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Using a Cross Impact matrix method to assess the impact of traffic on air quality in Tehran city

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Abstract—Tehran is one of the most polluted cities of the world. High car traffic and numerous factories and their geographical position have caused air pollution to be considered as one of the most important environmental and urban life issues inTehran. Air pollution produced by road traffic is one of the most serious problems in the management of urban areas in this city. This paper applies a technique as a preliminary tool for air quality assessments. For this, Cross impact matrix is used to determine the weightings to apply to spatial datasets within a GIS[1] to develop a pollution vulnerability map. Compared with sophisticated numerical models used in other studies, the method is less complicated and takes less time to be implemented. The purpose of this research is to explain how to develop a cross impact matrix method for assessing the environmental impacts of air quality resulted from traffic in a city. This technique provides pretty quick and understandable results that can be used by the city managers.

Keywords—Air quality management, Cross Impact matrix, GIS, Tehran.

I. INTRODUCTION

Air pollution is one of the most important environmental challenges in the recent decade in Tehran which has been continuing despite laws and administrative regulations, plans, projects and measures taken [1, 2, 3]. Excessive vehicles and heavy traffic, high consumption of energy, topography condition and atmospheric stability systems all have shares in Tehran to be one of the most polluted cities in the world. Meteorological conditions and changes in the

physical and dynamical properties of atmosphere play important roles in air pollution level [4].Among pollutants, nitrogen dioxide (NO_2) and carbon monoxide (CO) are emphasized due to the growing use of fossil fuels and their impact on human health [5]. According to the significant impactsof pollutants on air quality, prediction and analysis of emissions from vehicles is important to improving the environmental conditions.In this regard, Rebolj and Sturm used software such as ArcGIS in order to estimate air pollution caused by traffic [6].

Mavroulidou*et al*. used a simple and rapid method which was a combination of interactive matrix and GIS maps for preliminary assessment of air quality caused by traffic in Surry of the UK. The Traffic matrix method used in their study combines interactive GIS maps with modeling [7].

Puliafito*et al*. presented a model to determine air quality in urban areas using ArcGIS software that provided information for users toidentify areas which are vulnerable to air pollution [8].

In a research,Sefidkar*et al*. investigated the air pollution in Tehran by using a logistic model. The study concluded that the eastern and northern parts of Tehran were the most polluted areas [9].

In this paper, to evaluate the impact of traffic on air quality in Tehran, we provided a reciprocal matrix. To prepare the matrix, we needmaps for which thepreparation steps are mentioned in the following sections.

$$V0 = \frac{\sum_{i=1}^{n} \frac{1}{d_i} \times v_i}{\sum_{i=1}^{n} 1} \qquad (1)$$

II. CASE STUDY

Tehran is the largest city and capital of Iran, it is also the twenty fifth populous city in the world [10]. A special feature of the physical environment of Tehran air pollution is its extreme cases which is a major problem [11]. Mountains around Tehran and their position in a crescent-shaped like bring about problems in terms of natural air ventilation. Also these mountains create obstacle to penetration of western winds into the city and this causes Tehran's air to be more stable than the adjacent plains.

[1]Geographic Information System

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III. METHOD

Air Quality Mapping for emissions of NO_2 and CO

In this stage, we used digital terrain model (DTM[2]) to show distribution of pollutants in a continuous form which is more useful in efficient management of air quality. Selecting the extrapolation model is important which makes the results closer to reality. To prepare air quality map for pollutants CO and NO_2, we used inverse distance method (IDW[3]) as a completely statistical method. This method has been used in many studies for developing air pollution surfaces [12]. The IDW Method is one of the simplest methods which estimates unknown values in the points according to weights which are proportionateto distance of each sample to the place of estimation. In this method, the samples which are farther away receive less weight [12]

Where di is the sample distance from point, Vi is variable level in known points and variable and V0 is the estimated value.

Mapping the ripples (Roughness)
To prepare plan irregularities over the region of the map, we used Quantum GIS software. This software is very useful and easy to work with raster and vector data formats [21].

Mapping Wind Direction
For mapping the dominant wind direction, data from meteorological stations was used. In this part, the dominant wind direction cosine and sine of each station is calculated. Then the product of this process is multiplied to Pi values and divided by 180 degrees. Next, the two columns of data are multiplied at the prevailing wind to gain x-value and y-value columns. These numbers are then used for converting to trigonometric values.Thefollowingtrigonometricrelationswere usedto convertthese numbers.We then used the IDW interpolation method for preparing wind direction map.

```
1)      if x_value(i)>=0 & y_value(i)>0
avg_dir(i,2) =abs(atan)y_value(i)/x_value(i)*180/pi;
2)      if x_value(i)>=0 & y_value(i)<=0
avg_dir(i,2) =360-abs(atan)y_value(i)/x_value(i)*180/pi;
3)      if x_value(i)<0 & y_value(i)>=0
avg_dir(i,2) =180-abs(atan)y_value(i)/x_value(i)*180/pi;
4)      if x_value(i)<0 & y_value(i)<0
avg_dir(i,2) =180+abs(atan)y_value(i)/x_value(i)*180/pi;
```

Preparing wind speed map

Wind speed plays a key role in specifying time of transferring materials and pollutants from source to receivers. So we have taken the wind as an important factor in the distribution, transmission and pollution levels. To prepare the wind speed map, we applied inverse distance weighted (IDW) where wind speed map is provided according to data from weather stations.

Acquiring an air stability class

To determine air stability class, we used software Aloha. This software is available by Environmental Protection Agency (EPA) for modeling accidents resulting from release of toxic or explosives substances, fire, or explosion. This software has a very rich database and is simple to work with. Using this software, data related to all the air pollution measuring stations was entered into the system and in each level the air stability class was specified.

Table (1): air stability classes in software Alsoha [13].

Wind Speed			**Day: Incoming Solar Radiation**			**Night: Cloud Cover**	
Miles per Hour	**Knots**	**Meters per Second**	**Strong**	**Moderate**	**Slight**	**More than 50 %**	**Less than 50 %**
Less than 4.5	Less than 3.9	Less than 2	A	A–B	B	E	F
4.5 – 6.7	3.9 – 5.8	2 – 3	A–B	B	C	E	F
6.7 – 11.2	5.8 – 9.7	3 – 5	B	B–C	C	D	E
11.2 – 13.4	9.7 – 11.7	5 – 6	C	C–D	D	D	D
More than 13.4	More than 11.7	More than 6	C	D	D	D	D

Notes:

- **For completely overcast conditions during day or night, the stability class is D.**
- **This table is for releases over land. If the release occurs over water, the stability class will be either D or E.**
- ***Wind speed* is measured from a wind reference height of 10 meters.**
- ***Strong incoming solar radiation* corresponds to**

1 .DIGITAL TERRAINMODEL
2. INVERSE DISTANCE WEIGHTED

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clear skies with the sun high in the sky (solar angle greater than 60 degrees).

- ***Slight incoming solar radiation* corresponds to clear skies with the sun low in the sky (solar angle between 15 and 35 degrees).**
- **Table adapted from Turner, D. Bruce. 1994. *Workbook of Atmospheric Dispersion Estimates: An Introduction to Dispersion Modeling*. Second edition. Boca Raton, Florida: Lewis Publishers.**

Cross-impact analysis

Cross-impact analysis is a methodology developed by Theodore Gordon and Olaf Helmer in 1966 to help determine how relationships between events would impact resulting events and reduce uncertainty in the future[14][15][16]. A major part of the intelligence analysis style of cross-impact analysis is the cross-impact matrix. The matrix is a visualization of the cross-impact analysis and allows for modifications. It also allows an analyst to find both the most influential variables and those variables that are impacted by the other variables, not just direct, one-to-one relationships. While several traditional Cross Impact Analysis methods suggest the creation of a matrix, the priority still relies in probabilities, one-to-one relationships, and the order of events[17].

The cross impact model was introduced as a means of accounting for the interactions between a set of forecasts, when those interactions may not have been taken into consideration when individual forecasts were produced [17].In fact, cross impact models can stand alone as a method of future research, or can be integrated with other methods to form powerful forecasting tools.

Cross-impact analysis is a method that helps the process of scanning the field of possible futures to reduce uncertainties.The database of the method is the “cross-impact matrix”, a matrix scheme which lists all relevant events in rows and also in columns. The matrix cells contain numbers which describe how the occurrence of the row event would affect the probability of the column event. Some events increase the probability of another event to a greater or lesser extent. Sometimes the probability of the other event is decreased, sometimes the impact is neutral. The idea is to collect the cross-impact data using expert judgments [18].

In this study,after preparing data layers, a cross impact matrix was formed to analyze the perceptual environmental system. The cross impact matrix consists of a matrix of factors affecting air quality where these factors can influence each other as well. In the next step,the sum of rows and columns is calculated and significance level of factors affecting air quality is measured using below formula.

$$Sij = \sum_{1}^{n}(Xj - Xi) \qquad (2)$$

Where Si j is the degree of importance of each layer which affects air quality; it is a dimensionless number. Xi j is the number of ones in row i and X j is the number of ones in column j [19, 20].

In fact,scoring process becomes quasi-objective by using cross impact matrix. After deduction of the preferred classes and significance degree of layers, the obtained scores were applied to GIS maps. Using the method of harmonic maps, a vulnerability map of the area was prepared in terms of air quality using ArcGIS software.The principles of the cross impact matrix methodology combined with the GIS are shown in Fig. 1.

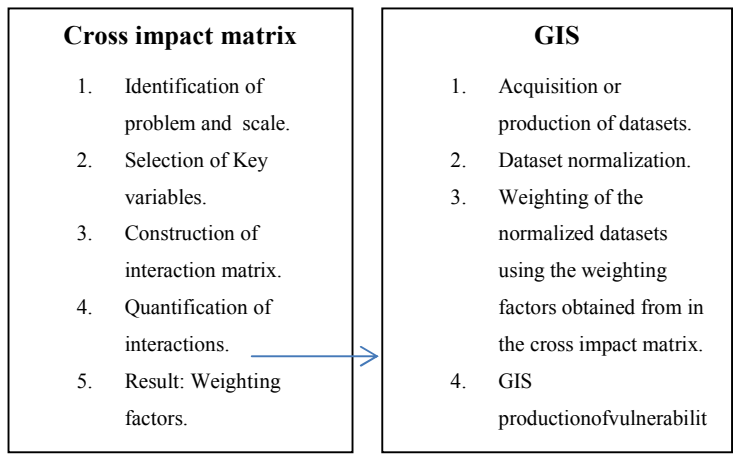

Figure (1). Overview of the methodology[7]

IV. CONCLUSION

Today, much attention is paid to the issues and problems associated with air pollution that is considered a major problem in urban areas. In this context, assessment of air quality modeling becomes important. In this paper, the interaction matrix method was used to study air quality in Tehran. As cross impact matrix shows, effective factors in determining air quality are influenced by each other. The cross impact matrix method is a clear and simple way to find weights for the relevant factors and to prepare air quality map. In this method, the importance of individual variables is highlighted in the whole system and the way of communication of these variables with other system variables and their effect on the whole system are analyzed, which is comparable to advanced numerical models. In this matrix, to determine the air quality, the use of key variables for matrix allows us to study the whole urban system.Once the cross impact matrix has been developed, it can be applied to other areas with similar characteristics. The aim of this research is explainingcross impact matrix method for assessing environmental effects. This technique provides fast and understandable results for lay people and experts.

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Analysis of meteorological drought Gorgan station using indexes drought

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Abstract— Drought is a normal part of the climate of each region's potential is even high rainfall areas.Resulting in a water shortage for many activities, especially the environmental and agriculture. Droughts are inevitable. And just by knowing its law-governing policies and strategies can reduce the damage caused by it. In the present study drought synoptic stations in Iran than 4 percent of normal precipitation index (PNPI), rainfall deciles (DPI), Governor Index (Z) and the Governor of precipitation (SPI) during the statistical period of 53 years (from 1953 to 2005) is used Based on the calculated values obtained from each of the indicators on an annual basis, according to the Cook pertaining to various classes of drought indicators of interest, to determine drought conditions during the period of time scales was studied. As the results were Due to the limited timeframe of four years of severe drought in 1953 and 1954 and the decade (1982 to 2000) during the past decades this has been the driest.

Keywords— drought, normal index, rainfall deciles benefited, the Governor and the Governor of Rainfall Index

I. INTRODUCTION

Lack of sufficient rainfall to grow a permanent feature of life in the dry climate of the area is dry The unexpected decrease in rainfall or less rainfall than the long term average in a certain period in an area that is not quite dry; Creates a high risk that this phenomenon can be interpreted as drought[12]. Drought is a global phenomenon that can occur anywhere and considerable damage to the structure of human and natural ecology enters [13]. Not only quick and direct effects on agricultural drought leaves but also indirect effects and adverse followed by the disruption of normal development followed by agricultural products and some believe that some of the drought could become a global crisis [9]. Drought has a continuous and gradual work and somewhat prolonged period occurs. So we need to develop management plans are prepared for it, to the extent of the problems caused by the reduced phenomena. This phenomenon can occur in any area of human and environmental influence, although its spread is different. Unlike the phenomenon of rapid climatic drought, drought occurs in arid and humid climates are normal and natural state [3].

The drought situation in Gorgan station using annual precipitation data, the four indexes of normal rainfall (PNPI), rainfall deciles (DPI), Governor Index (Z) and the Governor of precipitation (SPI) of were. On the basis of the calculated values of the parameters of interest, the tables corresponding to different classes of indicators to assess drought a drought condition the desired station on the scales during the current period, and four indexes were compared.

II. LITERATURE

SPI used in Colorado and found that it is able to detect the onset of drought and expansion. The results showed that the SPI scale in one month since the start of the 1996 drought better than replied Palmer that[7]. Europe regarding the frequency and persistence of droughts in different time scales studied and concluded that in the short time scales of drought frequency Most of the time scale, long-term and sustained drought [2]. Using SPI, the continuity of the map extent of droughts in Spain continues to be drawn.By combining these maps with maps return period rainfall, drought return period and range maps are drawn for each of them [14]. To assess the frequency of droughts in southern Portugal engaged in two areas Alnynjv and Agarv. Which concluded that widespread drought during the autumn and only 2 months of severe drought variable SPI is close to those [11]. The study of meteorological drought indices such as SPI, DPI, BMDI, RAI and PNPI engaged in some climatic zones of rainfall during used the past nine stations (1999-1961) [1]. Using some

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statistical indicators using data from rainfall, droughts four important features including frequency, duration, and intensity in Iran were investigated. Indicators used in this study: SD index, the index deciles, index, percent of normal rainfall distribution index. By comparing the various statistical indicators, the percent of normal precipitation are presented as appropriate indicators to study the characteristics of the four droughts for a period of 30 years (1985 1956) was used in 31 nation's weather station. Based on these studies, researchers found that the extensive drought in the year 1352 (1983) happened. That it is more than 60% area of the country has been dominated by the drought Finally, due to severe adverse fluctuations in rainfall amounts, drought is one of the main features of the climate In southern, eastern and central frequency, longer duration, higher intensity development is greater than in more other parts of Country [4]. Deciles for review drought index province (based on precipitation data of 11 meteorological stations) used in Chahar Mahal and Bakhtiari[6]. Indexes to evaluate the effect of the wet and drought in the province began. And concluded that the standardized precipitation index (SPI), the percentage of normal precipitation (PNPI) and Nietzsche used in this study is Standardized Precipitation Model) (SPI due to additional features including a more detailed breakdown of categories in each of the wet and drought phenomena, province knownHigher accuracy in the separation of wet and dry periods and greater sensitivity to changes in precipitation, the model is used to determine the statistical properties of precipitation (Intensity and frequency) or segregation of wet and drought in[8].

