical properties of African oil bean seeds to obtaining relevant data for the design of tools, equipment, machines and systems for their processing. Keramat Jahromi et al. [21] determined dimensions and projected areas of date (Barhi variety) by image processing technique. The objectives of this study is to determine some physical and mechanical properties of Mozafati date fruit in order to facilitate the design of some machines for its processing. In addition an attempt was made to model relationships between mass and other features.

II. MATERIALS AND METHODS

In this study, about 1000 Mozafati date samples in Rotab ripening stage were selected from local markets in Bam (important city in Mozafati date production in Iran). At this stage fresh dates are at their best. The hard skin begins to soften at the tip and turn brown, (moving up) the fruit as they continue to ripen. As the fruit softens, the tannins break down and the dates become juicier and sweeter. The fruits were transported, individually to the physical laboratory. All experiments were carried out at a temperature range of 23–29 °C in four days. In order to obtain the moisture content, samples were kept in an oven for 3 days at 105 °C. The moisture content was found 81.9% w.b. for fruit and 24.5% w.b. for nuts.

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The principal axial dimension (Figure 1), the length (L), width (W) and thickness (T) for 1000 randomly fruits and nuts of samples were measured using a digital caliper with an accuracy of 0.01 mm.

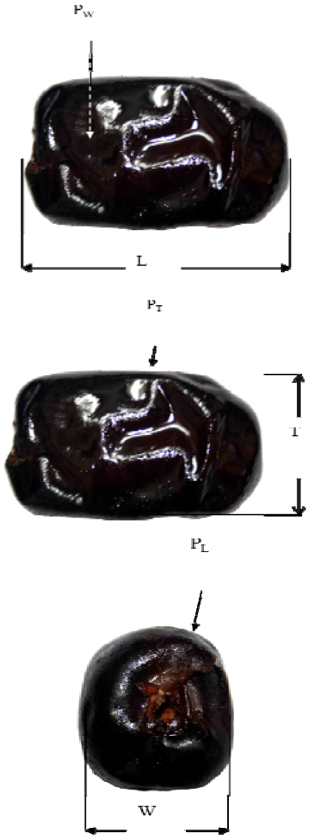

Fig. 1: Three major dimensions and projected areas of Mozafati date fruit

The geometric mean diameter (Dg), arithmetic mean diameter (Da) porosity (packing factor), bulk density, sphericity(f), surface area (S) of the varieties were calculated using the formula given by Mohsenin [22]. The arithmetic mean diameter (AMD), and geometric mean diameter (GMD), were calculated using expressions given by Asoegwu et al. Mohsenin and Eke et al. [23]. The volume of fruit and nut for the samples were calculated using the expression given by Mohsenin [22]. The true density was determined using toluene displacement method [24]. The porosity was computed from the values of the true and bulk density of samples by using the relationship given by Gharibzahedi et al. [25]. The static coefficients of friction were obtained with respect to four surfaces of aluminum, galvanized steel, rubber and plywood. The experiment was done by using an inclined plane device as described by Dutta et al. [26]. The inclined plane was gently raised and the angle of inclination at which the sample started sliding was read off the protractor with sensitivity of one degree. The tangent of the angle was reported as the coefficient of friction ([26, 27].

projected areas, were determined by image processing method. To obtain projected areas, WinArea _UT_08 system [28] was used. Captured images from the camera are transmitted to the computer card which works as an analog to digital converter. Digital images are then processed in the software and the desired user needs are determined. Total error for those objects was less than 1.5%. This method have been used and reported by several researchers ([29, 21 and 30].

Rupture stresses along three major dimension of date samples were measured by a texture analyzer machine (Universal Testing Machine). A date sample was compressed between two parallel plates of the machine along the three axes until rupture occurred (rupture point). At this moment deformation force was recorded. The absorbed energy by the sample at rupture was determined by calculating the area under the force-deformation curve using the formula given by [24]. The average toughness was calculated by dividing the average deformation energy on volume [22]. The results are shown in Table 1. Regression analysis was carried out using Microsoft Excel 2007 software to determine the relationship between mass and other physical properties.

III. RESULTS AND DISCUSSION

Agroforestry is the most important system of date production in the region of Sistan and Baluchestan. Farmers of this area often use annual plants such as barley and vegetables like lettuce under the palm tree for farming. The use of chemical fertilizers in the date production is not common in this area and mostly livestock manure is used. There just moldboard plow is used for earthwork operations and other cultivation operations and garden construction is done traditionally and in fighting with weeds also revertible plow is often used. Though mozafati date is valuable economically, but due to the fairly good resistance of this kind of date against diseases, the use of fungicides is not common. The most important pest of this region is the date weevil and the farmers force to use toxins to fight with this pest. The farmers of this region choose barley as a plant along with date in a low input agroforestry due to the keeping of livestock and the lack of forage.

Table 2 shows the amounts of inputs, date performance and their energy equivalents. The total amount of inputs for the date production was about 20081.75 MJ ha in a year. On the contrary to the other production systems, the energy obtained from the chemical fertilizers was zero in this system. The amount of used livestock manure was about 12 percent of the total energy inputs. Machinery and fossil fuels was about 47 percent of the total energy inputs which was more used for earthwork operations, the transportation of livestock manure and the products in the farm. The consumed water was about 31.37 percent and the manpower 8.11 percent that devoted about 3.31of the total energy inputs according to the harvest by hand and other common operations in the garden was about

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Issue 3(4), May 2014, pp. 67-73

3.85 percent. Machinery was 1.87 percent and meanwhile the land preparation operations devoted the most amount of energy. And eventually to combat with date weevil, the use of pesticides includes 1.48 percent of the total energy inputs. The average date performance and the total energy inputs were 4500 kg ha and 20081.75 MJ ha respectively. The amount of total energy output was 84420 MJ ha and the energy use efficiency was 4.20 in this production system.

Table 1: Some mechanical properties of date fruit (Mozafati variety)

	The average deformation force (N)	**The average rupture stress (Mpa)**	**The average deformation energy (mj)**	**The average toughness (j/mm^3)**
Along length direction	11.252	0.0423	22.5	2.332
Along width direction	8.193	0.0112	21.43	2.135
Along thickness direction	8.025	0.0123	21.65	2.113

Table 2: Some physical parameters of date fruit (Mozafati variety)

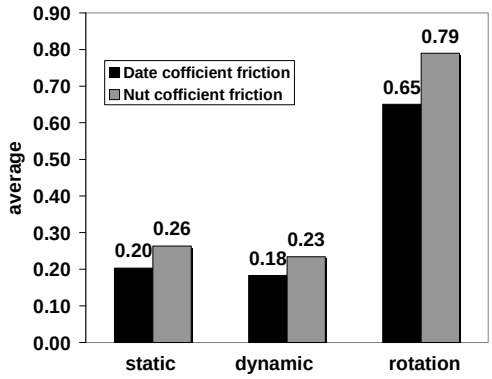
properties (date)	**min**	**max**	**mean**	**Equations**	R^2
Length(mm)	25.10	41.62	34.60	$M = 2.775e^{0.0444L}$	0.73
Width(mm)	19.05	27.32	22.73	M = 20.16Ln(W) - 49.807	0.54
Thickness(mm)	12.02	23.21	18.15	M = 0.5408T + 3.2824	0.22
Projected area perpendicular to L (mm^2)	342.21	568.09	411.32		
Projected area perpendicular to W (mm^2)	525.23	890.90	710.78		
Projected area perpendicular to T (mm^2)	544.43	908.06	732.21		
Arithmetic mean diameter(mm)	21.00	28.67	25.16	$M = 0.016\, D_a^{\,2.0774}$	0.82
Geometric mean diameter(mm)	20.52	25.17	24.21	$M = 0.0265\, D_g^{\,1.9431}$	0.73
Sphericity (%)	61	86	70	$M = 0.0022\, m^2 - 0.06\, \phi + 1.14$	0.23
Surface area (mm^2)	1322.12	2491.87	1840.80	M = 12.399Ln(S) - 80.039	0.72
Porosity (%)	45.65	51.69	48.67	M=0.4567ε+12.20	0.68
Mass (gr)	8.68	18.20	13.10		
Volume (cm^3)	7.01	16.04	11.23	$M = 4.9376e^{0.0854V}$	0.88
Bulk density $(grcm^{-3})$	0.64	0.69	0.63	$M = 0.5634\, \rho_b + 17.70$	0.79
True density $(grcm^{-3})$	1.01	1.40	1.17	$M = 0.0045\, \rho^2{}_t - 0.113\, \rho_t + 1.862$	0.54

Table 3: Some physical parameters of date fruit nut (Mozafati variety)

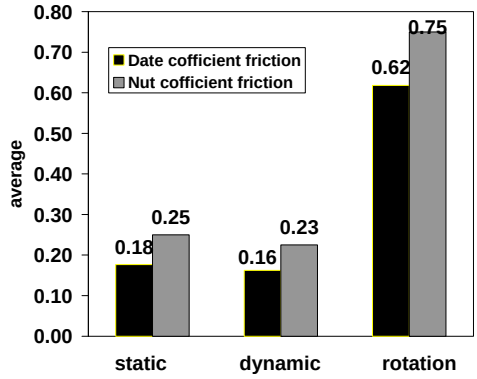
properties (nut)	**min**	**max**	**mean**	**Equations**	R^2
Length (mm)	15.50	26	21.48	M = 1.3818Ln(L) - 3.3524	0.69
Width (mm)	5.50	10.50	8.25	M = 1.1787Ln(W) - 1.601	0.57
Tickness (mm)	3	8.5	6.29	$M = 0.1075T^{1.136}$	0.57
Arithmetic mean diameter (mm)	8.33	14.50	12	$M = 0.0028 \times D_a^{\,2.3074}$	0.89
Geometric mean diameter (mm)	6.60	12.41	10.34	$M = 0.0073 \times D_g^{\,2.0444}$	0.84

ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 67-73

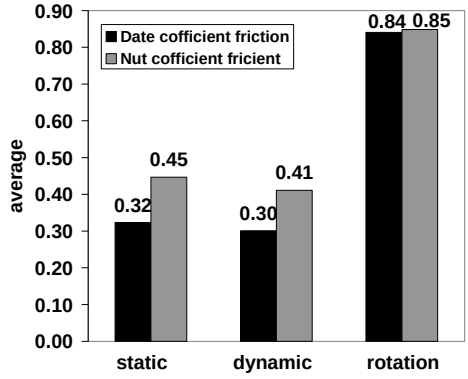
Sphericity (%)	0.38	0.64	0.48	M =0.02ln(φ)+0.486	0.02
Surface area (mm^2)	136.94	483.54	335.81	M = 0.0023 $S^{1.0222}$	0.80
Porosity (%)	38.2	47.1	42.5	M = 0.0028 $\varepsilon^{2.3074}$	0.45
Bulk density ($grcm^{-3}$)				M=0.2368 ρ_b +32.21	0.66
True density ($grcm^{-3}$)				M =0.1344 ρ_t +24.22	0.62



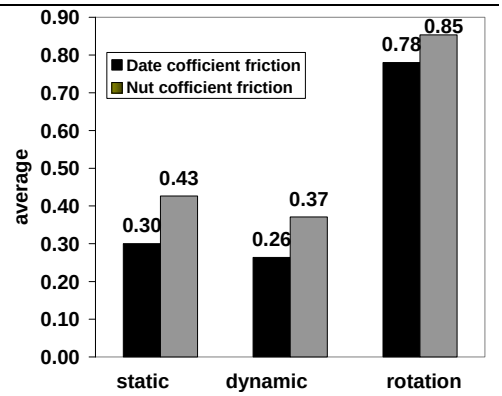
a) aluminum surface



b) galvanized steel surface



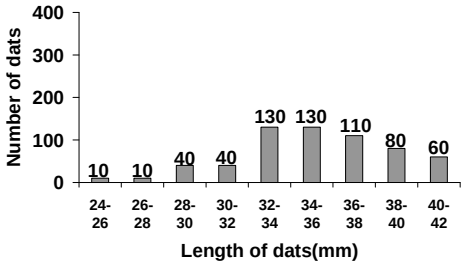
c) rubber surface

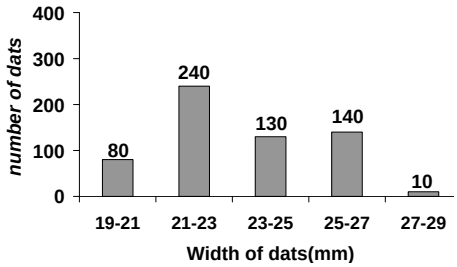


d)plywood surface

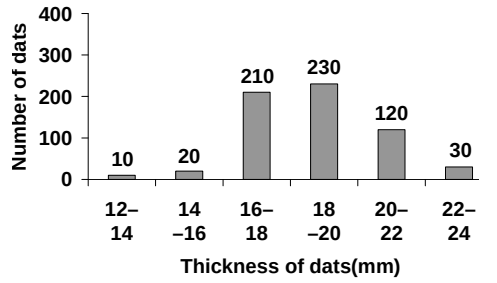
Fig.2: Coefficient of friction of dates and nuts on different surfaces

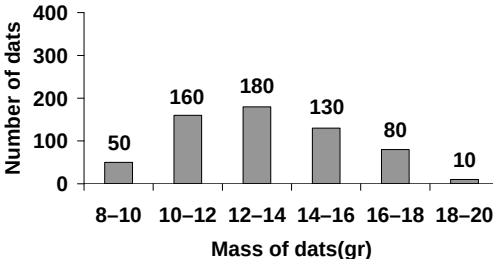
Date fruit affluence results in Figure 3. Showed that about 43% of date samples had length of 32 to 36 mm, 40% of date samples had width of 21 to 23 mm, 71% of dates had thickness of 16 to 20 mm and 56% of dates had mass of 10 to 14 gr. These results for the nuts was also showed that 57% of nut samples had length of 21 to 24 mm, 70% of nut samples had width of 7 to 9 mm, 67% of dates had thickness of 5 to 7 mm and 52% of dates had mass of 0.8 to 1.1 gr. The importance of these results is discussed in the discussion section. It was found that the projected area, perpendicular to thickness, showed higher values than that of other areas

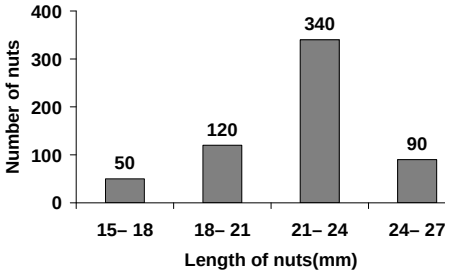


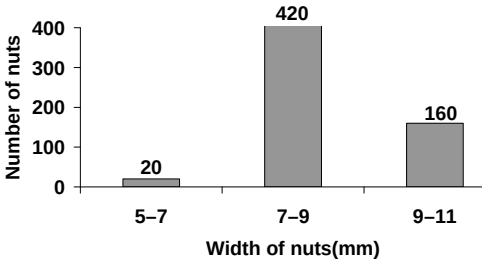


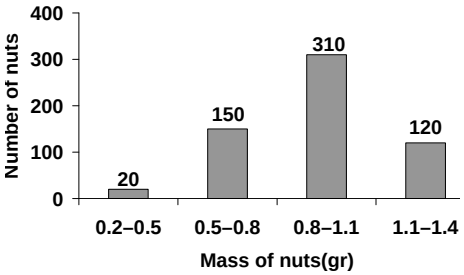
ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 67-73











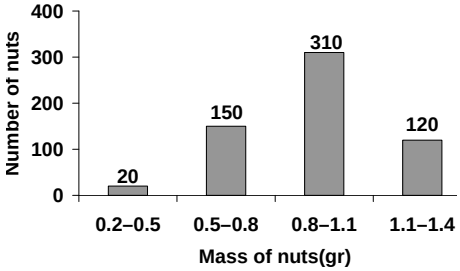


Fig3: Affluence of some physical properties of dates and nuts in different measurements

The results of physical properties are especially important for manufactories in designing of post-harvest machines, for example one of the most important machines in date sorting industry is worked based on size of date fruits, these results can help to design improved sorter machines for different varieties of dates and can help to factories to produce packaging system in different size.

The importance of dimensions is in determining the aperture size of different machines in harvesting and post-harvest industry as discussed by Mazloumzadeh *et al.* [31], They used some dimensional properties of date fruit for developing a fuzzy inference system for evaluation of alternative date harvesting machines. Mazloumzadeh *et al.* [32] was also used some dimensional properties of dates for applying precision agriculture in a date palm orchard. The major dimensions can also be used in separation of materials as discussed by Mohsenin [33]. Alavi, [34] used two parameters of length and freshness for classifying Mozafati date fruit. Major dimensions may be useful in estimating the number of fruits to be engaged at a time. Tabatabaeefar *et al.* [35], reported that among the systems that sorted oranges based on one dimension, the system that applies intermediate diameter is suitable with nonlinear relationship.

Weight of fruit is another important characteristic that can be used in advance in post-harvest industry. Customers choose fruits with equal mass and uniform shape. Mass grading of date fruit can reduce packaging and transportation prices, and also may provide an optimum packaging design [36]. For example Khoshnam et al. [30] showed grading fruit based on weight reduces packing and handling costs and also provides suitable packing patterns. Another important notice in these area is that sizing by weighing mechanism can be used for the irregular shape product [38]. Since intelligent sizing mechanism is expensive, therefore mechanical sizing mechanism can be used. Determining relationships between some physical properties as dimensions, mass and projected areas may be useful and applicable ([37, 38]. In the case of mass modeling, Tabatabaeefar et al. [35] determined models for predicting mass of grown orange from its dimensions, volumes and projected areas.

Coefficient of friction between date fruits and different materials is very important notice in determining angle of

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Issue 3(4), May 2014, pp. 67-73

transporting conveyor of fruits in a factory for different uses such as separation process. The differences between four surfaces in this study are due to the frictional properties between the fruits and surface materials.

I. CONCLUSION

Some physical and mechanical properties of Mozafati date and nuts were determined by several equipment. The following results are the most important.

1. Mean values of Length, Width, Thickness, Projected area perpendicular to length, width and thickness were found as, 34.60mm, 22.73mm, 18.15mm, 411.32mm^2, 710.78mm^2, 732.21mm^2
2. Arithmetic mean diameter, Geometric mean diameter, sphericity, surface area, Porosity, mass, volume, bulk density and true density were found as: 25.16mm, 24.21mm, 70%, 1840.80 mm^2, 48.67%, 13.10kg, 11.23 cm^3, 0.63gr cm^{-3},1.17gr cm^{-3}.
3. The best relationship was between mass and volume with R^2 as 0.88 (highest R^2 value among all the models) and then arithmetic mean diameter of dates with R^2 as 0.82.
4. The maximum of static, dynamic and rotation coefficient of friction for date and nut samples was found on rubber surface.
5. The minimum of static, dynamic and rotation coefficient of friction for date and nut samples was found on galvanized steel surface.
6. The maximum and minimum deformation force for date samples was found along length and thickness direction by average values of 11.52N and 8.02N.
7. Deformation force showed decline procedure with its pressure in direction of length, width and thickness.