III. Materials and Methods

Location

Gorgan city between 54 degrees and 13 minutes to 54 degrees 45 minutes east longitude and 36 degrees 31 minutes to 36 degrees 59 minutes north latitude in the southern part of the province The city is north of the city of Agh Ghala and Turkmen, Semnan province in the south of the city, Ali Abad, from West to East is Kordkoy city.In this paper, to analyze and estimate the statistics of 53-year drought Gorgan station that has been used. Through statistical software EXCLE and SPI data were statistically analyzed To determine the percent of normal precipitation drought indices (PNPI), rainfall deciles (DPI), the Governor Mbar (Z) and the Governor of precipitation (SPI) is used.Table 1 shows characteristics of geographic synoptic stations of Gorgan.

Table (1) Geographic Information synoptic stations of Gorgan

Period	altitude	Latitude	longitude	Type of station
1953-2005	1550.4	3732	4051	Sinoptic

Meteorological drought index one of the best uses of drought indicators, reporting the extent of drought. Index means that the summary information for a period of drought, drought conditions in the area to show information. Time scales of days and months and years of sustained drought can be different sizes. Each duration is prolonged drought, water reserves are under threat, so can increase the severity of a drought occurring. The present paper is to determine drought Gorgan Station, 4 percent of normal precipitation (PNPI), rainfall deciles (DPI), Governor Index (Z) and the Governor of precipitation (SPI) was analyzed. Percentage of normal rainfall (PNPI) Percent of normal rainfall, drought is one of the simplest measures are in place. Analyzes percent of normal rainfall, drought or wet during use them to study in a particular location or the growing season (Mackay, 1994). The index of actual precipitation by normal precipitation divided and multiplied by the number 100 is obtained

$$\%PN = \frac{P_i}{\overline{P}} \times 100$$

Equation 1

Rainfall deciles index (DPI) In this technique, events are recorded as long-term, one-tenth, one-tenth classify each decile or Deciles called. The first decile, the precipitation is 10% exceeds the smallest precipitation events. The second decile is the precipitation does not exceed 20% of the smallest decile in the same case continues. Fifth decile, the median is the amount of precipitation that does not exceed 50% of the rainfall data and the level is normal

(SPI) Standardized Precipitation Index (SPI)

SPI makes the short-term variability in measures for agricultural purposes, and the long-term scale. For the purpose of groundwater sources, river flows, lake levels and resources utilizing the surface. SPI mainly for time scales of 3, 6, 12, 24 and 48 months is calculated. Software for calculating SPI SPI WINDOSE year by giving information about the rainfall and the software will automatically start the Standardized Precipitation Index.

Positive values of SPI indicate more rainfall than average rainfall amount is negative, it means the opposite. According to this method, the periods of drought occurs when the SPI is continuously negative and the 1 or less when positive and the end of the. Thus, the beginning and end of a drought period that is determined by the values of the cumulative negative numbers and severity of droughts, SPI is also a great show. Refinements to the classification of McKee (1994) for grading the severity and likelihood of SPI was designed to be used in the results in Table 2 are presented.

Governor benchmark index or standard Z Standard Z Index Astandarya Zyrmhasbh relationship is:

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$$Z=\frac{Pi-\bar{P}}{S}$$ number of relation (2)

In this equation: PI monthly or annual rainfall desired station, P- Average and S is the standard deviation of rainfall series. Table 2 shows the classification of the index used.

Table 2 Classification of selected indicators of drought

extreme drought	, severe drought	moderate drought	Weak drought	Type of index
-0.84 to -1.28	-0.54 to -0.84	-0.25 to -0.52	-0.25 to +025	Distribution of standard criteria (Z)
20<	20-55	55-70	70-80	Percent of normal precipitation (PNPI)
Decile1	Decile2	Decile3	Decile4	Decile (DPI)
-2≤	-1.5 to -1.99	-1 to -1.49	-0. 5 to -0.99	Governor of precipitation (SPI)

IV. Results and Discussion

Analysis of rainfall stations of Gorgan

The survey showed that the average annual rainfall of Gorgan 603 mm annual precipitation ranges with up to 1580 mm in 1959 and 1953 was at least 183 mm. Also, check the amount of annual rainfall from 1982 to 1985 show that 12 consecutive years of less than normal rainfall occurred in the station. Table (3) indicates the initial analysis of rainfall in the region during the past 53 years (1953-2005) is. Figure 2: Volatility Moving Average annual precipitation in the study and at 3, 5 and 7 years old, it shows.

The investigations were carried out on seasonal rainfall stations in the study revealed that rainfall distribution is such that 22% of the annual precipitation in the spring, 14% in summer and 32% in autumn and 32% in winter reserved. Figure 3 shows the distribution of rainfall in different seasons.

In order to better analyze monthly precipitation, total long-term average for each month separately in Table (4) is given. As can be seen, the greatest amount of precipitation received on March 80 mm and the beam least amount of rainfall is 22.2 mm.

Table (3) statistical characteristics rainfall synoptic stations of Gorgan

standard deviation	annual rainfall minimum	annual rainfall, maximum	during the rainy period the average	The total rainfall	Period
192	183	1580	603	31948	1953-2005

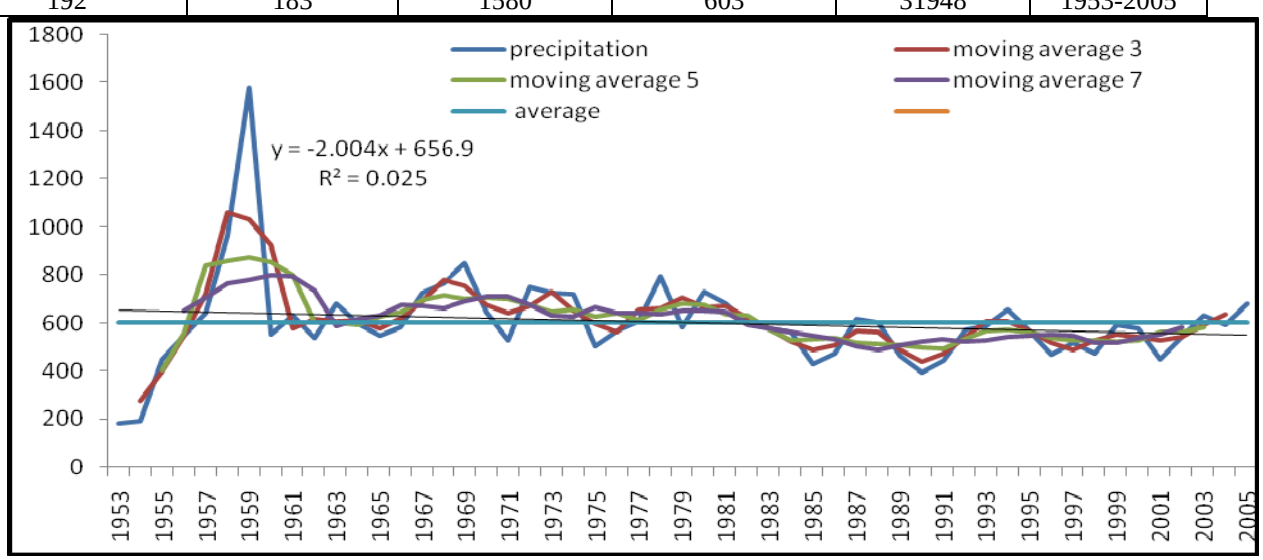

Figure (2) changes in annual precipitation series and moving average curves 3, 5 and 7 years synoptic stations of Gorgan

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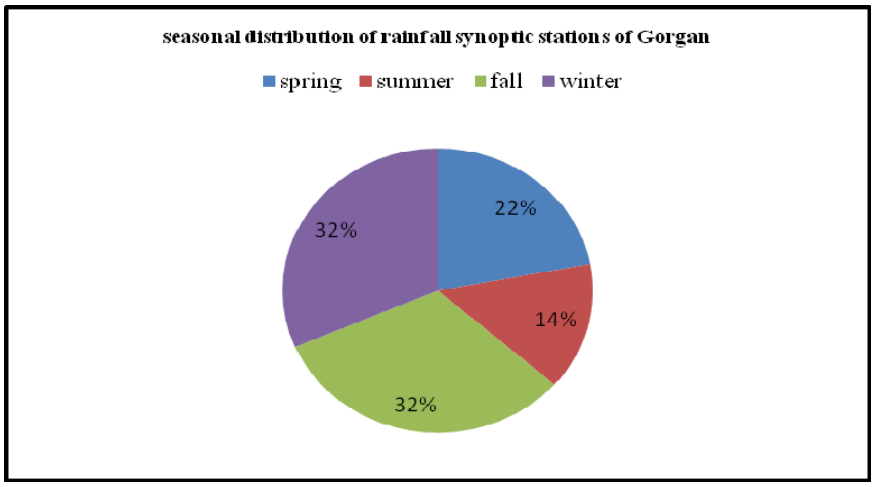

Figure (3) seasonal distribution of rainfall synoptic stations of Gorgan

Table (4) Average monthly rainfall synoptic stations of Iran (1953-2005)

March	February	January	December	November	October	September	August	July	June	May	April
79.5	59	55	57.5	68.5	66	39	27	22	33.5	44	53

To verify and monitor the drought in the study area using four indicators of normal rainfall (PNPI), rainfall deciles (DPI), Governor Index (Z) and the Governor of precipitation (SPI), statistical information on annual rainfall rainfall station of Gorgan city for 53 years (1953-2005) has been studied. After performing statistical operations and sorting data, using the relationship proposed by drought indices were determined. The following is a summary of the results of each indicator is provided in the form of a diagram.

Standards Index (Z)
The first index to analyze the rainfall stations used Gorgan Governor's benchmark index. Based on the highest drought index Gorgan Station 395 mm rainfall in 1990 with standard -1.8 and 429.5 mm rainfall in 1985 with a standard -0.9 been. Most remarkable, severe droughts during the years 1983-1993, with different degrees (Figure 4).

Percentage of normal rainfall (PNPI)
The drought index used to determine the percent of normal precipitation is. On the basis of the drought in 1332 and 1333, with 31% having the highest rainfall (Figure 5).

Rainfall deciles (DPI)
This indicator measures the percentage of normal rainfall to prevent defects in the method presented. This index is based on the years 1332, 1333, 1364, 1369 and 1370 the number of decile 1 have a very severe drought (Figure 6).

Standard indicators of precipitation (SPI)
The driest year period in the basin in 1954 and 1953, according to the index value, 3.1 and 3.2 the most humid months of the year 1959 index value of 3.9 is considered (Figure 7).

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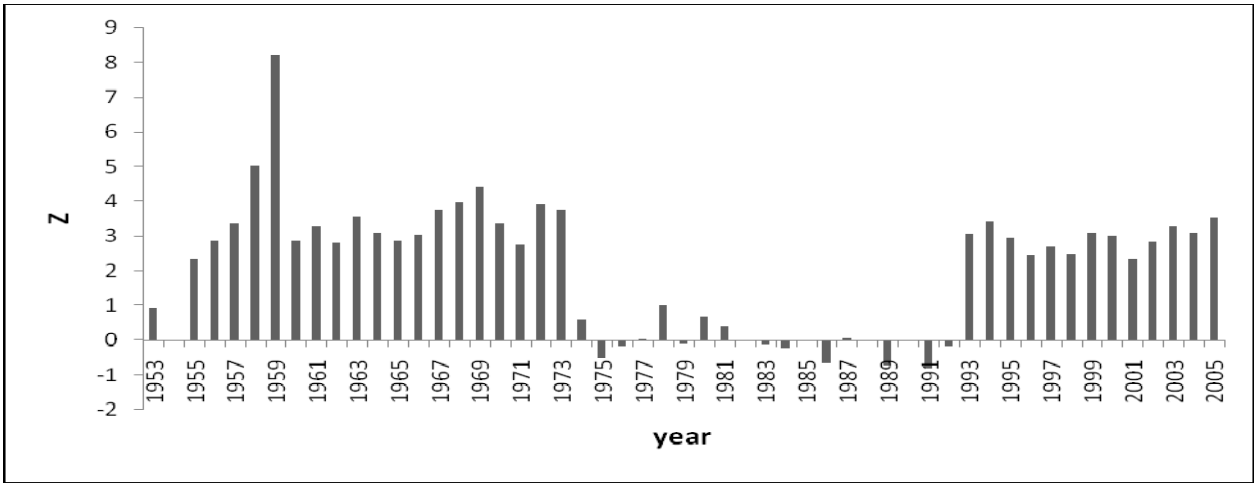

Figure 4 standard benchmark scores synoptic stations of Iran from 1953 to 2005

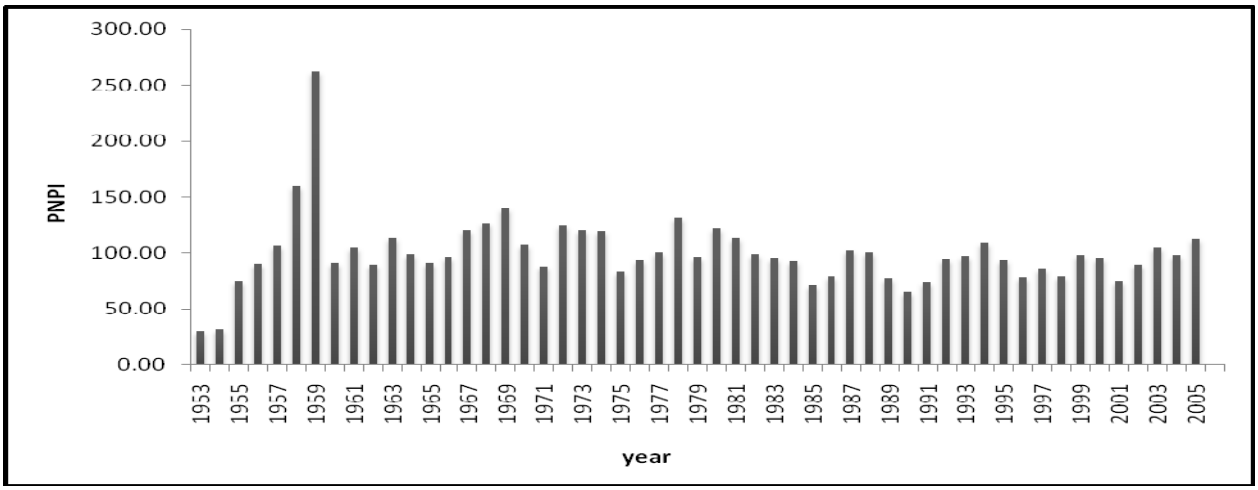

Figure 5 Percentage of normal rainfall Gorgan station 1953 to 2005

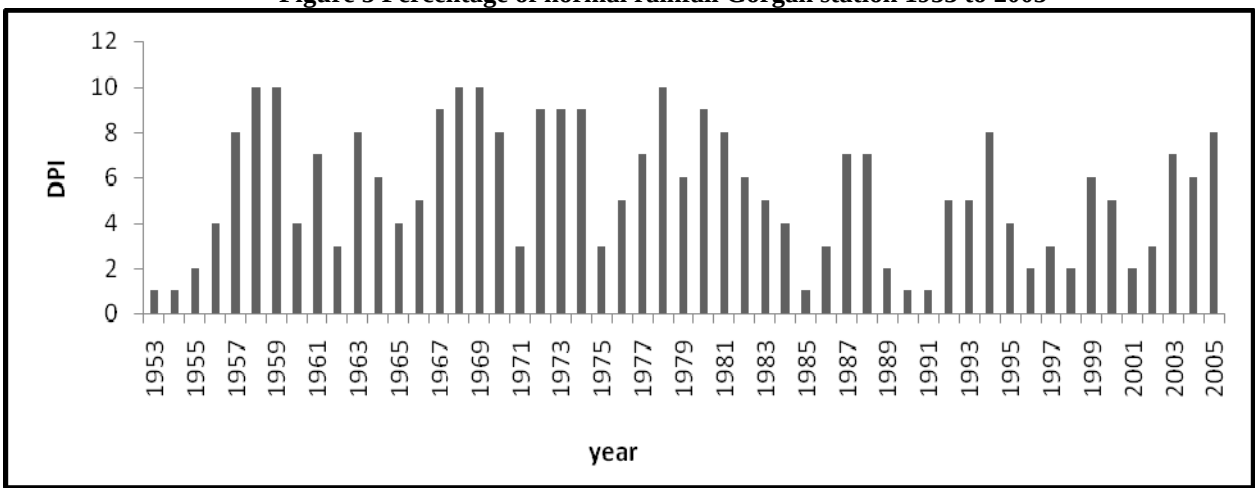

Figure (6) of rainfall deciles of Gorgan station 1953-2005

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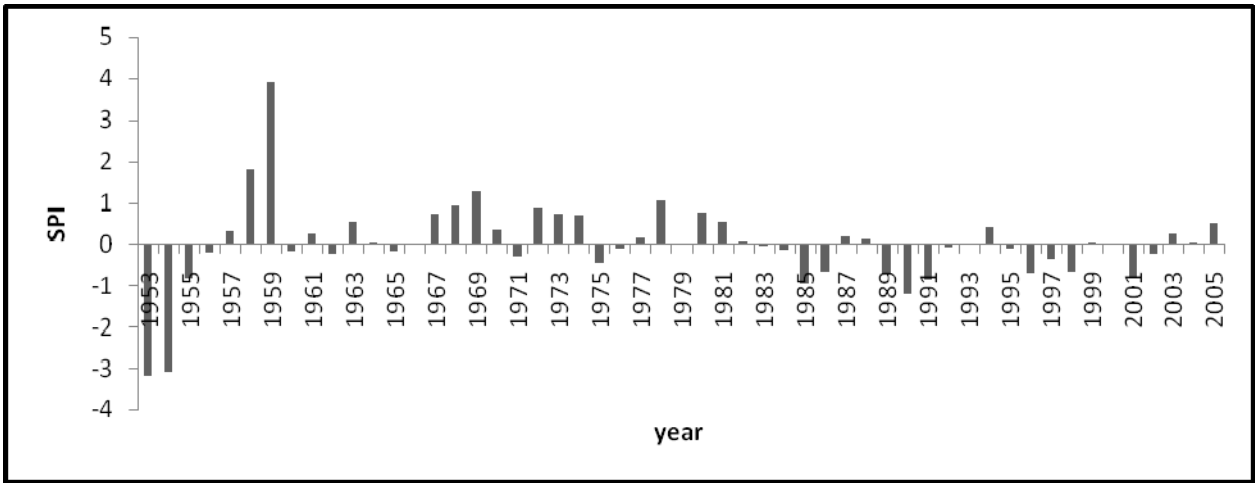

Figure (7), Governor of rainfall stations of Gorgan 1953-2005

By observing Table (5), with respect to the percentage of normal rainfall, we find that the most abundant of the types of droughts weakened by drought, which included %73 of Gorgan drought and moderate drought and severe drought, with a frequency of %9 frequency of occurrence is %19 While severe drought in the region has occurred.

Also according to the distribution of the criterion standard, the highest frequency of droughts weakened by the prevalence of %50, followed by moderate drought with a frequency of %21, a severe drought with a frequency of %16 and a drought so severe in %13, the lowest rate among all types of droughts include there.

Due to the drought, moderate respectively drought, the highest decile of the frequency of 6 and %28.

According to the Governor of precipitation in most drought-related famine is poor, with 38 lots and %93, whereas in moderate drought, according to the index, it did not.

Table (6) Most of Gorgan Station drought years 1332, 1333, 1334, 1364, 1365, 1368, 1369, 1370, 1375 and 1380 occurred in the years 1332 and 1333 in all four indices are the driest years.

According to this indicator, the standard benchmark 38-year drought in the distribution of normal index rainfall in 11 years, the decile of the Governor of precipitation is 21 years and 41 years.
Also according to the table during the statistical period of 53 years, 43 years, suffering from drought and famine have been only 10 years old and according to (2) of rainfall than average in the long-term. Table (7) years of drought and rainfall synoptic stations of Iran's annual show.

As mentioned drought indicators important role in monitoring droughts and quantify this phenomenon in order to predict and manage the damage caused by the drought phenomenon plays.

In this study, the four indexes of normal rainfall, rainfall deciles, the Governor and the Governor of precipitation Mbar were studied Using statistical data related to annual rainfall, rainfall station: Gorgan, droughts and periods of drought conditions in the area were determined.

As the results were observed with respect to each of the four years 1953 and 1954 indices ranged severe drought and the (1982 to 2000) droughtest during the statistical period of. In other time periods, sometimes in normal and drought conditions that period was less than normal.

Percent of normal precipitation, drought is one of the simplest measures in a location that was used in the study. Today, the index due to the high flexibility and integration are greatly used. These methods are statistically similar to SPI standards and assessments are almost identical in terms of frequency and intensity data is presented, but since the monthly and seasonal rainfall in this profile does not follow the normal distribution, the application of this model be more limited than SPI.

Results showed that the frequency of drought weakened the standard indicators of precipitation with 38 and %93 and the minimum frequency of rainfall deciles with 5 and %24 respectively. Most severe droughts on the decile indicator of precipitation with %5 and %24 of normal rainfall and the minimum frequency of severe droughts in the index, it did not.

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Table (5) the frequency and percentage of dry periods synoptic stations of Iran (1953-2005)

extreme drought		, severe drought		moderate drought		Weak drought		**Type of Index**
Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	
13	**5**	**16**	**6**	**21**	**8**	**50**	**19**	Distribution of standard criteria (Z)
*****	*****	**18**	**2**	**9**	**1**	**73**	**8**	Percent of normal precipitation (PNPI)
25	**5**	**24**	**5**	**28**	**6**	**24**	**5**	Decile (DPI)
5	**2**	**2**	**1**	*****	*****	**93**	**38**	Governor of precipitation (SPI)

Table (6) years of drought in synoptic stations of Iran (1953-2005)

(SPI)	(DPI)	(PNPI)	(Z)	سال	(SPI)	(DPI)	(PNPI)	(Z)	سال
				1985					1953
				1986					1954
				1987					1955
				1988					1956
				1989					1957
				1990					1960
				1991					1961
				1992					1962
				1993					1963
				1994					1964
				1995					1965
				1996					1966
				1997					1970
				1998					1971
				1999					1975
				2000					1976
				2001					1977
				2002					1978
				2003					1979
				2004					1982
				2005					1983
									1984

extreme drought	severe drought	moderate drought	Weak drought	Guide to the table

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Table (7) years of drought and lack of rainfall annually synoptic stations of Iran (1953-2005)

Rainfall	Year	rainfall	Year
751	1972	962	1958
724	1973	1580	1959
719	1974	726	1967
733	1980	763	1968
683	1981	847.3	1969

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Enhanced of Yield and Yield Components of *Zea mays* L. by Different Tillage methods and Levels of Triple Superphosphate

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***Abstract*—** To evaluate the effect of tillage and triple superphosphate on yield and yield fractions of filed corn single cross 704 cultivar, factorial experiment based on completely randomized design was performed. The first factor includes no-till farming, minimum tillage and disk tillage and the second factor include triple superphosphate at three levels include 60, 120 and 180 Kg/ha. According to the variance analysis results tillage has statistical significant effect (P<0.01) on plant height, stem diameter, leaf length, leaf area index, forage yield and dried forage yield. Triple superphosphate significantly affected the plant height, stem diameter, forage yield and dried forage yield, but did not affected leaf length and leaf area index. The interaction of triple superphosphate and tillage did not significant effect on the measured indices. The results showed that tillage enhances yield and yield fractions and tillage with disk has highest effect. Also triple superphosphate application enhanced plant height, stem diameter, forage and dried forage yield. The highest amount of forage and dried forage yield was observed at 180 kg/ha triple superphosphate. The highest plant height, stem diameter and leaf length was obtained at 180 kg/ha triple superphosphate with disk tillage. The highest amount of leaf area index was obtained at disk tillage with different levels of triple superphosphate and the highest forage yield was at 120 kg/ha triple superphosphate with disk tillage. The maximum dried forage yield was observed at minimum tillage with 120 kg/ha triple superphosphate.
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***Keywords*—** Corn, Dried forage yield, Forage yield, superphosphate, Leaf area index, Tillage.

I. Introduction

Corn is a member of Poaceae family and it has great adaptation to different climate, therefore its cultivation is increasing in most part of the Iran. Due to the high silo yield, sugar and starch, this plant is one of the best forage crops for silage production [1]. Corn has a lot of applications and widely cultivated in many countries. In addition, it is very desirable forage for livestock and unique in terms of energy source for livestock [2]. Repka and Dunk (1991) reported that corn is a source of energy for feeding of broilers and laying birds and it has key role in aviculture [3]. Nowadays in addition to the quality of the soil, tillage methods that's create optimum conditions for seedbed and plant growth is important [4]. Soil preparation is a common operations such as disc plow and harrow, which causes softening and prepare seedbed [5]. Seedbed preparation provides great conditions for sowing, germination and growth. Seedbed preparation time is very important and it has special role in maintaining of soil physical quality and saving of the fuel [6]. Since conventional tillage break up soil aggregates at loam and sandy loam soils and increases soil susceptibility to wind and water erosion, so the use of other methods of tillage in dryland farming is essential [7]. Corn is one of the most important strategic products with high nutritional requirements. Reducing of phosphor in corn reduces leaf area index and biomass. Phosphor has effect on leaf growth and photosynthetic activity efficiency [8].

Germination, fertilization, maturation are needed to adequate amounts of phosphor [9]. In general, the importance of these elements for production of the economic output and preserve of balance between the original elements of soil has been demonstrated. It is believed that the interaction between plant roots and soil microorganisms have been affected by human intervention through industrial and agricultural activities [10]. Since phosphor is an essential part of a number of compounds such as energy transfer molecule, ADP, ATP, NAD, NADPH, Phosphate esters, and genetic information transfer system such as DNA, RNA, and phospholipids such as lecithin, choline plays an important role in membrane stability and causing to facilitate of the nitrogen absorption by plants [9]-[11]. Motahari et al (2011) found that phosphor as one of the three elements essential for plants for improvement of biological yield, plant height, number of flowers and essence [12].

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Phosphor plays an important role in cell division and photosynthesis and cause to increasing of fresh and dry weight of roots and seed yield.

II. MATERIAL AND METHODS

A. Plant material morphological analysis

The factorial experiment based on completely randomized design with three replicates was conducted. The first factor was different tillage methods include no-tillage, minimum tillage and disk tillage and second factor was different levels of triple superphosphate fertilizer include 60, 120 and 180 kg/ha.

To investigation of soil status, samples were taken from 0-30 cm soil depth and sent to the soil laboratory (Table 1and 2).

Table 1. Physical and chemical analysis results of soil

Soil Texture	EC (mm/cm)	Saturation Percentage	pH	Organic Matter (%)	Total Nitrogen (%)	Available Phosphor (ppm)	Available Potassium (ppm)	Sand (%)	Silt (%)	Clay (%)
Loam	55	66.2	7.81	4.2	0.2	17.7	121	48	35	17

Table 2. Analysis of soil micronutrients

Depth (cm)	Copper (mg/kg)	Zinc (mg/kg)	Manganese (mg/kg)	Iron (mg/kg)
0-30	1.48	0.82	2.5	2.2

Field was plowed 25-30 cm depth and prepared for planting. In each plot was six-line with four meter length. The spaces between blocks was 1.5 meter and on line in spaces from each plot was fallow. The seeds are disinfected by anti-fungal toxin and were planted as a valvate. In each valvate three seeds planted and covered with a layer of soil. The space on the row was 16 cm and between the rows was 75 cm. one-third of the nitrogen fertilizer (60 kg/ha) and triple superphosphate was used before planting and two-thirds of nitrogen fertilizer was used after germination till end of experiment. Irrigation was every 7 days. Weeds was removed by hand weeding and thinning was performed at the 6-leaf stage. To eliminate of armyworms diazinon at 1.5 per thousand concentration was used. When seeds was dough, the forage was harvested by hand. For measuring of plant height, 10 plants from each plot were randomly taken and the plant height was measured from bed to the top of the first output node. Five plant from each plot was selected at flowering stage and measure leaf area index in four upper leaves of each plant by leaf area meter. After measuring of leaves weight by digital scale, the leaves was dried in the oven at 72°C for 48 hours and then weighted by digital scale.

Data analysis was performed using IBM SPSS Statistics for Windows, Version 22.0 (Armink, NY, USA). Mean comparisons were carried out using Duncan's multiple range test at a probability level of 0.05.

III. RESULTS

A. Plant height

Variance analysis showed that tillage and triple superphosphate significantly ($P<0.01$) affected plant height but tillage and triple superphosphate interaction did not affected plant height (Table 3).

Tillage was increased the plant height. The plant height was increased from 153.11 cm at no-tillage to 156.11 cm at minimum tillage and 160.67 cm at disk and plow tillage (Figure 1). Application of triple superphosphate increases plant height, but did not significantly difference between 60 kg/ha and 120 kg/ha treatments. The maximum plant height was observed at 180 mg/ha triple superphosphate with average 162.11 cm (Figure 2).

According to the mean comparisons of interactions between tillage and triple superphosphate, the highest plant height was 167 cm obtained at disk and plow tillage with 180 kg/ha triple superphosphate and the lowest amount of the was 150 cm at no-tillage condition with 60 kg/ha and 120 kg/ha triple superphosphate (Table 4).