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The effect of season on the selected plant species by Camel

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***Abstract*—** Effective management of grazing animals requires sufficient knowledge on the influence of animals on pastureland and environment and also influence of pastureland and environment on the animals. Camel is one of the animals that live in harsh conditions in arid and semi-arid areas and is very important in various aspects of socio-economic conditions. However, different studies have been done to improve the situation of this animal are very limited. In this study tried to investigate season changes on the orientation of camel grazing. Knowledge of seasonal changes in eating patterns of camels, increase our understanding as a guide to better management of animals and their habitats. This study was designed to investigate the effect of season on forage selection by camels; sampling was done in spring, summer and autumn. To this end, the study area and selected plants was studied in each season by five camels and the method (chronometer). In this study the changes in the orientation of camel grazing are examined. Knowledge of seasonal changes can be a guide to better manage of camels and increases our understanding of these animals and their habitats. This study was designed to investigate the effect of season on forage selection by camel, samples were taken in the spring, summer and autumn. In this research, each animal followed for 30 minutes, twice in the morning and evening grazing during its feeding. To analyze the data from this study, statistical software SPSS15 was used. Results were expressed that the number of selected species by livestock during the spring, summer and autumn, were 8, 5 and 5 respectively. Also among plant species, consumption of *Tamarix ramosissima* and *Seidlitzia rosmarinus* greatly influenced by the seasons, so that the consumption of *Tamarix* species significantly increased in autumn and consumption of *Se.rosmarinus* species in spring and summer seasons was higher of autumn season. The results also showed that the effect of season on consumption of other species has also been low.

***Keywords*—** Time method (chronometer), pastures under grazing camels, South Khorasan Province

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I. Introduction

Effective management of grazing animals needs to adequate information about the impact of grazing animals on pasture and environment, and also environmental and pasture impact on grazing animals. Ecologists believe that the interaction of animals, season and environment is based on that the environment determines the forage supply and also the quality and quantity of forage is determined by season. Animals to the need to provide food, by providing an appropriate grazing behavior complete the season and environment. Botanical composition of diet and animals selectivity affected by many factors such as season of the year (12 and 16), available plants [1] , the breed of the animals [2] and Animal sex and species [1,3]. Galt and colleagues [4] stated Botanical composition of cattle diets was changed greatly over time due to changes in forage availability. Hakkila and colleagues [5] , stated that more than 70% of cow's diet are Gross during summer and winter and a More than 60% of the cow's diet in spring and autumn are Forb and Shrubs. This shift in diet composition is due changes in plant phenology and availability. The results obtained by Rosiere et al., [6] , also pointed out that the cow's diet varies throughout the year and the trend is not uniform.

Hussain and Jan Durrani [7], studied palatability and accessibility of species in the arid rangelands of Pakistan. Results showed that availability of of palatable species, and thus food preference of sheep and goats is different during the growing season, so that with reduced availability of palatable species during the cold season, the animals are forced to exploit Non-palatable forage. According to the studies mentioned so far, very little research has been done to the camel. In this study the changes in the orientation of camel grazing are examined. Knowledge of seasonal changes in eating patterns of camel, increases our understanding as a guide to better management of animals and their habitats. Therefore the aim of this study is to assess the structure of camels' diet during different seasons. The effect of season on forage selection by camel in pasture under grazing, are also being evaluated in South Khorasan Province. South Khorasan having dry grasslands and desert, the sand storms and poor vegetation are not appropriate for livestock such as cattle, sheep and goats. Among the species that can adapt to

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Issue 3(4), May 2014, pp. 74-78

problems and severe dehydration and severe heat and severe cold and storms of sand to tolerate and adapt to the climatic conditions of the desert, the camel is adaptable animal. Considering the importance of the camel drivers in the area of job creation and economic recovery, and the financing part of the protein needs of the community, knowing the why of behavior, is essential for effective management. Due to the lack of data in this field, the present research is essential.

II. MATERIALS AND METHODS

The study area

The study was conducted in plain of "Sarchah Ammari" in the city of Khousf, one of the vulnerable areas for breeding camels in South Khorasan Province. The approximate height of studied area is 1300 meters above sea level and physical appearance of the area is as plain and foothills. The mean temperature in the coldest month (January) is 5.85°C and the mean temperature of the warmest month (July) is 31.22 °C and the mean annual temperature is 19.18°C. The annual rainfall is 116 mm and in terms of climate, based on climatic divisions of Ambege diagram [8], the region has a hot desert climate.

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Research Methodology

This study was designed to investigate the effect of season on forage selection by camel. Samples taken in the spring, summer and autumn took place. To do this, plants were selected in the region through the direct observation method (chronometer). In each season, studies were conducted by five camels. In this technique, each animal's was followed two times for 30 minutes during feeding at the morning and evening grazing. Further notes on selected species, time spent on each kind was also recorded. Due to the non-domesticated of camels, observation was done from away by the hunting camera. Morning observations, was done in the interval time between 6:00 to 9:00 and evening observations was done in the interval time between 14:00 to 17:00.

Methods of data analysis

This study was conducted using Excel 2003 and SPSS 15 statistical software for data analysis, SPSS 15 was used for normality test. To investigate the simultaneous effect of season on intake, GLM procedure was used for the overall comparison and Duncan Test was used for mean comparison. Statistically, significant or not significant differences between the methods, was obtained with respect to each other.

III. RESULTS AND DISCUSSION

The results of observations showed that the number of species selected by camel in spring, summer and autumn, was 8, 5 and 5 respectively. The results are shown in

Table 1: lists of the species of camel diet composition in different seasons

Persian Name	***Spring***	***Summer***	***Autumn***
Gaz	*Tamarix ramosissima*	*Tamarix ramosissima*	*Tamarix ramosissima*
Eshnan	*Seidlitzia rosmarinus*	*Seidlitzia rosmarinus*	*Seidlitzia rosmarinus*
.....	*Arthrocnemum fruticosum*	*Arthrocnemum fruticosum*	*Arthrocnemum fruticosum*
Dermaneh	*Artemisia herba alba*	----------	----------
Ghich	*Zygophyllum eurypterum*	----------	----------
Zard Tagh	*Haloxylon persicum*	*Haloxylon persicum*	*Haloxylon persicum*
Trat	*Hamada salicornica*	*Hamada salicornica*	*Hamada salicornica*
Parand	*Pteropyrum aucheri*	----------	----------

The results showed that based on the table of camel diet composition, there was little difference between the various seasons and in the summer and autumn the same species has been selected by camels.

Only in spring, the plant selection by camel is somewhat variable, so that the animal in this season has also been used *Artemisia herba Alba* and also *Zygophyllum eurypterum*, Pteropyrum aucheri.

Growth priod of plant species of *Zygophyllum eurypterum* was short and to the end of spring. This plant, was only present in the spring diet of camel. Two plant species, *Artemisia herba alba* and *Pteropyrum aucheri*, were dried in the study area and sampling year, due to drought and poor growth in summer and autumn. Given that these plants had shrub structure and phenology of these plants typically lasted until the autumn, therefore have not reached the stage of

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Issue 3(4), May 2014, pp. 74-78

flowering and seeding, and they were not present in the composition of the diet in summer and autumn.

Given that the majority of plant species that were selected by the camel, was common between seasons, so the data were used for statistical analysis. The effect of season on the rate of species consumption, and the share of each species in the diet of camel were studied in different seasons. Results are presented as two charts of pie and columns (Figs. 1, 2). The majority of species in the region (according to the bushes and shrubs), in the sampling time were in vegetative growth during spring, flowering during summer and seeding stage in autumn.

Also considering *Hammada salicornica* species in measurements, only one or at most two repeated was consumed by camel, Therefore, Due to the lack of repetition and the lack of data normality use this information for statistical analysis was incorrect. Therefore, this species had been removed from the statistical analysis and were analyzed qualitatively to compare the effect of season on the rate of selected forage; General Linear Model (GLM) procedure was used. The results of this test showed an interaction between season and species has a significant difference at level of 99%. To compare the mean values of these data, Duncan test was used, the results are shown in Figures 1 and 2. Figure 1 shows the contribution of each species in camel diet composition in terms of percentage of total grazing time. Figure 2 displays the effect of season on the rate of species consumption. In the column chart (Fig. 2), letters shows the significant difference between the in the different seasons.

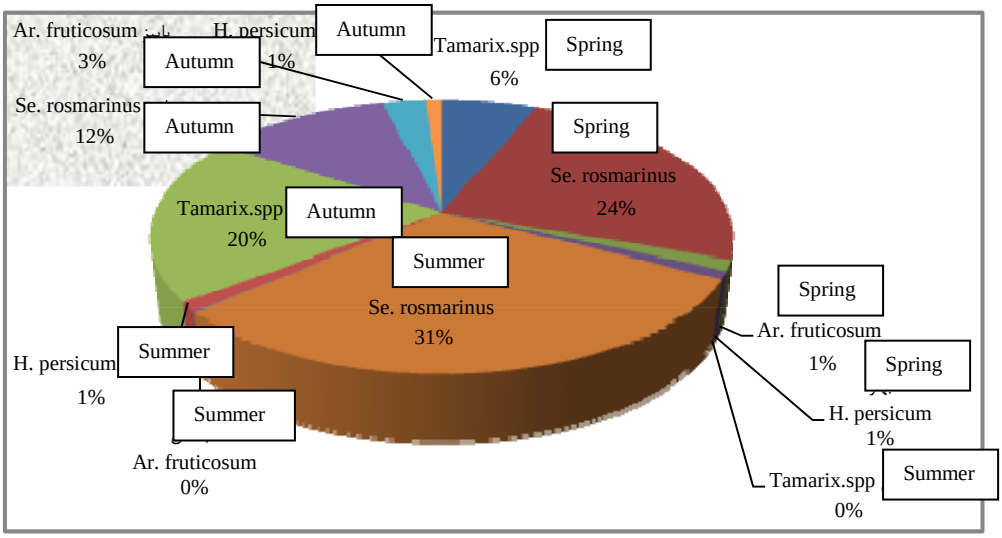

Fig 1: Plant species forming diet, and the share of each in the diet composition of camel in different seasons

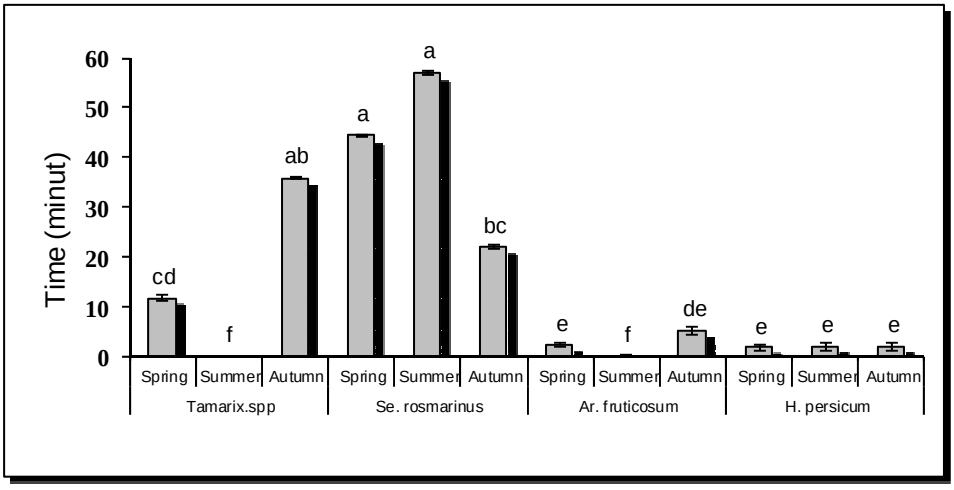

Fig 2: The effect of season on the rate of plant selection

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Issue 3(4), May 2014, pp. 74-78

I. Conclusion

As stated in the results, camel's diet species were five species in spring and were eight species in summer and autumn. However, based on the results and with observe of the consumption of these species in Fig. 1. It can be expressed that

The main forming of the diet was *Seidlitzia rosmarinus* with 24% and 31% in the spring and summer and species of *Seidlitzia rosmarinus* with 12% and *Tamarix ramosissima* with 20% in autumn. Other species were consumed at a very low level of 1 % to 6 %. Also, consumption of *Hamada salicornica* species, was low at three seasons and some species in the diet of camel in the spring have been also very low and at the level of 3%. But comparing the consumption of plant species in different seasons showed that among plant species, consumption of two species of *Seidlitzia rosmarinus* and *Tamarix ramosissima* was influenced by season. So that the choice of plant species of *Tamarix ramosissima* in autumn than in spring and summer has been increased significantly and its consumption declined from 6 % in spring to 0 % in summer. Then it has been increased to 20 % in autumn due to changing climate, particularly autumn rains increased consumption of this species. Camel drivers believed that the animals consume this species in autumn after autumn rains.

Based on results, this species were partly consumed by livestock in the spring. So that was the second plant species selected by the livestock. It could be because of low rainfall that had fallen a few days before sampling. And this has led to the use of this species in this season of the year. Season, also had an impact on consumption of *Seidlitzia rosmarinus*, so that the consumption of this species was not significantly different in spring and summer, but consumption of this species considerably reduced in autumn.

The results also partly in the spring of this species were consumed by livestock. So that was the second plant species selected by the animal. It could be because of low rainfall that had fallen a few days before sampling. And this has led to the use of this species in this season of the year. Season, also had an impact on consumption is *Seidlitzia rosmarinus*, so that the consumption of this species was not significantly different in spring and summer, but the fall is considerably reduced. According to the column and pie chart (Fig 1, 2), although the consumption of this species in the spring and summer was not statistically significant, however consumption was higher in the summer. So that its consumption has increased from 24% in spring to 31% in summer. Changes in plant phenology and probably much higher nutritional value in this season, which coincides with the flowering period of this species, can be a major cause of over-consumption in the summer. By comparing of this species to the other species has been consumed in this season, its consumption also has increased substantially.

According to the Fig. 2, the consumption of this species has dropped to 12% in autumn. Species of *Ar.fruticosum* despite being green in all seasons, was very low consumed by livestock. However, taking this species increased very slightly in autumn, due to the reduction of species of *Seidlitzia rosmarinus* in the region. This point has led to the tendency of animals to other green plants in the region. *H.persicum* species was low consumed in all seasons and showed no significant change.

Thus, a change of diet in the autumn from the species of *Seidlitzia rosmarinus*, to the *Tamarix ramosissima* species, is As a result of reducing the availability of *Seidlitzia rosmarinus* species and increase the palatability of *Tamarix ramosissima* species. Cause of this phenomenon is the change of climate and rainfall. Hakkila et al., [5], showed a change in the composition of the diet of cattle in different seasons is dependent on the changes in phenology and availability of species. Totally, in this study, the composition of plant species selected by camels, has not significant difference together between the different seasons. These results is inconsistent with the results from Mengli et al., [9], Their results showed that there are a significant impact of season on species selection, by Bactrian camel. Their results also showed that the main species forming diet of camel are *Agriophyllum squarrosum* (% 83), *Haloxylon ammodendron* (% 81), *Ceratoides lateens* (% 39), *A. squarrosum* (% 49), in winter, spring, summer and autumn respectively. Mohammad and colleagues [10], also observed significant impact of season on the Botanical composition of cattle's diet.

So that consumption of animals increased for grasses in summer, Forb in autumn and plants in winter. However, in the present study, Drought in the region and the growth of herbaceous plants could be the reason for the lack of seasonal changes in species selection. Sharma et al., [11], found similar results in this area for the goats. Therefore it can be stated that by effect of season on the parameters of plant phenology, nutritional value, freshness and greenness, levels of accessibility, climatic conditions and rainfall, it had a significant impact on consumption of species. As numerous sources such as [12, 13, 14], indicated that parameters of climatic conditions, plant growth, availability of forage are important factors in the selection of forage by livestock. Mohammad et al., [10] also indicated that the factors such as phenology, morphology, palatability, availability, and the presence of other species are important in selectivity of species by cattle.

ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 74-78

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Issue 3(4), May 2014, pp. 79-82

Effects of Animal Manures and Harvesting Time on Dried Flowers Yield and Essence Yield of Calendula Officinalis.L

Salileh Golestaneh, Hamid Reza Ganjali, Ahmad Mehraban, and Isa Khamari

***Abstract*—**To evaluate the effect of animals manure (including Chicken, Ostrich, and Cow manure) and harvesting time on dried flowers yield and essence yield of Calendula Officinalis.L, an experiment was carried out through the 2012-2013 season at the Agricultural Research Institute related to Zabol University (Chahnime) Zabol, Iran. A split plot in based on randomized complete blocks design (RCBD) with three replications was followed in the study. Results represented that dried flowers yield and essence yield of Calendula Officinalis.L, were significantly affected by different fertilizer treatments and harvesting time. Chicken manure increased 450% on dried flowers weight in compare with control in late flowering stage. Maximum of amount of essence was obtained by cow manure in early and mid flowering stage.

***Keywords*—**Animal Manure, Calendula Officinalis L., Dried Flowers Yield, Essence Yield.

I. Introduction

THE present use of chemical manure in the cultivating of medical plant threatens agronomic and economic sustainability and has a negative effect on their pharmaceutical quality.

In order to decrease harmful effects of chemical manures, using organic fertilizers has been increased in recent years [1].

Moreover, low yield of medicinal plants persuaded researchers to increase yield. The best and economic way is to achieve the performances in order to increasing yield, using the organic fertilizers such as animals manures and appropriate time to harvest [2].

New and emerging medical and industrial plants such as calendula (Calendula officinalis L.) provide socio-economic, agronomic, and environmental opportunities.

Statistics of recent years shows that despite increasing in chemical medicine, producing and using of herbal medicine increases in the world. As, one-third of medicines originate from herbal medicine and it continuously increasing [3]. According to the report of global bank, marketing value of herbal medicine will reach to 5 billion dollars by 2050 [5]. Calendula officinalis L. is a perennial plant in the tribe Calenduleae within Asteraceae [4]. It is an oil plant, annuls, the origin is the west of Asia and Mediterranean. Historically, Calendula has been cultivated throughout the world as an ornamental flowering plant and produced commercially in parts of Europe as an herbal medicine [5].

The flowers of this plant can be used for the treatment of gastrointestinal disorders, skin ulcers and inflammation .Marigold accelerates skin wounds healing by preventing inflammation in the skin and mucous membranes, reducing tissue swelling and abscess re-built.

The oil extracted from the seeds has industrial and pharmaceutical application [6]. However, within the past two decades, considerable attention has been given to the development of Calendula for the commercial production of its seed oil.

Harvesting time and biological fertilizer are two important factors may affect qualitative and quantitative production of Calendula officinalis. The use of organic fertilizers such as animal manures can improve soil fertility [7], increases soil organic matter [8], plant growth [9], and soil properties [10]. In an experiment on pepper, [11] reported that highest yield of pepper was recorded with the application of poultry manure with the combinations of other inorganic nutrient sources. The problematic aspect of these high rates of organic manure recommendations is the unavailability of such enormous amounts.

In addition, determination of the appropriate time to harvest the flowers is very important because it impact on the amount of active ingredients in flowers. As, in recent years great attention has been drawn to improve the effectiveness of these plants through increasing their essences [12].

Use of organic fertilizers, especially animal manures, may increase the flower yield quality and quantity of their essences but also may decrease the effectiveness of the medicinal plants or change the composition of the effective substances.

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Regarding the limitations to obtain the appropriate harvesting time and organic fertilizers (Chicken, Ostrich, and Cow manures) in medicinal plants to achieve sustainable agriculture systems, this study aims to evaluate the effects harvesting time and animal fertilization on flower yield of Calendula officinalis and the essence in flower in three different stages of flowering, (including early, mid and late flowering, respectively)

II. Procedure Materials and Methods

The study was carried out on Sistan Agricultural Research Institute located 35 km southeast of Zabol, Iran (30◦54_N, 61◦41_E) during 2012-2013. Results of climate and physical and chemical soil characteristics of the field experiment have been shown in following tables.