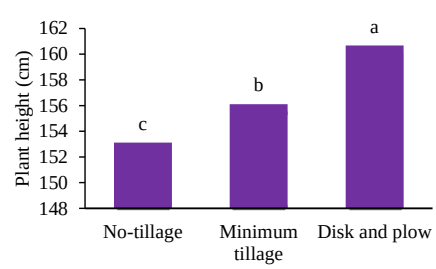

Figure 1. Effect of different tillage methods on plant height.

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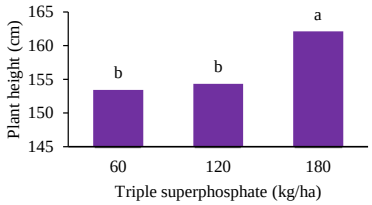

Figure 2. Effect of different levels of triple superphosphate on plant height.

Table 3. Analysis of variance the effect of different type of tillage and different levels of triple superphosphate on yield and yield components of *Z. mays* L. single cross 704 cultivar.

S.O.V	df	Mean of square					
		Plant height	Stem diameter	Leaf length	Leaf area index	Forage yield	Dried forage yield
Block	2	6.37^{ns}	0.02^{ns}	5.44^{ns}	0.01^{ns}	2044698.50^{ns}	2228448.30^{ns}
Tillage (a)	2	130.26^{**}	3.10^{**}	64.33^{**}	4.81^{**}	348890266.3^{**}	19774815.3^{**}
Triple superphosphate (B)	2	204.59^{ns}	3.60^{**}	3.00^{ns}	0.004^{ns}	44408900.6^{*}	5676639.31^{ns}
a×b	4	4.82^{ns}	0.94^{**}	6.83^{ns}	0.01^{ns}	24468161.77^{ns}	2940670.97^{ns}
Error	16	2.16	0.12	3.07	0.006	8703906.33	1078884.4
CV (%)		0.94	2.00	2.50	2.31	8.94	8.66

ns: not significant, ** and * are significantly at 1% and 5% respectively.

B. Stem diameter

According to the variance analysis different tillage methods and different levels of triple superphosphate significantly (P<0.01) affected stem diameter but the interaction between tillage and triple superphosphate did not significant effect on stem diameter (Table 3). Tillage cause to increases of stem diameter. Tillage increased this index from 17.5 mm at no-tillage condition to 18.67 mm at disk and plow tillage (Figure 3).

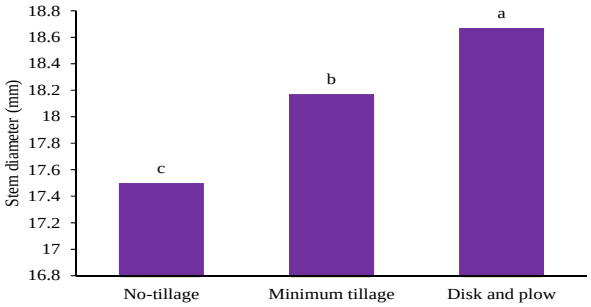

Figure 3. Effect of different tillage methods on stem diameter.

Different levels of triple superphosphate cause to increases of stem diameter. Triple superphosphate increases stem diameter from 17.47 mm at 60 kg/ha to 18.78 mm at 180 kg/ha (Figure 4).

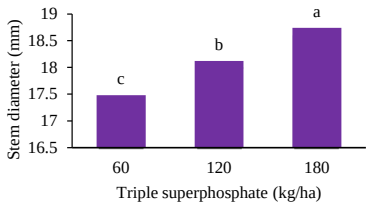

Figure 4. Effect of different levels of triple superphosphate on stem diameter.

The mean comparisons showed application of tillage with triple superphosphate increases stem diameter. The highest and lowest amount of that was obtained at disk and plow tillage with 180 kg/ha triple superphosphate and no-tillage with 60 kg/ha and 120 kg/ha, respectively (Table 4).

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C. Leaf length

Variance analysis showed that different tillage methods has statistically significant effect (P<0.01) on leaf length, but different levels of triple superphosphate and interaction of them with different tillage methods did not significantly affected leaf length (Table 3). Different tillage methods significantly increases leaf length. The maximum leaf length obtained at disk and plow tillage (72.57 cm) and the minimum of that was 67.22 cm at no-tillage treatment (Figure 5). There was no difference between different levels of triple superphosphate on leaf length (Figure 6). Mean comparisons of interaction between tillage methods and triple superphosphate showed that, the highest leaf length was 73 cm obtained at disk and plow tillage with 180 kg/ha triple superphosphate treatment and the lowest amount of that was 64.67 cm at no-tillage treatment with 180 kg/ha triple superphosphate (Table 4).

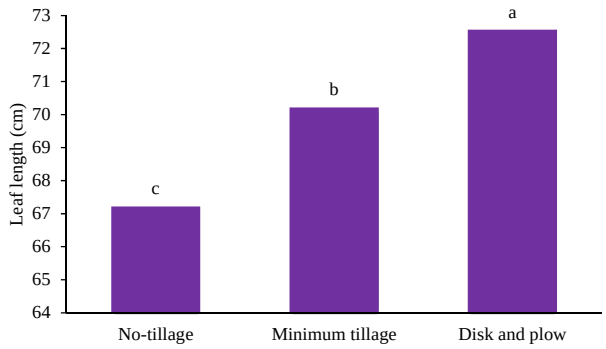

Figure 5. Effect of different tillage methods on leaf length.

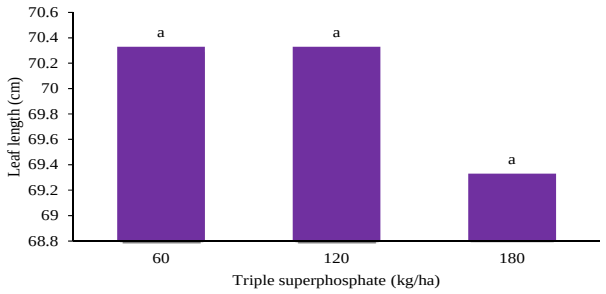

Figure 6. Effect of different levels of triple super phosphate on leaf length.

D. Leaf area index

The results showed that different tillage significantly affected (P<0.01) leaf area index, but different levels of triple superphosphate and it's interactions with tillage did not significant effect on leaf area index (Table 3). Tillage has increased leaf area index, so that, the maximum leaf area index was at disk and plow tillage and the minimum leaf area index was at no-tillage treatment (Figure 7). The different levels of triple superphosphate did not significant effect on leaf area index (Figure 8). According to the results leaf area index influenced by tillage methods and triple superphosphate, the highest leaf area index obtained at disk and plow tillage with different levels of triple superphosphate and the lowest amount of that was observed at no-tillage with 180 kg/ha triple superphosphate (Table 4).

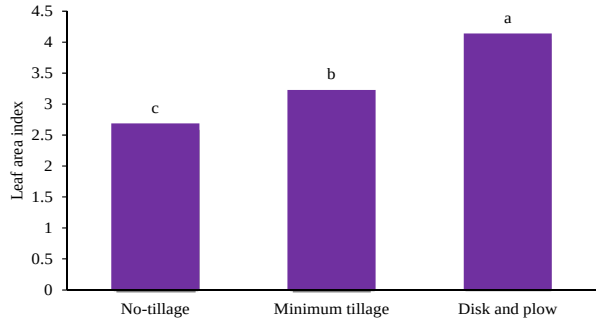

Figure 7. Effect of different tillage methods on leaf area index.

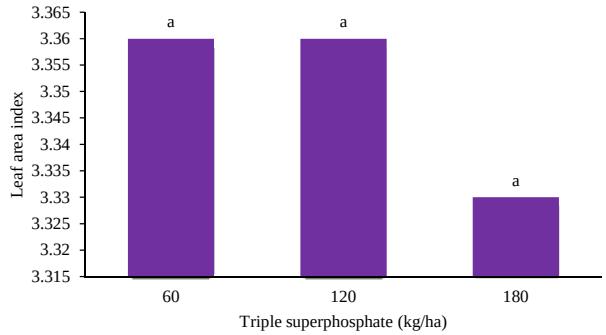

Figure 8. Effect of different levels of triple super phosphate on leaf area index.

E. Forage yield

According to the variance analysis results, different tillage methods has significant effect at P<0.01 and different levels of triple superphosphate has significant effect at P<0.05 on forage yield, but different interaction between different tillage methods and triple superphosphate did not significantly affected forage yield (Table 3). It was found that tillage can increases forage yield, so that, the highest forage yields was 38566.56 kg/ha at disk and plow tillage (Figure 9). According to the results, with using triple superphosphate forage yield is increases. The highest amount of forage yield was obtained at 180 kg/ha triple superphosphate treatment (Figure 10). The mean comparisons of interactions between different tillage methods and triple superphosphate levels showed that the highest forage yield was 39634.21 kg/ha and 40132.91 kg/ha obtained at minimum tillage with 180 kg/ha triple superphosphate and disk and plow tillage with 120 kg/ha triple superphosphate, respectively. The lowest amount of

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that was 25056.83 kg/ha and 25201.84 kg/ha obtained at minimum tillage with 60 kg/ha triple superphosphate and minimum tillage with 120 kg/ha triple superphosphate treatment, respectively (Table 4).

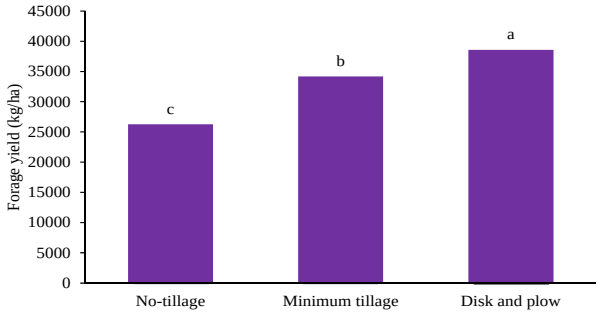

Figure 9. Effect of different tillage methods on forage yield.

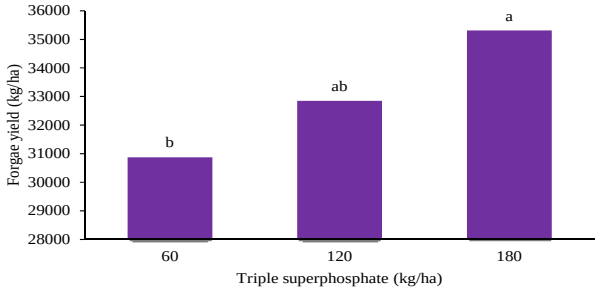

Figure 10. Effect of different levels of triple superphosphate on forage yield.

F. Dried forage yield

The results indicated that different tillage methods significantly affected dried forage yield at P<0.01 and different levels of triple superphosphate significantly affected dried forage yield at P<0.05, but interactions of different tillage methods with different levels of triple superphosphate did not significantly affected dried forage yield (Table 3). Dried forage yield increases by tillage application, but the results showed that there is no significant difference between minimum tillage and disk and plow tillage (Figure 11). The mean comparisons of different levels of triple superphosphate indicated that the highest dried forage yield was 12829.84 kg/ha at 180 kg/ha triple superphosphate (Figure 12).

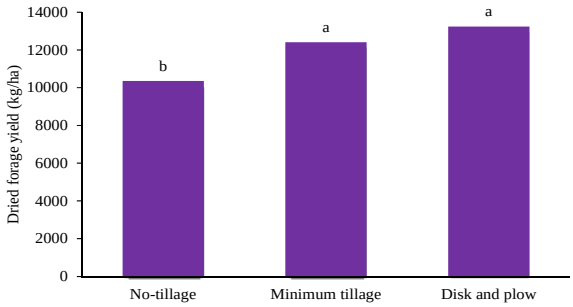

Figure 11. Effect of different tillage methods on dried forage yield.

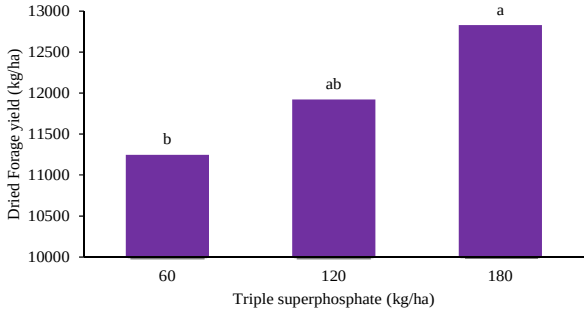

Figure 12. Effect of different levels of triple superphosphate on dried forage yield.

The highest dried forage yield was 14312.81 kg/ha obtained at minimum tillage with 180 kg/ha triple superphosphate treatment and the lowest amount of that was 9895.44 kg/ha and 9956.05 kg/ha observed at no-tillage treatment with 60 kg/ha and 120 kg/ha triple superphosphate, respectively (Table 4).

IV. Discussion

According to the Ossible et al. (1992) showed that in no-tillage system, soil compression at lower layer and thicker and shorter root system cause to decreases of seed and straw yield [13].

Application of tillage management cause to increases of corn yield and saves time, fuel and reduce of soil erosion. The effect of different tillage methods on corn growth were evaluated. The results showed that the maximum amount of growth and germination of corn was obtained at conventional tillage methods (moldboard). The reason of this results is increases of temperature at plowed area and seed location (5 cm depth) [14].

Phosphor is one of the most important elements needed for plant and cause to stronger root growth, thicker stems, massive grain, increase of yield and early maturity [15].

Application of phosphor increases of yield, phosphor uptake, root length and density. Plants affected by phosphor fertilizer treatments produce more roots than the other plants. Phosphor increases photosynthesis, which in turn increases plant growth and yield [11]. Phosphor is

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necessary for growth, cell division, growth and elongation of roots, development of fruit and seeds and precocity [16]. Phosphor is moves from soil to root by diffusion. Diffusion is an important way for phosphor absorption [17].

The experiments results showed that with using of minimum tillage, field corn yield in no-rainy years is higher than rainy years. This results are related to improvement of soil physical properties, less resistivity of soil to water penetration and less soil compaction. Its indirect effects are include fewer weeds, roots growth and vegetative growth [18].

Table 4. Mean comparisons of the effect of different tillage methods and different levels of triple superphosphate on yield and yield component of *Z. mays* L. single cross 704 cultivar.

Tillage	Triple superphosphate (kg/ha)	Plant height (cm)	Stem diameter (mm)	Leaf length (cm)	Leaf area index	Forage yield (kg/ha)	Dried forage yield (kg/ha)
no-tillage	60	150.00^{f}	16.85^{e}	68.00^{c}	2.72^{cd}	25056.83^{d}	9895.44^{e}
no-tillage	120	150.00^{f}	16.94^{e}	69.00^{bc}	2.76^{c}	25201.84^{d}	9956.05^{e}
no-tillage	180	159.33^{bc}	18.70^{b}	64.67^{d}	2.59^{d}	28588.56^{cd}	11219.18^{cde}
Minimum tillage	60	153.67^{e}	17.62^{d}	70.67^{abc}	3.25^{b}	29721.49^{cd}	10845.44^{de}
Minimum tillage	120	154.67^{de}	18.67^{b}	69.67^{abc}	3.20^{b}	33218.06^{bc}	12062.98^{bcd}
Minimum tillage	180	160.00^{b}	18.21^{bc}	70.33^{abc}	3.24^{b}	39634.21^{a}	14312.81^{a}
Disk and plow	60	156.67^{cd}	17.95^{cd}	72.33^{ab}	4.12^{a}	37855.00^{ab}	13000.10^{abc}
Disk and plow	120	158.33^{bc}	18.75^{ab}	72.33^{ab}	4.12^{a}	40132.91^{a}	13751.82^{ab}
Disk and plow	180	167.00^{a}	19.30^{a}	73.00^{a}	4.16^{de}	37711.78^{ab}	12957.52^{abc}

Values followed by different letters in each column are significantly different at $P \leq 0.05$.

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Biogas production yield of anaerobic baffled reactor in low pH and HRT

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***Abstract*—** The purpose of this research is to examine the performance of anaerobic baffled reactor (ABR) in two different operational conditions with focus on biogas production. For this purpose, a pilot with 6 compartments, having overall net volume of 60 liters, was used and inoculated continuously with dairy wastewater. After start-up, the average COD removal efficiency of 82% was achieved for 36 hours hydraulic retention time (HRT). In first step, by decreasing HRT to 18 hours, the overall COD removal efficiency and total biogas production yield were reduced 5 and 24%, respectively. Here, the ratio of methane to carbon dioxide content of biogas was reduced from 1.6 to about 1.14. In the second step, in HRT of 18 hours, the influent pH was reduced below 6 instantaneously. The experimental results show that the COD removal efficiency and biogas production yield were reduced dramatically about 46 and 82%, respectively. As a consequence, the M:C ratio was dramatically decreased to 0.14. It can be concluded that ABR with 6 compartments is rather a robust technology for dairy wastewater treatment and biogas production in low HRTs. However, it seems more susceptible to pH reductions. Therefore, for a well energy recovery, it obviously requires an equalization or pre-treatment unit as neutralization.

***Keywords*—** Anaerobic baffled reactor (ABR), Biogas, Dairy Wastewater, hydraulic retention time, pH, Operation

I. Introduction

Operational stability is as important as organic removal efficiency for biological wastewater treatment units. Different conditions are directly or indirectly in charge of unstable function of these systems. Two typical factors that mainly threat the overall performance are low influent pH and hydraulic shock loads. Generally, low pH affects the enzymatic activity of some microbial groups and may disturb appropriate environmental conditions. Low hydraulic retention time (HRT) has influence on hydrolysis step. For example, in anaerobic process, the conversion of volatile solids to gaseous product is influenced by HRT [1]. High HRT ensures the generation time required for a population of bacteria to double in size as well as controlling solids wash-out. Conversely, the metabolic activities of different bacteria and rapid hydrolysis require that they be in close contact. This can be provided in rather low HRTs. In addition, systems with high HRT require more capital cost and land in use.

High rate anaerobic systems, such as up-flow anaerobic sludge bed (UASB) and anaerobic baffled reactor (ABR) have been introduced as engineered systems for stable operation. These can result in maximizing removal and buffering capacity against the adverse effects of shock loads and toxic compounds. For example, in a recent study, an intermittent operation of UASB was recommended for stable biogas production [2]. ABR has been also identified as a promising solution for urban wastewater treatment. This system is typically defined as a hydraulically based reactor forcing wastewater to be in direct contact with the biomass [3], [4]. The primary advantage of ABR is the partial separation of microbial groups longitudinally down the reactor [5]. The potential of retaining proper biomass within the system by means of hydraulic based function, and the ability of influent equalization providing microbial evolution are other explicit specifications mentioned in literatures [6], [7].

Various researchers analyzed the performance of ABR treating different types of wastewater. For example, low strength municipal wastewater has been extensively studied in which it was verified that ABR has a great potential for practice [8]-[12]. It was also concluded that ABR is able to be used either as an independent or preliminary unit. The latter was recommended to be accomplished by stabilization ponds [13], subsurface horizontal and vertical constructed wetlands [14], duckweed ponds [15], and activated sludge units [16]. Furthermore, wastewater and substrates containing alcohol based desizing of textile industries [17], textile dyes [18], heavy oil [19], swine wastes [20], Pulp and paper mill [21], high sulphate [22] and acidic zinc concentration of influent [23], Soybean protein processing [24], dilute aircraft de-icing fluid [25] and dilute soluble and colloidal [26] were investigated thoroughly. However, treating dairy wastewater was studied by UASB [27], the performance evaluation of ABR treating dairy wastewater can be introduced as a novel approach. In addition, very few researches mentioned above have studied the biogas and methane production rate of their systems. For operational challenges and their influence on ABR performance and microbial specifications, the impacts of mesophilic [28] and termophilic temperature conditions [29],

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and start-up period [30] were also evaluated. Yet, the assessment of biogas production, including methane content, in different operational conditions treating dairy wastewater is definitely a new approach for system analysis.

Regarding the literatures, in order to compare the biogas production rate of anaerobic systems in different operational conditions, anaerobic baffled reactor treating dairy wastewater were determined to be analyzed in pilot scale. The purpose of this research is to study the effects of low HRT and pH, as two typical operational upsets, on COD removal, biogas production rate and eventually methane composition in ABR treating dairy wastewater.

II. Materials and methods

A. Pilot setup

In order to investigate the influence of operational conditions for ABR performance, a bench scale anaerobic baffled reactors (ABR) was setup and operated continuously for 6 months in ambient temperature (with an average of 28ºC). These pilots were made of Plexiglas in total and net volume of 75 L and 60 L, respectively. These systems consisted of equally six chambers through the standard practice with internal size of 94 cm length, 16 cm width, and 50 cm depth [7]. Each chamber was divided by vertical baffles having up-flow to down-flow parts by a ratio of 3:1 as recommended in other studies [6], [31]. The sampling and discharge valves were located on the side (with 30 cm distance from the bottom) and beneath, respectively. The biogas formed in each compartment was directly discharged through the exhaust valves located on the top without any mixture with the content of other chambers.

B. Start-up

Start-up was initiated with the batch mode of ABR by seeding the mixture of cow dung and sewage sludge at the ratio of 1:2 (50% v/V) on effluent wastewater in each compartment for 2 weeks. The biomass content was recycled for homogeneity in the same period as per standard practice [6], [30]. The ABR was then inoculated continuously by dairy wastewater starting from 25% loading rate and gradually increased to 100% over 35 days. Here, the system was operated at overall HRT of 52 hours for about 50 days as an acclimatization period. This was performed continuously by peristaltic pumps feeding from the equalization tank of dairy industry wastewater treatment plant. The start-up period was continued till the chemical oxidation demand (COD) removal has reached a constant level while the ratio of the volatile fatty acids to total alkalinity concentration was observed to be maintained below 0.25. The HRT of ABR was then reduced in two steps and maintained constant for about one month on 36 hours and 18 hours. This was carried out to find the effect of HRT on biogas production in ABR. In the second step, when the system was running in 18 hours retention time, HCl 1 N was added for a month as standard practices [32] to the feeding tanks to reduce and keep the influent pH below 6 (5.8 ±0.2). The performance of ABR was then compared with other operational conditions.

C. Samplings and tests

The whole samplings were performed weekly to analyze chemical oxidation demand (COD), pH, and oxidation reduction potential (ORP) values in the whole chambers and the effluent of system. These parameters were measured after based on standard methods for the examination of water and wastewater [33]. The gas composition was also analyzed to find the percentage of CH_4 and CO_2 measured by gas chromatography using thermal conductivity detection (GC-TCD). For this purpose, it was assumed that biogas was totally constituted of methane and carbon dioxide and other compositions were assumed not significant.

III. Results and discussion

In this research, the experimental results were carried out in 2 steps to evaluate the effects of operational conditions on the performance of ABR and biogas production. Fig. 1 illustrates the total biogas production yield and COD removal efficiency (%) through the six chambers of ABR. It is obvious that passing substrate through the compartmentalized configuration of ABR could gradually make the organic loads decreased. However, in 36 hours retention time, the most of biogas and methane are produced in the second and fourth chambers, respectively. It means that the HRT and substrate concentrations were quite enough that methanogenesis has occurred in even in the initial chambers (Fig. 2). Moreover, it was observed that methane formation was dominated in comparison with carbon dioxide in the second and third chambers which remained constant to the last. The average biogas production rate was calculated as 0.16 d^{-1} in which methane and carbon dioxide composed of 61% and 39% of biogas, respectively.

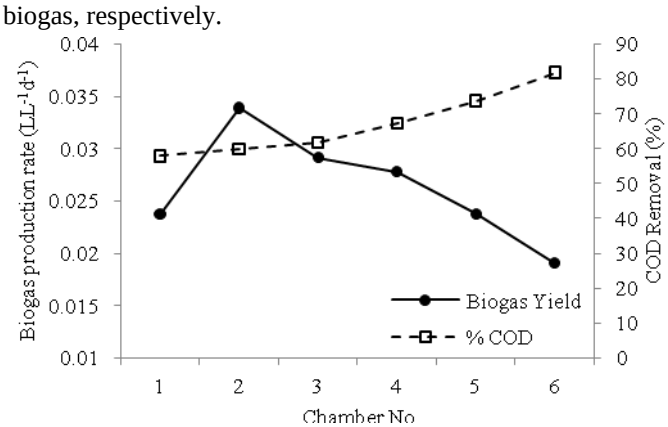

Fig. 1 Biogas production yield and COD removal efficiency in 36 hours HRT

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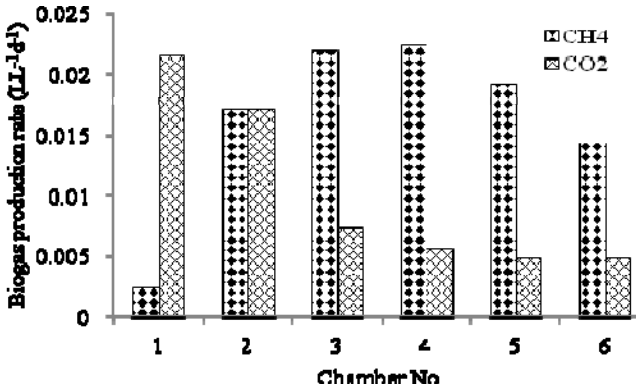

Fig. 2 Methane and carbon dioxide production rates through ABR in 36 hours HRT

As illustrated in Fig. 3, a reduction in HRT to 18 hours could not significantly reduce the overall COD removal efficiency of ABR in comparison with 36 hours HRT. It was decreased to 77% showing only 5% reductions. However, this difference was about 22% in the initial chamber. It shows that the compartmentalized configuration of ABR is effective against hydraulic shock loads. It could effectively compensate the low removal efficiency of initial chambers as predicted by artificial neural network previously [7]. As a consequence, methane production was initiated in the third and dominated in the fourth chamber (Fig. 4). It was implied that decreasing retention time may result in a delay for methane formation and consequently COD removal. This emphasizes on this fact that ABR should be necessarily designed in its optimum configuration. This mainly includes the total number of compartments and HRT. However, it seems that the former is more important. It not only preserves the overall COD removal efficiency but also makes it a more productive system for biogas. Here, the average biogas production rate was determined as 0.12 d^{-1} and the methane and carbon dioxide were 53% and 47% of its content, respectively.

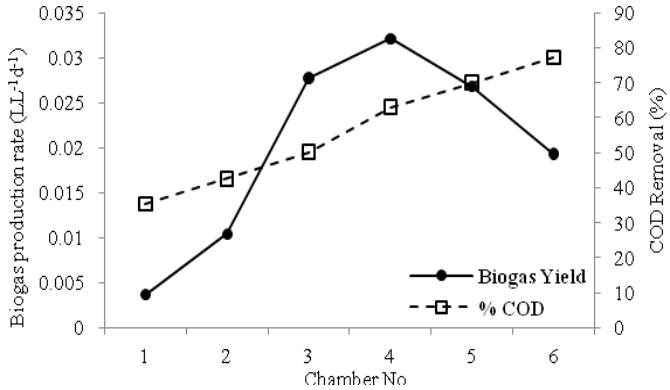

Fig. 3 Biogas production yield and COD removal efficiency in 18 hours HRT

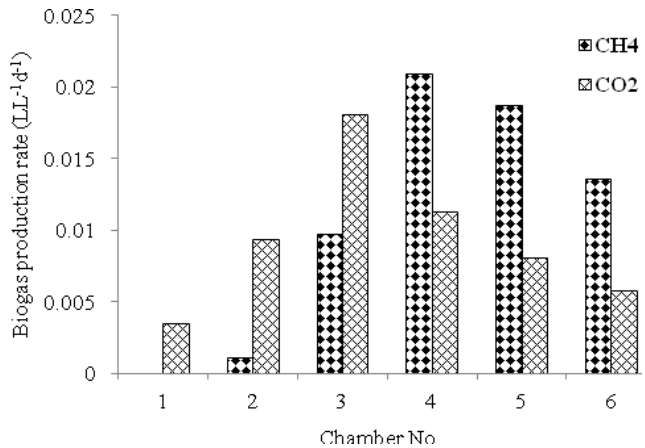

Fig. 4 Methane and carbon dioxide production rates through ABR in 18 hours HRT

This configuration of ABR was not significantly susceptible to the low HRTs. Conversely, a pH reduction to below 6 has significantly reduced the overall COD removal of the system in the second step. As demonstrated in Fig. 5, pH reduction resulted in 48% reduction in overall COD removal (from 77% to 31%). It seems that has more detrimental effect on ABR performance in comparison with HRT. Here, the configuration could not compensate the consequences of pH reduction. In addition, Fig. 6 shows that biogas production and particularly, methane formation was totally stopped in initial chambers. Only carbon dioxide as a matter of acidogenesis could be produced. However, methane could hardly emit in final chambers. Here, the average biogas production was reduced to 0.02 d^{-1} in which it contained methane less than 15%. This is due to the fact that in low pH, the equalization step of anaerobic process cannot kinetically compete with the fermentation, and consequently it inhibits methane formation.