Table 1: A Summary of Physical and Chemical Characteristics of the Soil

Soil texture	Sand	loam	Silt
	%		
Sandy – loam	20	31	26
K	**P**	**N**	**pH**
mg/kg		%	
176	11.1	0.05	7.7

Main plots were consisted of application of three animal manures from Cow, Chicken and Ostrich; a control treatment to which no fertilizers were also added and sub plots included in three different stages of flowering, (including early, mid and late flowering). The application rate of each manure was 20 tons.ha^{-1} that were applied to the each plot when the bed was prepared in the fall.

Plots were plowed before sowing date and disked before planting. The individual plot size was 4 m × 12 m.

Samples were gathered from the middle rows of each plot. Samples were dried in a forced-air oven at 78°C for 24 h. The weight of each sample (dried flowers) was measured by a digital scale with an accuracy of 0.001gr. In addition, amount of 100 grams of dried flower in three phases of flowering (including early, mid and late flowering,) collected and sent to a lab to determine essence. The amount of essences was determined by the method of steam distillation using Clevenger.

Data were analyzed by analysis of variance [16].When significant differences were found (P=0.05) among means, Duncan's multiple range test (DMRT) were applied.

III. Results and Discussion

A. Dried Flower Yield

The results of analysis of compound variance showed the significant effect of organic manures (Chicken, Ostrich, and Cow) on dried flower weight ($P \leq 0.01$) (Table 2). In all organic manures, dried flower weight was increased (Table 3)

Mean comparison of dried flower weight (Table 3) showed that receiving the plants chicken manure led to a greatly significant increase in Calendula dried flower weight as compared to other treatments.

The chicken manure application had the most dried flower weight of Calendula officinalis, averaging 1395 kg.ha^{-1} and the lowest weight for dried Flowers was found in the control treatment, without fertilizer application (kg.ha^{-1}). The positive effect of organic manure in improving dried flower weight was studied by many researchers, [12, 13] on marigold.

Moreover, ANOVA results of harvesting time in Table 2 showed the significant effect of harvesting time on dried flower weight ($P \leq 0.01$) and there are significant differences between the treatments in dried flower weight.

Results of mean comparison of dried flower weight (Table 3) showed that harvest in late flowering resulted in increase the dried flower weight. However, the dried flower weight in mid flowering with 629.50 kg.ha^{-1} is twice than in early flowering stage.

Results of [12] on Calandula confirmed the effect of harvesting time on essence Calendula officinalis.

In addition, there is a significant difference for the dried flower weight in interaction effects of organic fertilizer and harvesting time. As Table 3 shows, the interaction effects of harvesting time in different application of organic fertilizer were significant at the 1% level.

Harvesting in late flowering and application of chicken manure produced the highest values in the amount of dried flower weight (2200.00 kg.ha^{-1}). Treatment without any fertilization in early flowering had the minimum of the dried flower weight with 188.33 kg.ha^{-1}.

A. Essence

The results of analysis of compound variance showed that amount of essence of Calendula officinalis were significantly affected by application of different animal manures at 1% probability level (Table 2). Mean comparison of the essences which was illustrated in Table 3 showed that the percentage of essences of calendula flowers increased by application of animal manures however, the treatment with chicken manures had the lowest essence. The treatment with cow and ostrich manures had the highest essence with 0.174 and 0.166 mg in each 100 gram of dried flowers, respectively. This could be resulted from the difference level of nitrogen in different manures.

Table 2: Analysis of Variance for Some Traits of Calendula that Affected by Animal Manures.

S.OV	df	Means of Square		
		Dried Flower weight	Essence	Essence Yield
Replication	2	6318.70^{ns}	0.00013*	0.022^{ns}
Manure	3	2432834**	0.0025**	2.81**

ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 79-82

Error a	6	1337^{ns}	0.00005^{ns}	0.0044^{ns}
Harvesting Time	2	1159720.36^{**}	0.032^{**}	0.33^{**}
Manure * Time	6	3333331.47^{**}	0.00007^{ns}	0.158^{**}
Error b	16	1801.32	0.00003	0.0062
C.V (%)		6.74	3.69	9.45

*significant at $p < 0.05$; **significant at $p < 0.001$; ^{ns} non significant.

Table 3: Mean Comparison of Animals Manures and Harvesting Time for Some Traits of Calendula

Treatments		Essence (%)	Dried Flower Weight	Essence Yield
Manure (M)				
Control		0.156^{b}	313.33^{c}	0.442^{c}
Chicken Manure		0.135^{c}	1395^{a}	1.647^{a}
Ostrich Manure		0.166^{a}	516.67^{b}	0.77b
Cow Manure		0.174^{a}	294.44^{c}	0.488^{c}
LSD(0.05)		0.008	42.18	0.076
Harvesting Time (T)				
Early flowering		0.21^{a}	319.17^{c}	0.937^{a}
Mid flowering		0.156^{b}	629.50^{b}	0.931^{a}
Late flowering		0.107^{c}	940.92^{a}	0.645^{b}
LSD(0.05)		0.005	36.73	0.068
Manure* Harvesting Time				
M1	T1	0.21^{b}	188.33^{i}	0.40^{f}
M1	T2	0.15^{e}	288.33^{fgh}	0.44^{ef}
M1	T3	0.10^{h}	463.3^{e}	0.48^{ef}
M2	T1	0.18^{c}	601.66^{d}	1.08^{c}
M2	T2	0.13^{f}	1383.33^{b}	1.85^{b}
M2	T3	0.09^{i}	2200.00^{a}	2.00^{a}
M3	T1	0.22^{ab}	266.66^{igh}	0.59^{e}
M3	T2	0.16^{d}	541.66^{d}	0.90^{d}
M3	T3	0.11^{gh}	741.66^{c}	0.82^{d}
M4	T1	0.22^{a}	220.00^{ih}	0.49^{ef}
M4	T2	0.17^{cd}	304.66^{fg}	0.52^{ef}
M4	T3	0.12^{g}	358.66^{f}	0.43^{ef}

Different lower case letters within the same column indicate significant difference at the 5% level (Duncan's new multiple range test).

Results of [13] on Calandula confirmed the effect of nitrogen level on essence of Calendula officinalis.

Moreover, ANOVA results of harvesting time in Table 2 showed the significant effect of harvesting time on the obtained essences of dried flower of Calendula officinalis ($P \leq 0.01$) however interaction between harvesting time and organic fertilizer on amount of essence wasn't significant.

Results of mean comparison of the essences (Table 3) showed that the harvesting in early flowering stage caused in increase the essences of dried flower with 0.21 mg for each 100 gram of dried flowers.

Results of [12] on Calandula confirmed the effect of harvesting time on essence Calendula officinalis.

B. Essence Yield

The essence yield (dried flowers * essence percentage), was measured for every experimental unit. Sampling was done from middle rows of each plot by eliminating border effects. Analysis of variance (Table 2) showed the significant effect of organic manures (Chicken, Ostrich, and Cow) on the essence yield. Mean comparison of treatments (Table 3) showed that the highest essence yield (1.647) was obtained by application of chicken manure lowest obtained from control treatment without use of any manure. However, ostrich and cow manures treatments were between them.

Moreover, analysis of variance (Table 2) showed the significant effect of different harvesting times on essence yield. Mean comparison of treatments (Table 3) showed that flowers in early and mid flowering phase had significant difference with the late flowering stage.

As Table 2 shows for this trait, the interaction effects of harvesting time in different application of organic fertilizer were significant at the 1% level.

Harvesting in late flowering and application of chicken manure produced the highest essence yield (2.00 $kg.ha^{-1}$).

It is important to mention that as the mean comparison of treatments (Table 3) shows if the purpose of cultivating of Calendula is to get it essence so, we can get the same amount of essence yield at the early flowering with the lower weight of dried flowers in early or mid flowering stages. It can reduce the cost of producing essence for farmers.

IV. CONCLUSION

The results showed that the use of organic fertilizers in the cultivating of Calendula can improve its flower yield without worrying about their negative effects on the environment and its pharmaceutical quality.

This study highlights that chicken manure contains essential nutrients required by plants. Animal manure is heterogeneous in nature and its quality as fertilizer is affected by many factors.

In addition, to reach the highest amount of essence in Calendula officinalis L., it is better to use the cow manure and harvest in early flowering phase because the best time for the highest essence amount is beginning of flowering, but for obtaining the highest essence yield, and dried flower weight, application of chicken manure and harvesting in late of flowering is better than other animal manures and other harvesting times. Considering the daily increasing in Calendula essence use it is recommended to harvest this plant in beginning or mid flowering phases in Sistan region (Iran) and similar areas.

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Investigating the Impact of Groundwater Electrical Conductivity Changes on Desertification Trend Using GIS (Case Study: Mehran Plain)

Abdolreza Mohammadi, Haji Karimi, Zahedeh Haydarizadi, Mohammad Javad Khojasteh and Fatemeh Mahdavifar

Abstract— Desertification has been considered as one of the most destructive phenomena in nature and over the past few decades. There have been many international efforts to prevent and balance this phenomenon. Understanding the processes of desertification and factors involved in it and also awareness of the varying degrees of intensity of these processes and factors are important and necessary matters which have to be assessed and evaluated. Over-exploitation of groundwater degrades water quality. Using low quality water is one of the contributing factors in soil salinity and desertification increase. To evaluate the impact of electrical conductivity in desertification trend in the study area, 9 wells located in the Mehran plain were investigated over three time periods (2004-2008, 2001-2005, and 2009-2012). Iranian model (IMDPA) and ArcGIS9.3 software are utilized firstly to give weights to the information layers, then every layer's value is interfered in the specified indicator and its effect on desertification was evaluated. Then, each layer was granted a weight between 1 and 4 according to the study area conditions. Finally, for each parameter and according to weights allocated, a map was prepared. The results showed that the intensity of desertification increased from the beginning to the end of the study period, so that, at the beginning of the period 8.95% of the area was classified at severe desertification class, while, this class increased to 14.47% at the end of study period.

Keywords— Groundwater; Desertification Trend; IMDPA; Electrical Conductivity.

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I. INTRODUCTION AND OBJECTIVES

Currently, many countries, including the developing countries, are experiencing the desertification phenomenon which is gradually destroying renewable resources [1]. Desertification consists of processes which happen due to natural causes and improper behavior of the mankind [8]. In order to develop methods for assessing desertification and generating maps or even choosing the most appropriate methods or desertification assessment models, it is necessary to understand the desertification processes, factors controlling these processes, and effective criteria and indicators in the rate and process of desertification [2].

Proper planning and management is necessary to prevent the desertification phenomenon, identifying the factors, criteria and indicators of desertification in desert areas and also areas which are prone to desertification. Limited water resources, development of soil and water salinity, and over-exploitation, have made the degradation of groundwater resources along with other processes, the main reasons of desertification. Over-exploitation degrades the quality of groundwater. Using low quality waters is one of the effective factors on soil salinity and desertification expansion. This research aims to investigate the impact of changes in electrical conductivity of groundwater, which is one of the parameters of water quality, in desertification trend in Mehran Plain, Ilam Province, Iran.

II. LITERATURE REVIEW

Sepehr (2005), in his master's thesis, evaluated the role of groundwater on desertification using electrical conductivity, chloride levels, sodium absorption ratio and water table parameters in Fiduyeh Garmdasht area using modified MEDALUS model. The results showed that almost 75% of the

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Issue 3(4), May 2014, pp. 83-86

area is at fair and 9% is at high quality condition. Also, 97% of the area is at low water quality condition which is considered as one of the main causes of desertification. Abdi (2006) investigated the desertification and prepared desertification severity maps based on the IMDPA model and focusing water and soil parameters in the Abouzidabad area. The results showed that the indicators of electrical conductivity of the soil and water with weighted averages of 3.6 and 2.8 respectively had the highest effect, and indicators of decline in groundwater, sodium absorption ratio, and chlorine concentration with weighted average of one, had the lowest effect on desertification. Nateghi (2006), in his study using IMDPA model, and focusing on indicators of water, ground, and vegetation cover, investigated the intensity of desertification of Segzi plain and the obtained results showed that indicators of water with weighted average of 3.17 is classified with severe desertification. Zahtabian et al (2007) assessed the indicator of water and soil in the Einkhosh area using Medalus methodology and prepared a desertification map. Based on the obtained map, the area is classified in the critical desertification class.

III. MATERIALS AND METHODS

The study area, Mehran plain is located at southwest of Iran, Ilam province, and Mehran county. Mehran plain is bordered with Iraq by the west and covers 495 km^2 and is located at the geographical location between 32° to 33°, 81′ 39″ northern latitudes, and 46° 08′30″ to 46° 39′88″ eastern longitudes (figure 1). This area has a semi-arid temperate climate. Average annual precipitation according to the synoptic station of Mehran is 247 mm. Mehran plain has two major and important rivers, Gavi and Konjancham which emanate from Yekshanbeh and Kounk mountains respectively. These two rivers join together at the west of the Mehran and enter Iraq country [6].

Based on statistical data from synoptic station of Mehran, the average annual temperature in Mehran plain is 23.5° C. The maximum temperature was observed in August and the average daily temperature for this month is 36° C. The average maximum temperature in the same month is 45° C.

IV. RESEARCH METHODOLOGY

The Iranian Model for Desertification Potential Assessment (IMDPA) which is formulated according to Iran conditions and calibrated in different climatic zones has been used to assess the current status of desertification and prepare maps in this research. The electrical conductivity of water is one of the 36 parameters which have been implemented in this model. In the IMDPA model, layers of each parameter an also the final desertification map are classified in four classes including low risk (negligible), moderate risk, severe risk, and very severe risk (table 2). Such that according to its impact on desertification and regional conditions, each layer is attributed with a weight between 1 and 4. Weights are distributed equally, so that the figure 1 has the best and 4 has the worst value.

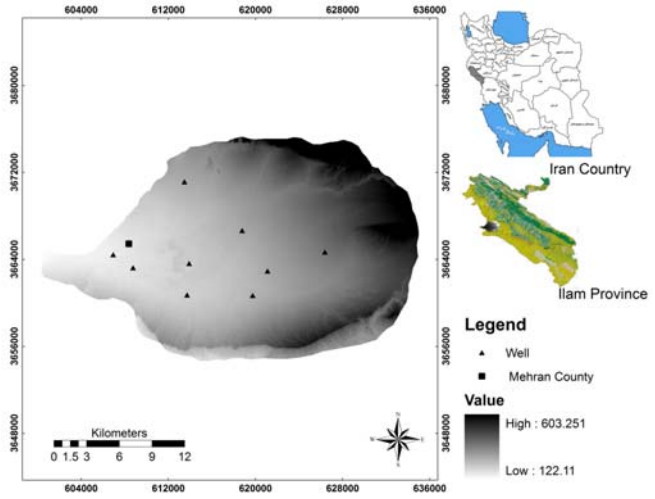


Figure 1. National and provincial location of the study area based on the Digital elevation lines

V. ELECTRICAL CONDUCTIVITY (EC)

Electrical conductivity which is calculated according to micro mohs/cm at 25 ° C, shows the amount of available cationic and anionic solutes dissolved in water which can accelerate its electrical conductivity. This parameter can be measured by laboratory and field experiments. The greater the amount of electrical conductivity of a water sample, the greater the amount solutes in it which according to quality classification, is an indication of poor water quality. Firstly, to assess the changes in electrical conductivity of the groundwater of Mehran plain area, according to available information and field visits, location of all wells in the study area were drawn. Then, to understand the condition of electrical conductivity of water in different areas of Mehran plain aquifer, the chemical analysis of 9 wells were investigated and three time periods (2001-2004, 2005-2008, 2009-2012) were considered. Also, to evaluate this parameter, according to table 1, each well was attributed with the relevant score. After preparing the desertification severity map for each period based on the mentioned index, the numerical value of the geometric mean of the studied indexes is determined.

Table 1. Determining the score of the electrical conductivity of water in IMDPA model

Evaluation Index	Desertification Class	Low	Moderate	Severe	Very Severe
	Score	1.00-1.50	1.51-2.50	2.51-3.5	3.51-4
EC (µmhos/cm)		<750	750-2250	2250-5000	>5000

ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 83-86

Information layers of each parameter and index for three period were created separately using GIS software. Finally, after creating the layers related to water quality indicator by integrating the indicators in ArcGIS software, the final desertification map for all of the three periods was generated and according to table 2, desertification classes were classified.

Table 2. Frequency distribution for intensity of current desertification classes

Qualitative classification of desertification intensity	Sign	Range of numerical value
Low	1	0-1.5
Moderate	2	1.51-2.5
Severe	3	2.51-3.5
Very Severe	4	3.51-4

VI. RESULTS

Table 3, shows the geometric mean of groundwater electrical conductivity indicator quantitative values in the three time periods (2001-2004, 2005-2008, 2009-2012) and also this table shows the maximum and minimum groundwater electrical conductivity values in all three time periods in the study area.

Table 3. Geometric mean of groundwater electrical conductivity indicator quantitative values

Benchmark index	2001-2004 period		2005-2008 period		2009-2012 per	
	Indicator Score	Desertification Status	Indicator Score	Desertification Status	Indicator Score	Deserti Sta
EC	2.07	Moderate	2.06	Moderate	2.4	Mod

Table 3. The Maximum and Minimum Values of EC in the wells of the area

period	EC (µmhos/cm)	
	Minimum	Maximum
2001-2004	559.3	3271.4
2005-2008	449.5	2741.7
2009-2012	502.1	3462.5

Figures 2, 3 and 4, show the desertification severity map based on the electrical conductivity indicator in three time periods and table 5 shows area and percentage of each class of desertification based on water index in the area. These figures and table indicate that the intensity of desertification in Mehran plain, have increased from the beginning of the time period to the end.