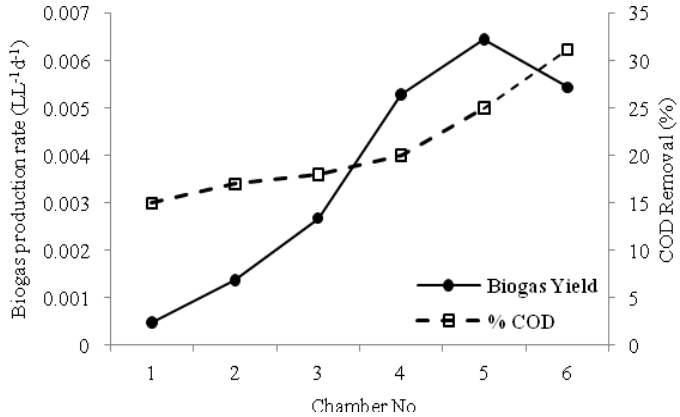

Fig. 5 Biogas production yield and COD removal efficiency in low pH

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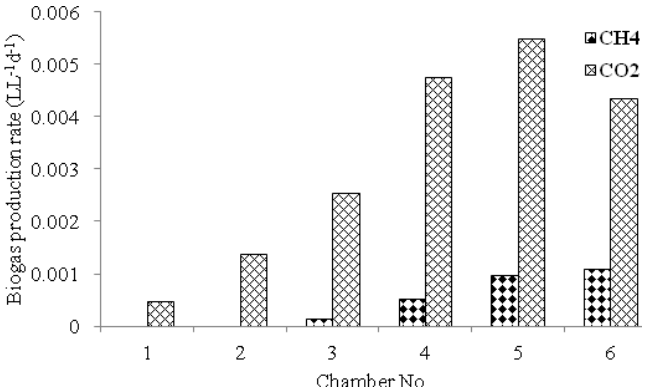

Fig. 6 Methane and carbon dioxide production rates through ABR in low pH

In should be discussed that ABR in its optimized configuration, is able to provide three steps to complete the anaerobic process. They are here termed as fermentation, equalization, and methane production. These can take effect in initial, middle, and final chambers, respectively. The long chain organics (i.e. proteins or carbohydrates) are hydrolyzed in initial chambers where acidogenesis bacteria produce volatile fatty acids (VFAs). As a consequence, the value of VFA ratio to alkalinity would then be increased which reduces pH level. This procedure can even increase the ratio of BOD to COD in the mixed liquor by discharging VFAs and soluble microbial products (SMPs). In middle chambers, the concentrations of by-products, such as hydrogen and acetate, are increased where biogas is mostly made of carbon dioxide [34], [35]. In these two steps, ORP is continuously reduced to provide obligate anaerobic condition for the third step. In final chambers, it probably can be verified that the digestion of VFAs, acetate, carbon dioxide, and hydrogen by different methanogens, decreases the values of by-products where methane is increased significantly in the biogas.

It is noteworthy that the efficient and stable operation of anaerobic process and reactors, particularly in high COD concentrations, totally rely on the equalization characteristics of anaerobic system. This not only provides appropriate environmental conditions, but also may cause acetate generation and reduction of hydrogen partial pressure [36]. All are required for stable acetoclastic methane formation. As a result, the operational indicators of pH and ORP, as the process tracing tools in association with VFA concentrations can focus on the process in details while the ratio of methane to carbon dioxide formation and COD removal rate can outline the overall performance. Since the effects of operational conditions of pH variation and hydraulic retention time in industrial wastewater treatment is totally required to be analyzed in long terms, total COD removal, biogas production rate and its content are compared in this study and illustrated in Fig. 7.

In all operational conditions studied in this research, ORP was gradually reduced from -100 mV in initial chamber to below -250 mV in the fourth chamber to the last. It verifies that the last two chambers provided suitable chemical conditions for the growth of methane formation bacteria. This configuration confirms a big success in HRT reduction. Furthermore, it can be discussed that reduction in COD removal efficiency (%) through the system can directly represent a decrease for methane content of biogas (%) in operational conditions. Conversely, this emits more carbon dioxide instead.

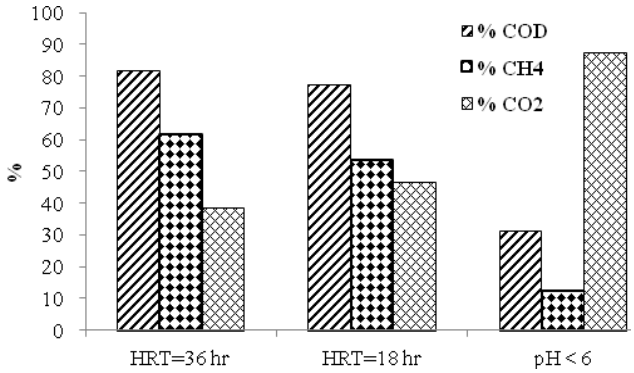

Fig. 7 The comparative results of COD removal, methane and carbon dioxide content of biogas in ABR

The final product of anaerobic system is biogas, which was analyzed here through the volume produced and its composition. The latter highlights the potential energy may be achieved. If the content of methane dominates carbon dioxide, the biogas energy recovery would be more economical. It surely depends on how the anaerobic system performed. As illustrated in Fig. 8, the ratio of methane to carbon dioxide increased through ABR in whole conditions. However, in low HRT and particularly low pH, this value is considerably less than optimum operational condition of dairy wastewater treatment. Therefore, it can be recommended that a neutralization or equalization step may be useful for sustainable operation of ABR. It can include using chemical additives or more novel technologies based on electrolysis-enhanced methods [32].

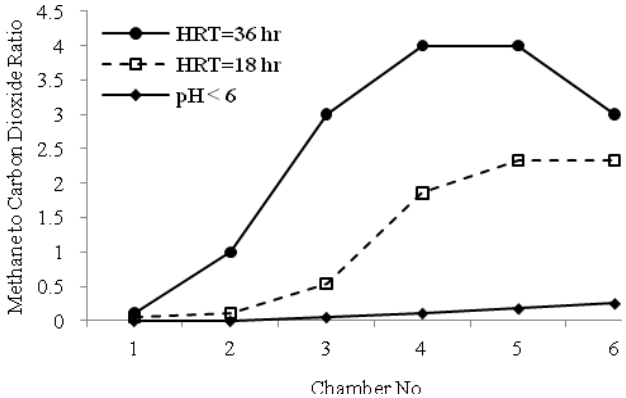

Fig. 8 The ratio of methane to carbon dioxide for different operational conditions in ABR

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IV. Conclusions

This research studies the performance of ABR and its biogas production rate treating dairy wastewater in different operational conditions. Regarding the results, it can be concluded that ABR is more susceptible to pH variations in comparison with hydraulic retention time reduction. This could be due to the compartmentalized configuration of ABR. The adverse effects of pH reduction on microbial activity could not be compensated as well as HRT reduction. As a consequence, the total biogas production rate is decreased and carbon dioxide has totally formed the biogas. It implies that for a well energy recovery via anaerobic systems like ABR treating dairy wastewater, and well biogas production, the equalization of influent and pH neutralization is essential. Furthermore, ABR should have enough chambers in its design and operation.

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Assessment tourism abilities of protected region parvar in Semnan

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***Abstract*—**Profit by nature and touring init that now called ecotourism is important part of tourism activities. Various weather, existing nature gifts in Mahdishahr also historical greats heritage and cultural, art, cultural, architecture, hand craft precious works and also different and beautiful attraction such as parvar protected region with different worth, beautiful valley splendid slop and heights, vegetable and animal special led to this region have necessary abilities for any enjoying and programming particularly in different part of tourism and ecotourism. Parvar protected region and Mahdishahr city play a special role in dividend system field to extension country tourism using enjoying various abilities in different fields .About study results can considered as model pattern for applying environmental abilities and systematic outlook in developmental programming and recognition necessary capabilities for different part of tourism and ecotourism and led to compiling regulations and laws for kinds of permissible and conditional application in region.

***Keywords*—**Ecotourism, Stable Development, Tourism.

INTRODUCTION

Tourism is one of people activities that take place in different societies gradually, transformed with changing people life style and came to now stage. In today world, travel and tour not only is one of big international commerce source, but also is as important instrument for cultural development and growth. Tourism as a policy is a art and perhaps is a attribute having benefits that its development in a fit country is meaningful. Iran with having tourism attraction provided with responsible having management policy can became as a most important of world tourism poles and get meaningful foreign currency return.

Mahdishahr with having natural potential abilities and equipments, ecological various properties, ecological attractive view, various historical building and economical and cultural attractions is very important as one of important agricultural regions. Above mentioned environmental ability cause to region have necessary capabilities for any special programming in ecotourism and tourist different parts [1]. Therefore recognition natural potential, ecological view, profitable environmental resource, cultural and natural attraction and preservation bioenvironmental precious works can have high economical effect in Mahdishahr (specially parvar protected region) and cause to employment and get return on region. In this study objective is recognition abilities of above mentioned region – parvar protected region for programming in ecotourism and its effects on parvar and Mahdishahr for reaching stable development.

A theory that bring up is that seems that recognition tourism and ecotourism abilities of Mahdishahr can provide economical and social development. In analysis information SWOT model has been used. Analyzing with this model minimize one of important instrument of strategic management for conformity weakness and strengthens with opportunity and threat. First with regarding to done studies about region internal and external environment, list of strength weakness, threats and opportunities were recognized and finally for removing or minimizing weakness, threats and improving strengths of existing opportunities relate to extension of tourism in studied protected regions and suitable strategies has been provided.

Table. 1 SWOT matrix and the way of determination strategies

Weakness W	**Strengths** S	**Matrix** SWOT
Strategies WO	**Strategies** SO	**Opportunities** O
Strategies WT	**Strategies** ST	**Threats** T

Reference: Makhdum, 1993

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GEOGRAPHICAL SITUATION

Parvar protected region is situated in Mahdishahr city. This region limited to Mazandaran from North, Shahmirzad from South, to Damghan from East and to Chashm from West [2].

TOPOGRAPHY STUDIES

Consideration topography of studied region show that it has relative height, as maximum height in Nizwa mountain is 3782 meter and its minimum in Darjazin is 1350 meter. It is evident that region relative height reach to 2432 meter that is meaningful. Based on done studying about region topography maps, slope move than 50٪ with 46٪ have most space with 703km. Totally we can say parvar protected region is a region which have different heights such as high mountain rock, hills and high ground that in some its parts situated pastoral space and shallow valley. A bow mentioned heights have promenade, and worth seeing attraction. These heights in south and east south region have steeply properties, and in middle districts have arboreal vegetable covering with the type of leave needle trees and shrub with sparse pasture species and in north districts there are leaf throw forest trees that were affected by Khazar weather.

GEOLOGY STRUCTURE STUDIES

Most part of studied region have been covered by sedimentary and continental stones. Volcanic and penetrating rocks also exist sparsely. Studied region have crumpled structure with crevasse. These crevasse were divided studied region to various tectonic that each has special properties. Effect of active and young tectonic can be seen in the long of coaterner crevasse as chaing river appearance, extends in the river meanders, changing the rate of jammed or withdrawed sediments in the long of flood way.

HYDROLOGY AND CLIMATE STUDIES

Parvar protected region is situated in southern slope of eastern Alborz mountain range that from north districts way affected by weather of north circumstances and from south way affected by atmospheric system on Iran central plateau. Mean rate of atmospheric raining in north districts of parvar is 500 mm because of forest covering, is 260mm in central and south districts and in east south districts reach to 150mm, really raining rate is decrease from north to south and east to west parvar protected region have a permanent river range that were originated from outside of region in heights named Nizva and after passing west and north districts in the placed named kasha Roodbarak exit region and formed one of branches of Tajan in Mazandaran, and many canal and stream reach to this river that meaningful water and we can say that parvar region have good water situation because of shallow flowing in western north and north but in other region shallow flowing or not exist or isn't meaningful.

PLANT COVERING OR SOIL STUDIES

Regions soils with means slope include low heights mountains with the slope 15-30٪ this soils cover most part of region and include number one pasture a have many potential for grazing. Low slope skirt soils include plateau districts and is situated on southern parts of limited space of studied region and from north to south include to steeply soils with mean abilities for pasture and nomadic soils with low to mean ability for irrigated forming. Parvar forest regions can know as Khazar Phylldeforest that are affected by Khazar weather and humidity and needle leaf forest (orszar) that cover limited space of region specially north and west north districts and formed less than one-five its area.

HUMAN STUDIES (POPULATION - ECONOMIC)

Population statics survey on different period of census suggested that most parvar region residence faced to population decrease. For example population of Telajem was 91 in the census of 1365 and was in 1385, or Kulim faced to decreasing. This subject was seen in more village of course in studied village. Kavard is a exception.

Trend of employed in agriculture to total agriculture in Semnan province, Semnan city, Mahdishahr, and studied region during previous decade suggested redoubling this economic part in Semnan province, Semnan city and studied region.

Employment to animal husbandry is a critical index of studied region and Mahdishahr that for preservation, necessity in programming and government economic enormous investing and local responsible are very noticeable. Approximately clans constitute move than half population that with the population 15000 allocated itself nearly 1milion domesticated animal which increased economic importance with producing meat and dairy products and export to adjacent provinces [3].

Aforesaid subject consideration in region suggested that industry haven't accepted and meaningful position in region. Service and trading activities that done on studied village zone often are related to foodstuffs retailing services and alimentation, vehicles repair shops and house goods. According to received information in studied region there are one village cooperative company (Telajim), one bath 7 Islamic assembly. All villages access to filtrated water, electricity, and most villages cover a radio waves and original TV channels(1 and 2) also existence telegraph center has been reported.

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Table. 2 Population transformation in village of parvar

Number of family2006	Population in 2006	Number of family1996	Population in 1996	Number of family1986	Population in 1986	Village
5	5	3	8	6	24	Parvar
7	16	16	58	17	91	Telajim
8	17	3	7	20	49	Roodbarak bala
7	25	14	59	15	88	Finsek
30	85	8	25	12	37	Kavard
21	41	23	66	30	145	Kulim
12	18	8	19	-	-	Roodbarak pain

Reference: Iran statistic center, 1996-2006

Table. 3 Total area of irrigated farming lands in village of parvar

Total area of irrigated farming lands	Village
33	Parvar
50	Kulim
Not reported	Kavard
24	Telajim
20	Finsek
1	Roodbarak bala
5	Roodbarak pain

Reference: Semnan General design,1999

ANALYZING BASED ON SWOT MODEL

For providing policies and strategies for development tourism in protected regions, recognition factors (SWOT) for remaining weakness, threats and improving strengths are inevitable. Based on this, policies for development this regions with listing most important strengths and opportunities aimed:

1-Plan for aggressive strategies based on exploitation competing preference of protected regions.

2-Explaining most important opportunities for removing inter-region weakness by providing reviewing strategies for re-allocation resources.

3-Plan of most important inter-region strengths for removing intra-region threats, with emphasis on variation strategies for removing protected regions necessities.

4-Plan of defensive strategies for removing regional vulnerability just as we can see from table 7 external opportunities, 9 external threats and 10 internal weakness have been identified and considered. Therefore totally we can say vulnerability threshold this region are very high and required providing and reviewing suitable policies for removing weakness and threats using opportunities and strengths.