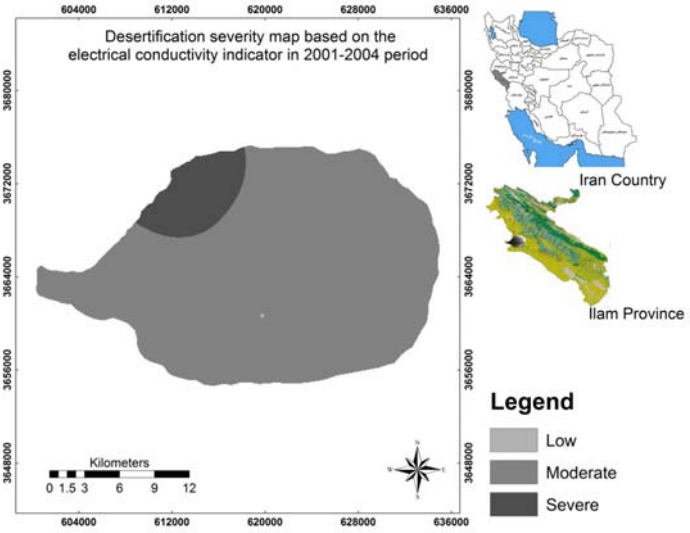


Figure 2. Desertification severity map based on the electrical conductivity indicator in 2001-2004 period

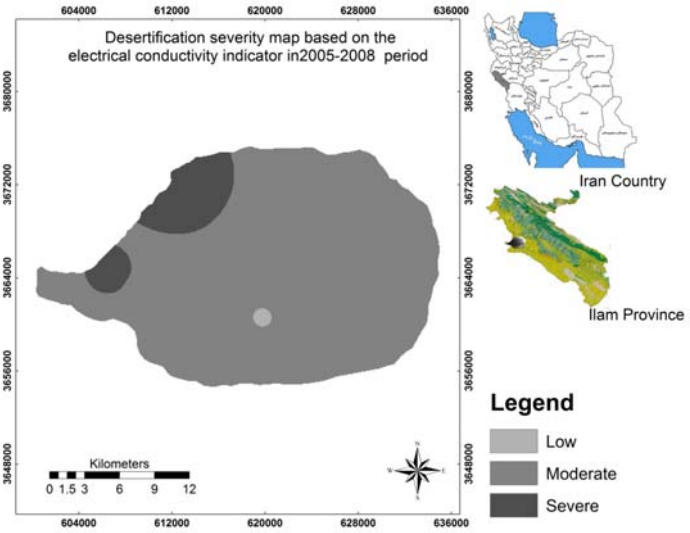
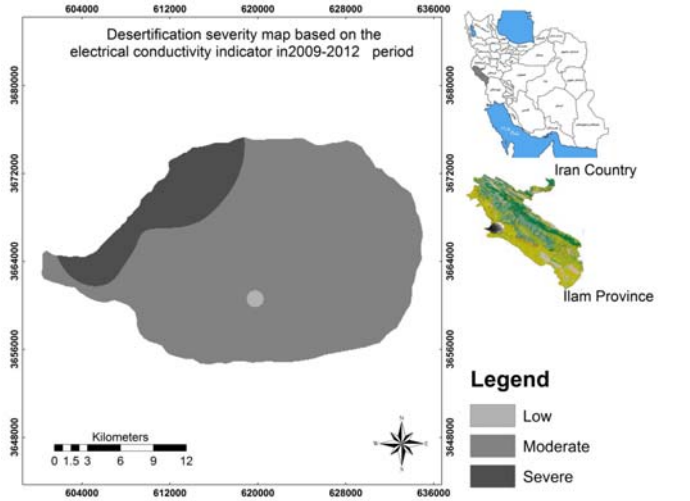


Figure 3. Desertification intensity map based on the electrical conductivity indicator in 2005-2008 period



ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 83-86

Figure 4. Desertification intensity map based on the electrical conductivity indicator in 2009-2012 period

period	Low		Moderate		Severe	
	Area (km^2)	Percentage	Area (km^2)	Percentage	Area (km^2)	Percentage
2001-2003	0.09	0.05	451.2	91	44.4	8.95
2005-2008	1.9	0.38	446.4	90.06	47.4	9.56
2009-2012	1.8	0.37	422.2	85.16	71.7	14.47

VII. DISCUSSION AND CONCLUSION

The desertification intensity map in Mehran plain based on the electrical conductivity index shows that the severity of desertification have increased from the beginning of the time period to the end of study, such that at the beginning of the first period 8.95% of the area were suffering from severe desertification, and unfortunately at the end of the last period 14.47% of the area is classified in severe desertification. Also, the results obtained from investigating the quantitative values of weighted average of water electrical conductivity index, shows that this parameter in the study area, is at moderate desertification status; so that the area and percentage of each desertification class indicates moderate desertification status based on the electrical conductivity indicator in all three periods (average for all three periods is 88%). This research shows that groundwater electrical conductivity of the study area in the last few years has undergone an increasing trend which can be attributed to rainfall reduction and increased extraction of groundwater by wells in the area. Increase in electrical conductivity degrades soil structure and creates problems in the drainage and also most certainly will cause serious damage to vegetation cover. Proper management, control and usage of these waters for irrigation are absolutely necessary to prevent adverse effects on soil quality and also desertification expansion in the study area. Overall, one can say that water electrical conductivity parameter is one of the most important indicators in dry areas. It is suggested to investigate rest of the quantities parameters such as chloride, dissolved solids, and sodium absorption ratio in order to investigate the effects of water quality on desertification.

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ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 87-91

Expansion of Ecotourism, New Approach To Sustainable Development of Tourism Industry

(Case study: Khabr conserved area, Baft province, Kerman, Iran)

Sanaz Rostami, and Mohammad Hosein FroozanFar

***Abstract*—** Ecotourism known as one of the most important activities in different areas of the world provides visitors with opportunities to experience nature. Among types of tourism, ecotourism and sustainable development are more consistently related. Sustainable ecotourism is ecologically sustainable tourism, i.e. the tourism that responds to current needs of tourists and maintains and develops ecotourism opportunities for the future. In this paper, capabilities of ecotourism in the region "Khabr and Roochoon" located in Kerman, Iran were investigated using a descriptive-analytic approach and beside evaluation of characteristics of ecotourism, problems and opportunities of the region were described, and strategies were suggested to develop tourism.

***Keywords*—** Ecotourism, Sustainable Development, Environment, Conserved Areas, Khabr and Roochoon.

I. Introduction

TODAY the tourism industry is considered as a powerful arm to increase income and decrease poverty rate in developing countries. Limitation of many resources such as oil, gas and mineral ores has inevitably made governments ponder if their sustainable sources as cultural and natural heritage may be utilized and these attractions may become economic resources and helpful to maintain using various scheduling programs.

The essence of tourism activities is in such a manner that development of this industry requires a close relationship with environment. Thus the physical environment is one of the major sources of tourism. It includes earth, air, water, plants, wildlife and human artifacts. Regarding the role of environment in the development of tourism industry as well as its rapid growth in the recent years, survival of this industry and preservation of existing resources will only be possible through changing attitudes about the environment and the interaction between them, because uncontrolled development in the industry based on traditional attitudes causes detrimental effects on the environment while changing them stimulates tourism (as nature-friendly) in such a way that not to damage it. Nowadays, stabilization and preservation in widespread manner is accepted as a fundamental approach to development and prosperity of every industry and sustainable development of tourism is of course no exception and it would not be possible without planning and management. The aim of sustainable tourism is conservation of diversity and quality of environment maintaining its ecologies, increasing revenue and so on, such that unwanted effects of tourism are minimized and positive ones strengthened.

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II. Statement of the problem

Nowadays, tourism is considered as one of the largest beneficial industries worldwide and environment is the most focused spot and at the top develop applications of the industry. Tourists were not only significant economic force but also the most important physical factor affecting the environment. More and more attention is being paid to the environment. In the tourism industry, the term “environment” is economically discussed when its aesthetics and purity is to be taken to the account and it is concentrated as central core in the tourism production and consumption sector. Profitable tourism devotes special attention to every single component of tourist attraction including the environment and suggests power of increasing environment potentials, their conservation and sustainable attraction in the provision of infrastructure. However, the industry must be proposed as integrated planning otherwise it may cause problem and damage to the vegetation and wildlife as well as accumulation of plastic and paper [9].

In Persian literature, ecological tourism is called “nature patrolling” [1]. Ecotourism is a form of tourism that originates from nature and outdoors. The people who visited Serengeti before everyone about half a century ago or adventurers who hiked in the Himalayas for the first time may be considered as pioneers of ecotourism. Due to beauty of pristine nature many tourists are brought to around the world from Antarctica to the heart of tropical forests with the aim of observation of wild life and adventuring. In addition to getting familiar with

ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 87-91

various life styles and different civilization of people around the world, these trips have also attractions that stimulates visitor passion with nature patrolling motivation and familiarity with native cultures. Term tourism was introduced to the tourism literature by Miller and found his path towards sustainable development movement. At the first step of this approach, ecotourism monitors ecological considerations (the concept of sustainable development) and at the second step, nature patrolling makes sense [4]. First comprehensive definition was established by International Association of Ecotourism in 1991, according to which, ecotourism is liable travel to natural areas that conserves the environment and sustains the well-being of local people [8] and it would be the best way that is beneficial for the area and its residents and would lead to the conservation of nature. Use of natural resources as tourism attractions without its damage is an ideal topic directed toward sustainable development.

The objective of ecotourism is by definition to preserve the environment. Moreover, considering the participation of local communities and economic development could be of importance and play a significant role in this respect. Ecotourism objectives can be summarized as following:

1- To enhance potential natural and cultural identities of a territory. To explore rich aesthetics and protect them.

2- Alternative income making for the population of host village from occupations including local guidance, house rental and horse hiring, restaurant related jobs, and sales of agricultural product, artifact and handicraft.

3- To encourage investment in remote mountainous areas. To reduce poverty of people and local communities.

4- To develop infrastructure, communication and access possibility to information for people in rural and underserved communities.

Ecotourism generates a great deal of opportunities in an area (Fig. 1).

A. Ecotourism constituents

1- Sustainable use of biodiversity and natural resources.

2- To minimize impact on the natural environment and social- cultural spaces, especially in terms of climate change, energy consumption, and traditional cultures.

3- Effective and comprehensive participation of parties have party favor from, especially local and indigenous communities.

4- Increasing environmental awareness and education of the aforementioned parties, particularly the tourists and their hosts.

Sustainable economic benefits for all practitioners [4].

Fig. 1 opportunities generated by ecotourism

B. Sustainable Development

The term sustainable development was first reported by Brundtlamd. According to the report, the sustainable development provides needs of the present generation without compromising the ability of future generations to meet their needs. In this concept not only environmental issues are taken to the account but human resources, and cultural factors, food supply, industrial energy, and urban development at the global level are also considered [15]. Sustainable development is such a strategy that manages all assets and natural and human as well as physical and financial resources to enhance the long-term wealth opposes to the policies and practices of any kind that to jeopardize the interests of future generations [2].