Table. 4 Matrix SWOT

External	Internal
•opportunities(o): O1=Increasing more motive for travelling and tour on parvar O2=Nearness to population and political poles-Mahdishahr and Semnan O3=Increasing government attention to programming and investing in tourism O4=Increasing motive of private part to investing in tourism part O5=Skilled and expert forces adjacent to this regions (specially semnan)	**•Strengths(s)** S1=Beautiful and unique view S2=High summit and heights S3=Sport and recreation attraction in studied region S4=Easy and suitable access to this region for tourists S5=Nearness to semnan, Mahdishahr and Shahmirzad S6=Traditional and local culture and ceremonies also historical and worth seeing places S7=Quiet and silent

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O6=Governmental and nongovernmental organization and constitution for supporting and providing services and facilities to studied region O7=Increasing attention and protection authorities of tourism with employment and getting return from protected regions	environment S8=suitable market for selling agricultural product, etc to tourists
Threats(T): T1=Increasing services and facilities in competitor tourism region (specially north) T2=Lack of providing license and facilities from government for extension and development tourism equipments and installation in this tourism regions T3=Increasing tourism rage and motive for travelling to adjacent regions T4=More population and crowding this regions compared to competitor region in future T5=Water, soil and climate pollution this regions T6=Increasing social violation with arrival tourists T7=Destruction trees and plants covering and pasturage T8=Destruction agricultural lands and rural farms T9=Destruction local culture and tradition	**Weakness(W):** W1=Unsuitable residing facilities and equipment W2=Unsuitable service and hygienic facilities W3=Region people untendency to investing in tourism W4=Unsuitable recreative facilities and equipment W5=Lack of skilled and expert forces on studied region W6=Unsuitable distribution of tourists in different seasons W7=Unsuitable environmental sub structure W8=lack of governmental programming and investing in this region W9=Different between culture of tourists and region residents W10=Lack of acquaintance of villages and lack of them education about their contact with tourists

Reference: Researcher Analyzing studies

Furthermore in this part have been tried rather than above cases, assess most advantages, and limitation for prioritizing alternative in the view of people, authorities and tourists to get a qualitative result and more critical logic. Then have been prioritized regard to provided opinions. Now each of weakness, strengths, opportunities and threats have been analyzed and considered in the view of three partnership group in this survey.

1-Authorities: Analyzing SWOT suggested that beautiful view components and green environment and gardens, then after that springs and different attraction are very important in parvar tourism development in the view of authorities.

Also increasing more motive for travelling among people is most important external opportunity in the view of authorities although lack of desired facilities and services component in competitor regions compared to this region are less important external opportunity for develop tourism.

2-People: Also analyze SWOT show that beautiful view garden and green environment are most important internal strengths and suitable market for selling agricultural products to tourism are as less important internal strengths in development and extension tourism in the view of people. Furthermore , unsuitable residing equipment and facilities in the region are most important internal strengths and un tendency to investing in different parvar of tourism are less important internal weakness in the view of people.

3-Tourists: With regarding to table and SWOT model we can say that beautiful view, gardens and green environment are most important internal strengths and local and traditional culture and tradition are as less important internal strengths in tourism extension in this region in the view of tourists.

About external opportunities tourists believed increasing more motive for tour and travelling among people are most important external opportunity and lack of suitable desired services and facilities in competitor region because of high crowding are as a less important for extension tourism in region.

CONCLUSION AND SUGGESTION

Parvar protected region for having different natural view and bright historical antecedent can turn to one of internal tourism important centers and following strategies can be useful:

1-Setting skilled and proficient director in protected and historical places.

2-Increasing basically and tourism facilities specially pay attention to residence.

3-Informing tourists about the way of people living and culture and region attractions.

4-Preventing pollution environment by tourists.

5-Introducing tourism attraction of Semnan by mass media specially Semnan TV and radio.

6-Apointing stable price for goods and services.

7-Strengthening tourism agency and establishing hotels and hospitality centers with suitable quality and price.

8-Providing long-term loan with low profit for ones who want to investing on tourism.

9-Establishment installment tours for poor people.

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Review of effective parameters on the nanofluid thermal conductivity

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***Abstract*—**Nanofluid is produced by distribution of solid nanoparticles in a base fluid such as water, organic fluids, glycol, oil, lubricants, or other fluids. In such a technique, increase in conductivity is the main idea of enhanced heat transfer in fluids. In this paper, an introduction to the needs of using nanofluids are presented follow by preparing procedure and its applications as well as the effective parameters on nanofluid conductivity. The investigated parameters in this paper are: nanofluid type, nanoparticle shape, and size, acidity, base fluid type, nanofluid surface charge, nanofluid concentration, and temperature. The results show that all the mentioned parameters have significant effect on nanofluid conductivity. Therefore, it is important to understand the effects for correct collection of nanofluids.

***Keywords*—**Nanofluid, Thermal Conductivity, Base Fluid, Nanoparticle.

I. Introduction

Common fluids, which are using in cooling and heating heat transfer systems such as water and glycol, has poor thermal properties [1]. In the recent decades, many efforts to manufacture capable high efficient heat transfer equipment have been done in order to decrease in energy consumption, cost reduction, and environmental considerations. The main target is reduction in heat exchanger size for the same heat load and increase in the capacity of existing exchangers [2]. Such methods can be used for heat transfer enhancement of exchangers are finned tubes, tube inserts (with different geometry), using nanofluids, twisted tubes, and etc. [3] Nanofluids are produced by distribution of solid nanoparticles in a base fluid such as water or ethylene glycol [4]. The main idea in this method is increasing of conductivity in heat transfer properties of a fluid. In physical viewpoint, conductivity is the ability of a substance to conduct heat [2]. Nanofluids are not a simple mixture of solid and liquid. Some special conditions in nanofluids are required, such as uniform and stable suspension, low clustering of particles, and etc. To achieve to these special conditions different ways are used. The main problem for preparing of a nanofluid is its clustering. For instance, to achieve to the mentioned properties, changing in pH of solution suspension, using of surfactants, disperser, or vibrators can be used [2],[5].

To prepare nanofluids two main common methods are known. One-step process and two-step process. In one-step process, with this technique, nanoparticles are formed and dispersed in a fluid in a single process. However, in two-step process different types and sizes of powders can be used. At the first step, nanoparticle or nanotube is prepared and then is added to the base fluid. It seems this procedure is more economical and suitable for industrial applications in order to easiest preparation of nanoparticles and nanotubes in comparison with one-step process [2],[6].

In general, nanofluids are used in often cooling systems and heat transfer applications such as enhanced in vehicles systems (Radiator and lube oil system of automobile) [7],[8], cooling fluid in nuclear power plants [9], cooling of computer chips [10], cooling in machining process [11], enhanced oil recovery [12], and etc. [13]-[16].

II. Effective parameters on thermal conductivity (Conduction heat transfer coefficient)

Conductivity is the most important parameter in increasing of a nanofluid heat transfer. On the other words, conductivity is one of the effective parameters in conduction and convection heat transfer. The highest conductivity the highest heat transfer rate of each mentioned heat transfer mechanism. Published publications illustrated that in different type of nanofluids (different types of base fluid/ nanoparticle/ nanotube) by adding nanoparticle to the base fluid, conductivity increases and the rate of this is due to different parameters [2]. In order to the importance of conductivity in nanofluids, the effective parameters to this coefficient are studied in this paper. In the current section effectiveness of

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parameters such as nanoparticle type, nanoparticle size and shape, acidity, base fluid type, nanofluid surface charge, nanofluid concentration, and temperature are studied.

A. Nanoparticle type effect

Common materials, which are using as nanoparticle in nanofluids are including chemically stable metals (i.e. gold and cooper), metallic oxides (i.e. silica, zirconia, titanium), ceramic oxides (i.e. Al_2O_3 and CuO), metallic carbides (i.e. SiC), metallic nitrides (i.e. SiN), carbon in different structures (i.e. diamond, graphite, carbon nanotubes, and fullerene), and other nanoparticles [17].

Different types of nanoparticle, which, is added to the base fluid, has significant effect in nanofluid's conductivity. The reason is due to the different conductivity of nanoparticles. As it is shown in figure 1, adding the same amount of different nanoparticles to the same base fluid causes different results in nanofluid's conductivity. The comparison of two type of metallic nanoparticle and a ceramic nanoparticle on the effect of nanoparticle type in conductivity of nanofluids are shown in figure 1. As it is observed, increasing in thermal conductivity of metallic particles in much lower concentrations is equal to thermal conductivity of Al_2O_3. Better results for metallic particles than ceramic oxides is expected, because thermal conductivity of Al_2O_3 is lower than metallic particles. In this figure, it seems increasing in conductivity ration in metallic particles is faster than Al_2O_3 [18].

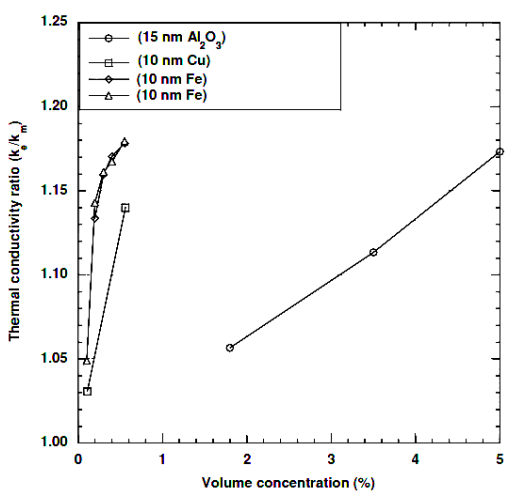

Fig.1 - Dependency of the increasing amount of nanofluid conductivity to the nanoparticle type in base fluid [18]

B. Base fluid effect

Base fluid has also a significant effect on nanofluid's thermal conductivity due to its different thermal conductivity [2],[18]. Different base fluids are used to prepare nanofluids such as water, ethylene glycol, engine oil, etc. [17]. The investigations, which has occurred on Al_2O_3 nanoparticle in base fluids such as water, glycol and engine oil shows that Al_2O_3– engine oil has higher thermal conductivity than Al_2O_3– ethylene glycol and Al_2O_3 – ethylene glycol has higher thermal conductivity than Al_2O_3 – water (Figure-2). However, thermal conductivity of water is higher than ethylene glycol and thermal conductivity of ethylene glycol is higher than engine oil [19],[20].

C. Nanoparticle concentration effect

Nanoparticle concentration effect on nanofluid thermal conductivity is shown in figure 3. It is crystal clear that by increasing in nanoparticle concentration, nanofluid's thermal conductivity increases [2]. Normally, volume concentrations are below 5% in order to maintain moderate viscosity increases, and an enhancement level up to about 1.3 (30%) is typical [18]. Figure 3 shows the effect of nanoparticle concentration on nanofluid's thermal conductivity for $Al_{70}Cu_{30}$-ethylene glycol and Al_2O_3- water nanofluis. This has been studied for CuO- Water and CuO- ethylene glycol nanofluids too [21]. It should be noted that the difference between slopes in each system is due to the effect of other parameters such as nanoparticle size, nanoparticle type, temperature, base fluid, etc. in some systems this trend is linear while in other is non-linear.

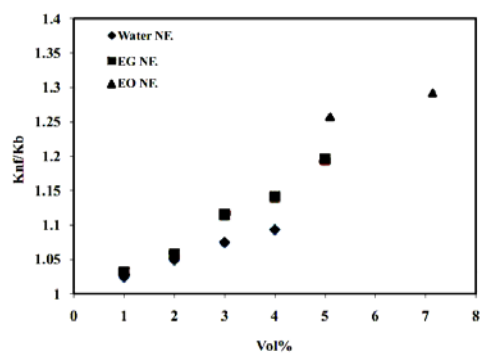

Fig. 2 - Base fluid effect on increasing nanofluid thermal conductivity, containing Al_2O_3 [19]

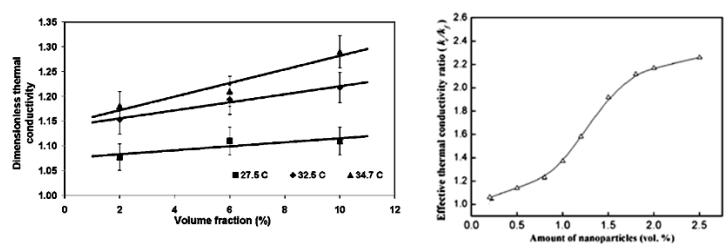

Fig. 3- Right) Thermal conductivity for $Al_{70}Cu_{30}$-ethylene glycol as a concentration functions of nanoparticles [22]. Left) The effect of Al_2O_3 nanoparticle concentration on thermal conductivity of and Al_2O_3- water nanofluid [23]

D. Nanoparticle Shape effect

Nanoparticle shape effect on nanofluid thermal conductivity has been investigated. Comparison of the effect of spherical

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and cylindrical SiC nanoparticle on water-SiC nanofluid thermal conductivity is shown in figure 4. Cylindrical nanoparticles show more increase in thermal conductivity than spherical nanoparticles, the reason is to be due to a mesh formed by the elongated particles that conducts heat through the fluid [18]. Ethylene glycol- SiC nanofluid results also show thermal conductivity increase in in cylindrical particles than spherical ones [18].

E. Surface charge effect

To study the effect of surface charge on nanofluid thermal conductivity three types of surfactant with Positive charge, negative charge and non-ionic has been used in water- Al_2O_3 nanofluid. Results showed that using of surfactant, especially ionic surfactant has significant effect on preventing sedimentation in nanofluids; however, it has no significant effect on thermal properties of nanofluid [27].

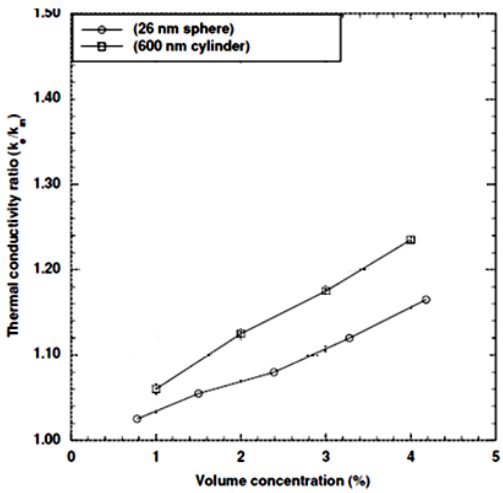

Fig. 4 - The effect of SiC particle shapes in water on thermal conductivity [18]

F. Additive effect

Researchers use additives in nanofluids in order to prepare suspension solution and prevent sedimentation. So many results according to different additives, concentration, and other factors are available in literature. However, most of studies on additives are in thermal conductivity area. Figure 5 demonstrated data from two different study on different fluids and additives. In both studies, by adding the additive, heat conduction increases. Nowadays a little information about the influence of this effect is available [18]. Figure 5 shows the effect of additives on thermal conductivity of ethylene glycol-CuO nanofluid.

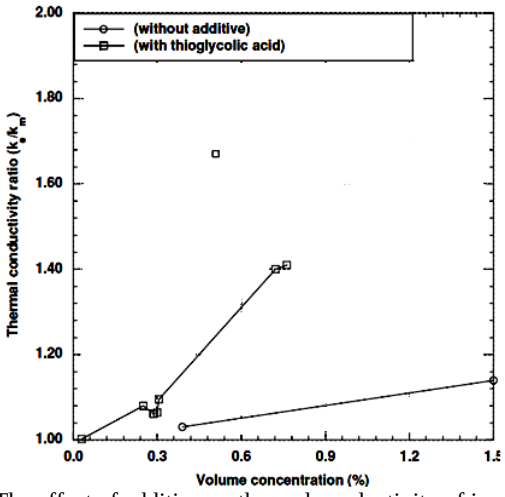

Fig. 5- The effect of additive on thermal conductivity of in water on thermal conductivity ethylene glycol- CuO nanofluid [18]

G. Temperature effect

In general, nanofluid's thermal conductivity is more sensitive to temperature than base fluids. General trend in most experiments shows that increase in thermal conductivity is the result of increase in temperature [18]. The main reason of dependency of conductivity to temperature is particle's brownian motion. In addition, currently particle accumulation and change in viscosity are other reasons for difference in conductivity vs. temperature changes [24]. By increasing in temperature, fluids viscosity declines and brownian motion of nanoparticles increases [24]. Indeed, when temperature increases, surface energy of particles decreases consequently nanoparticle accumulation decreases and in result mean size of particle accumulation declines. Therefore, nanofluid's thermal conductivity is highly dependent on temperature [21],[23], and [24]. In figure 6 increasing percentage of thermal conductivity vs. temperatures is given. As it is illustrated in figure the highest temperature the highest effect of concentration on thermal conductivity [2].