C. Sustainability and Tourism

Today sustainability is broadly admitted as fundamental approach for every type of tourism development. In political and environmental issues, sustainable tourism has been introduced as a novel concept to deal with the negative effects of tourism development [15]. Sustainable tourism emphasizes on the balance in tourism development through innovative approaches and policies of public and private sector in the future. Applying sustainability principles in the development of modern tourism means, for example, shoreline hotels must not generate across the coast nor ruin spectacular natural landscapes. Mountain footages must not be contaminated by dumping waste materials. Moreover, scarce natural and wildlife resources must not be exposed to detriments by tourists. Therefore governments must assess laws and regulations to seriously protect the natural and cultural resources target for tourism and tourists must visit and use attractions under the regulations and the rules. Conservation of the quality of the tourism industry can only be ensured under such a framework.

D. Principles of sustainable tourism

In the early 1980s, Great Britain Department of the Environment introduced a sustainable tourism model entitled “principles of sustainable tourism” to conduct tourism activities toward sustainable development issued as follows:

1- Environment has intrinsic value, and this value is more important than that is considered as asset of the tourism industry. Long-term benefits and environmental protection considerations should not sacrifice for the short-term ones.

ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 87-91

2- Tourism should be a positive factor with useful capabilities for the community and tourists be known.

3- Relationships between the environment and tourism should be managed so that sustainability of the environment is maintained in the long term. Tourism activities must not harm the environment nor cause adverse effects to it.

4- Tourism activities and their development should be scheduled according to the characteristics of the environment and nature of the area.

5- In each region, there must be some harmony between the needs of visitors, the site visitor and the host community.

6- Some changes are inevitable and may be useful in a dynamic world. Adaptation to changes should not cause harm with none of this principles.

7- Tourism industry, local authorities and environmental agencies, all should work according to the principles to achieve their purposes.

The first principle is important and emphasizes the intrinsic value of the environment. The environment should not be considered as a property of tourism. Therefore every exploitation of environment for tourism development is allowed and recommendations of Brundtlamd report in the long term also covers the industry.

III. Literature review

Until now, much research has been done on various issues related to tourism, but not much on ecotourism. Environmental impacts of tourism were studied in the Latian river basin using SWOT model [11]. A research entitled "ecotourism extension and a new approach to sustainable development" was conducted in the Hamedan province, Iran to review the ecotourism areas [9]. The typical tourism village MolaAgha was examined and advantages and opportunities of ecotourism and tourism in the region was analyzed [5].

IV. Study area

Khabr national park and Roochoon conserved area with longitude of 56o29'E and latitude of 28o40'N and an area of 153.178 acres as one of the oldest protected areas of the country is located in the Baft city, Kerman province, Iran. The region was initially registered as "Khabr and Roochoon conserved area" and authorized by environmental protection agency and it was promoted as "Khabr and Roochoon wildlife refuge" in the 1975 and eventually in September 1999 according to the Supreme Council of the Environment Act (982.149 hectares of the area has ecologically very high conditions), its name was changed to "Khabr national park" and the rest of the region with an area of more than 28000 hectares retained its name as "Roochoon wildlife refuge" regarding residential villages with five separate areas.

A. Regional Tourism Resources

Tourism attractions of Khabr and Roochoon region can be divided into two parts, Natural and human geography.

1. Tourism attractions of natural geography:

Khabr area comprises of rare plant and animal species due to its specific natural ecosystem. Vicinity with "Tang Ashoob", one of the longest narrow in Iran, Torang cave, Jofriz cave, Orsoiieeh plain (considered as granary of Kerman province due to its productivity) and exploration of a prehistoric stone in this area have introduced it as nature patrolling center in the sothern part of Baft city. In other words, locating Khabr national park, suitable climate, geology, zoology, botany, plant medical, water bodies, hunting and nature, mountain climbing and caving, converted it to an attractive area for tourism, recreation, science, sport, and cure purposes.

2. Tourism attractions of human geography:

Due to locating in the interface between Persia and Jiroft (Arta) civilizations, Khabr area has cultural landscapes, historical motifs, graveyards and historic and prehistoric castles. In General, attractions of human geography of the region can be outlined as follows:

1- Hill castles Morteza and Kahat, two adobe castles located in Khabr and Kahat villages.

2- Historic villages such as Khabr, Kahat, Mazar and Kahdan.

3- Historic cemeteries and Mazar related to prehistory and early Islam.

4- Proximity to ancient copper mines of SheikhAali.

5- Neighborhood of Yahya hill (the site of discovery of world's oldest handwriting).

6- Vicinity to TangAshoob and longest motifs related to hunting age, one kilometers in length.

7- Cultural-manufacture-livelihood landscapes in respect of water generation, handicrafts, and livestock products.

B. Features, capabilities and opportunities of the area

This area has water, electricity, telecommunications and cell-phone networks, as well as suitable rural roads which connect Khabr to Baft, Orsoiieh, and Sirjan cities. It also includes places for accommodation and catering, and orgent clinical services. Facilities like sheriffdom, village council, and environment protection agency can be effective in controlling and informing tourists. Other capabilities of the region include fertile soil, formation of agricultural and horticultural lands, and water bodies as springs and rivers. From social capabilities, existence of two nomadic and rural lives, production participation culture in villages of Khabr, young jobseekers population and typical tourism villages could be mentioned. Moreover, economic capabilities of the region are traditional production including horticulture, livestock, handicraft, collection of medical plants, forest products, cumin, and linen.

C. Limitations, challenges and threats of the region

1. Problems related to the management

ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 87-91

These problems can be classified into broad categories:

a) Decision making factors related to study area that further subdivided to the following groups:

1- Number of agencies and organizations involved in the management;

2- Lack of authority and responsibility of federal government or any other companies in tourism;

3- Lack of participation of public and private sectors; and

4- Lack of expertise individuals.

b) Problems related to decision making documents and instruments in the area:

Kerman district development and rehabilitation programs and rural guidance plan are definitive and firm documents to which is not looked from tourism prospect and so that due to lack of specific regulations and laws, actions are rather stylish and sometimes subjective.

2. Problems related to geographical structure

Human population density, formation of urban lives and leisure needs causes invasion of people to the well climate and natural recreational followed by interest the abuse and degradation of the environment and desertification.

3. Problems related to the economic structure

The problems are divided into three categories:

I) Lack of funding indigent residents

II) Lack of government and private investment

III) Low land values in the area

V. Analysis of Findings and Recommendations

Sustainable tourism maintains preservation and conservation of environmental resources that constitute the basis for the attraction. Moreover, it ensures conservation of the host society culture that enjoys from a long experience. Sustainable tourism establish a balance between the tourism industry needs and environment protection, social space and local community. Khabr area with abundant natural and ecotourism attractions, has a lot of potential for nature-based tourism development. Khabr region regarding the natural and historical potential and proximity to the special commercial zone of Sirjan city, shows a high tourism attracting capacity on a national and international scale with different motivations and target markets of recreations, sports, pilgrimage and scientific tourism prospects in a concentrated fashion (Table 1) and the creation of appropriate infrastructure and correct introduction enables daily tourists attraction of more than 10,000 people.

Table. 1 possible and potentials of Khabr region

Possible potentials	Existing potentials	Tourism type
Unknown springs are in the region	Shahevelayat spring and presence of recreational tourists	Recreation
Historic castles Morteza and Kahat	Hunting and wilderness	Sports - Recreation
Historical gardens	SayedAliMusa Pilgrims and KASHKOOYEH village	Pilgrimage - Recreation
The traditional system of agriculture and livestock	Medical plants	Scientific - Recreation
SheikhAali historic mines	Nomads and handicraft and their products	Scientific - Recreation - Commercial
Proximity Tel-e-Yahya Hill and to the center of the world's oldest handwriting	Species of plants and animals to attract tourists	Scientific - Recreation - Sport
Vicinity to Tarang cave and natural landscapes in the cave		Scientific - Recreation
Proximity to the historic village Mazar with gravestones of thousand years age		Scientific - Recreation - Historical

Some suggestions and strategies for attracting tourists in this area include:

1- Cycling road construction

2- Water parks construction (seems to be suitable due to presence of tourism and the water potential in the region)

3- Construction of garden sports including water sports, rock climbing, mountaineering, hill ski, land for football, volleyball, basketball, and intellectual games.

4- Constructing a two or three-star hotels

5- Construction of the museum and exhibition (construction of gallery museum in the place is suitable regarding multi-thousand years history of properties and human-made cultural structure of Khabr and according to the existing presence of tourists in the area).

6- Construction of birds garden (it can be effective in tourist attraction due to the region's biodiversity and ecosystem)

7- Construction of artificial lake, fishing and swimming

8- Camping construction

9- Construction of chairlift

Moreover, it could be useful noticing the following when ecotourism is going to be developed.

1- To provide facilities for the development of travel services agencies for nature-patrolling and constant monitoring of their activities.

2- To organize conferences for feeding back from the views of academics, researchers and experts in the field of nature-patrolling development.

3- To provide adequate security in the environment protection and to enhance the quality levels in areas prone nature-patrolling.

4- Marketing and introduction of ecotourism attraction of the region using new technologies.

5- To create websites to introduce ecotourism attractions of the province to the international community.

6- To prepare comprehensive and detailed plans for nature-patrolling of Kerman province.

The main motivations for sustainable ecotourism are acquisition of knowledge, culture, historical and natural background of the region such that the dignity and status of ecosystem is respected, opportunities are also provided for income generation in the region and a portion of revenues from sustainable ecotourism is devoted to the protection of natural resources. Primer emphasis in this approach is pursuing an ethical approach in the ecotourism motivation. Ethical criteria are not only repeated literally and orally but they also must be implemented practically and with the help of efficient systems and effective executive guarantees be converted into behavior and action. Thus in such case, future generations will be able to benefit from natural resources heritage.

ISSN (Online): 2305-0225
Issue 3(4), May 2014, pp. 87-91

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