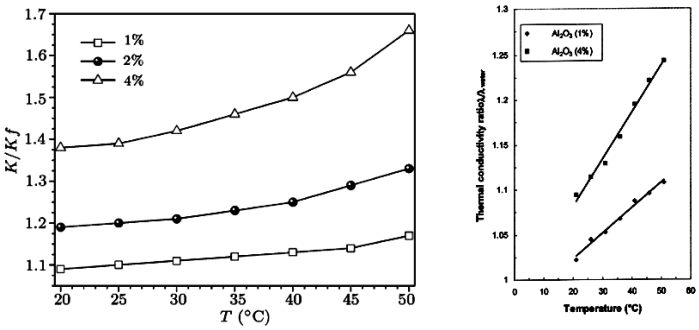

Fig. 6- Right) Dependency of water- Al_2O_3 nanofluid to temperature [25] Left) nanofluid's thermal conductivity changes to demperature in different nanoparticle concentrations [24]

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H. Acidity (pH) effect

Nanofluid's pH is one of the effective factors that increase thermal conductivity of nanofluids compared to base fluid. An investigation on a nanofluid containing Al_2O_3 nanoparticles show that despite of increasing thermal conductivity by increasing of nanoparticle volume fraction, increasing slope in different pH values is different [26]. The results in figure 7 show that thermal conductivity decreases by increasing in pH.

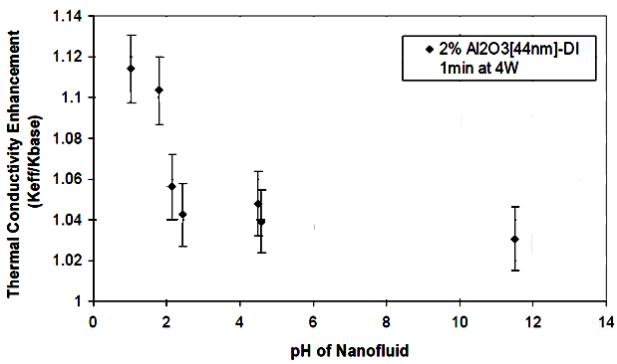

Fig. 7- pH effect on water- Al_2O_3 nanofluid thermal conductivity [26]

When a nanoparticle disperses in water, general behavior of fluid-particle interaction is dependent on particle's surface properties. For water- Al_2O_3 nanofluid iso-electric point 9.2. It means at this pH repulsion force Al_2O_3 particles is zero and this helps particles join each other. Therefore, suspension become unstable. The experimental results show that the best conditions for nanofluid heat transfer is in low pH [2]. However, other opposite behaviors are also reported in literature.

I. Nanoparticle size effect

Difference in nanoparticle size causes changes in nanofluid thermal conductivity. One of these changes may related to the ratio of surface to volume of particles. By decreasing of nanoparticle size, this ratio increases. On the other hand, nanoparticle size is effective on Brownian motion [21], viscosity [28], and nanoparticle accumulation [18] in nanofluid. The experiment's results in order to study the effect of nanoparticles on nanofluid's thermal conductivity don't show the same trend. For instance, in a study on ethylene glycol-silver nanofluid in presence of Polyvinylpyrrolidone (PVP) additive, nanoparticle size effect on nanofluid's thermal conductivity has been investigated. In this study, each experiment carried out for 5 times and the mean of results with ± 3% error has reported. Nanoparticle size vs. thermal conductivity is shown in figure 8. Researchers of this study claim that general trend of thermal conductivity by decreaseing in nanoparticle sizes declines, and the reason is due to agglomeration of 20 nm silver nanoparticles [29].

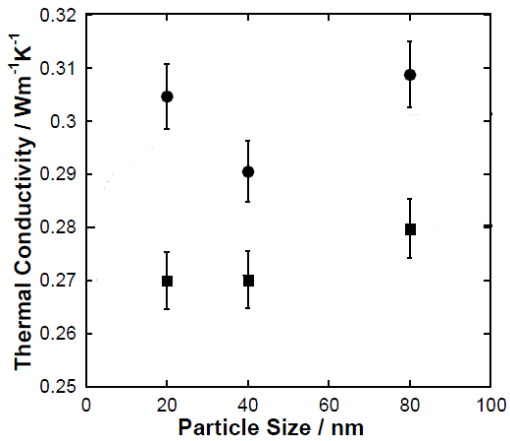

Fig. 8- Nanoparticle size effect on ethylene glycol-silver nanofluid thermal conductivity [29]

Other study has been carried out on seven different sizes of Alumina nanoparticles in 8-282 nm range. Results shows that, thermal conductivity increasing rate decreases by decreasing in nanoparticle sizes under 50 nm. This occurs due to the effect of increasing phonon dispersion when the nanoparticles are small enough. When the nanoparticle sizes increases (more than 50 nm) nanofluid's thermal conductivity increases slowly, somehow, this decreases by increasing in nanoparticle size [30]. It can be mentioned that, using large size of nanoparticles decreases nanoparticle stability and increases the accumulation. On the other words, smaller particles strengthens brownian motion and increase them [21].

In third investigation on water-TiO_2 nanofluid, He et al. [28] reported by increasing in nanoparticle size thermal conductivity of nanofluid decreases vs. base fluid. They justified this manner to the ratio of nanoparticle area to smaller volume. Figure 9 demonstrated differences in water-TiO_2 nanofluid thermal conductivity vs. nanoparticle's size.

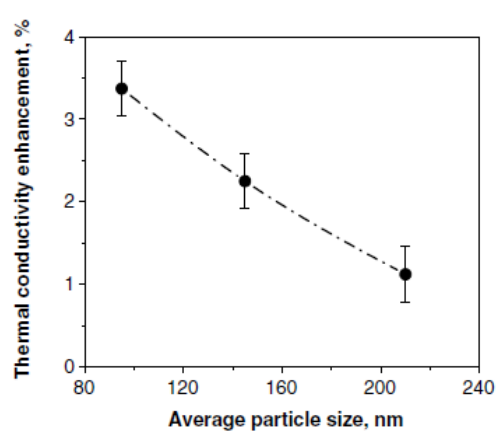

Fig. 9- Nanoparticle size effect on water – TiO_2 nanofluid thermal conductivity [28]

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In other words, the thermal conductivity changes can be attributed to two factors. The first is that when particle get smaller, its special surface increases. Heat transfer between fluid and particle occurs in their interface. Therefore, it is expected that decrease in particle size increases in interface thus highly increase in thermal conductivity. Second, if the phonon mean free path and particle size measurements are close together because of dispersion of main carrier (phonon) at particle's border the thermal conductivity decreases due to nanoparticle's size vs. bulk conditions. Therefore, it is expected that by increasing of special surface, the thermal conductivity of suspension decrease [2].

III. Conclusion

In this paper, the reason why using nanofluids has been discussed; then after, nanofluid preparing procedure and applications as well as the effect of different parameters on nanofluid's thermal conductivity such as nanoparticle type, nanoparticle shape and size, acidity factor, base fluid, nanoparticle concentration, nanofluid surface charge, additives, and temperature has been studied. Results show that, nanoparticle type and base fluid have significant effect on nanofluid thermal conductivity. For nanoparticle size and acidity conflicting results has been found. That means for each individual nanofluid the results may vary and this variation is due to many other parameters. By increasing in nanoparticle's concentration up to an identified range, thermal conductivity will increase.

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Effect Different Tillage Methods and Fe Micronutrient Levels on Yield and Yield Components of *Zea mays* L.

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Abstract— In this study for investigation of the effect of tillage and Fe micronutrient on yield and yield components of filed corn single cross 704 cultivar, factorial experiment based on completely randomized design was conducted. The first factor includes no-till farming, minimum tillage and disk and plow tillage and the second factor was Fe fertilizer at three levels include 0, 15 and 30 mg/L. The results showed that tillage has been affected plant height, leaf area index, forage yield and dried forage yield at P<0.01, but did not affected stem diameter and leaf length. Also, the interaction of Fe and tillage did not significant effect on the measured indices. The results indicated that tillage enhances plant height, leaf area index, forage and dried forage yield. 30 mg/L Fe intake cause to increasing of dried forage yield. The highest plant height and leaf area index was obtained at 30 mg/L Fe with minimum tillage, the highest amount of forage yield was observed at disk and plow tillage with different levels of Fe and minimum tillage with and without 30 mg/L Fe.
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Keywords— Corn, Dried forage yield, Forage yield, Fe, Leaf area index, Tillage.

I. Introduction

Zea mays L. has a lot of different applications and widely cultivated in many countries. Corn is very desirable forage for livestock, and it is unique energy source for livestock and rich from starch [1]. Z. mays is belongs to Poaceae family and due to adaptation to different climate, its cultivation is increasing in most part of the Iran. Due to having the high silo yield, sugar and starch, this plant is one of the best forage crop for silo fodder production [2]. Repka and Dunk (1991) reported that Z. mays is one of the most energizing grain crops for feeding of broilers and laying birds and it has key role in aviculture [3]. Nowadays in addition to the quality of the soil, tillage methods with the least expenditure of energy selected and created optimum conditions for seed bed and plant growth [4]. Land preparation is a series of common operations such as disc plow and harrow, which causes softening and prepare seedbed [5]. Preparing of seedbed provides ideal conditions for sowing. Germination and growth. Seedbed preparation time is very important and it has special role in maintaining of soil physical quality and saving of the fuel [6].

Since conventional tillage break up soil granule at loam and sandy loam soils and increases soil susceptibility to wind and water erosion, so the use of other methods of tillage in dryland farming is essential [7]. Azimzadeh et al. (2002) showed that no-till has the lowest biological yield, straw yield and grain yield [8]. Corn is one of the most important strategic products with high nutritional requirements. Microelements are essential nutrients for plant growth and development, and used lower than microelements nutrients such as nitrogen, phosphorus and potassium. These elements include Fe, zinc, copper, molybdenum, manganese and chlorine. In some plants, such as rice and horsetail, silicon is also a member of micronutrients [9].

The results of the Ronaghi et al. (2002) showed that application of Fe up to 5 mg/ha increases dry weight, but at higher rates decreases dry weight [10]. Abdolsalam et al (1994) study of plant feeding with micronutrients and stated that foliar applications of these elements is better than application at soil and/or seed treatment with these elements increases of yield and yield components of Corn [11]. Whitty and Chambliss (2005) reported that the main problem of corn, sorghum, small grains and peanuts in the central and northern part of Florida is lack of micronutrients such as Fe, zinc, manganese and copper content due to sandy soils with low organic matter, high pH of soil and lack fertilizer in the past [12]. Study showed that micronutrients are increasing production and effective for human health. A simple strategy to achieve economic self-sufficiency and healthy communities

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is adding micronutrients to the soils and uses its foliar [13]. The aim of this study is evaluate the effect of tillage and Fe on yield and yield components of Corn.

II. MATERIAL AND METHODS

Plant material and experimental design

The factorial experiment based on completely randomized design with three replicates was conducted. The first factor was different tillage methods include no-tillage, minimum tillage and disk and plow tillage and second factor was different levels of Fe fertilizer include 0, 15 and 30 mg/L. To investigation of soil status, samples were taken from 0-30 cm soil depth and sent to the soil laboratory (Table 1and 2).

Table 1. Physical and chemical analysis results of soil

Soil Texture	EC (mm/cm)	Saturation Percentage	pH	Organic Matter (%)	Total Nitrogen (%)	Available Phosphor (ppm)	Available Potassium (ppm)	Sand (%)	Silt (%)	Clay (%)
Loam	55	66.2	7.81	4.2	0.2	17.7	121	48	35	17

Table 2. Analysis of soil micronutrients

Depth (cm)	Copper (mg/kg)	Zinc (mg/kg)	Manganese (mg/kg)	Fe (mg/kg)
0-30	1.48	0.82	2.5	2.2

Field was plowed 25-30 cm depth and prepared for planting. In each plot was six-line with four meter length. The spaces between blocks was 1.5 meter and on line in spaces from each plot was fallow. The seeds are disinfected by anti-fungal toxin and were planted as a valvate. In each valvate three seeds planted and covered with a layer of soil. The space on the row was 16 cm and between the rows was 75 cm. one-third of the nitrogen fertilizer (60 kg/ha) was used before planting and two-thirds was used after germination till end of experiment. Fe micronutrient fertilizer was used in two stages, at 8-leaf stage and emerging of inflorescences. Irrigation was every 7 days. Weeds was removed by hand weeding and thinning was performed at the 6-leaf stage. To eliminate of armyworms diazinon at 1.5 per thousand concentration was used. When seeds was dough, the forage was harvested by hand. For measuring of plant height, 10 plants from each plot were randomly taken and the plant height was measured from bed to the top of the first output node. Five plant from each plot was selected at flowering stage and measure leaf area index in four upper leaves of each plant by leaf area meter. After measuring of leaves weight by digital scale, the leaves was dried in the oven at 72°C for 48 hours and then weighted by digital scale.

Data analysis was performed using IBM SPSS Statistics for Windows, Version 22.0 (Armink, NY, USA). Mean comparisons were carried out using Duncan's multiple range test at a probability level of 0.05.

III. RESULTS

A. Plant height

Variance analysis showed that tillage significantly ($P<0.01$) affected plant height and Fe and its interaction with tillage did not affected plant height (Table 3).

Tillage was increased the plant height. The highest plant height was at minimum tillage with average 161.89 cm and the lowest of that was obtained at no-tillage with average 148.78 cm (Figure 1). The different levels of Fe did not significant effect on plant height. (Figure 2).

The mean comparisons on interaction between tillage and Fe showed that applying of tillage and Fe cause to increases of plant height. The highest plant height was observed at minimum tillage with 30 mg/L Fe (164 cm) and the lowest of that was at no-tillage with 15 mg/L Fe (148 cm) (Table 4).

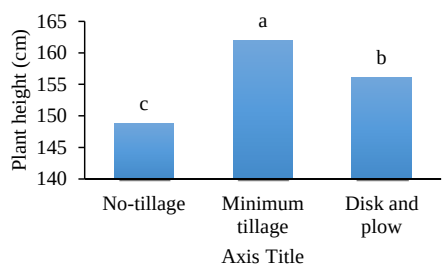

Figure 1. Effect of different tillage methods on plant height.

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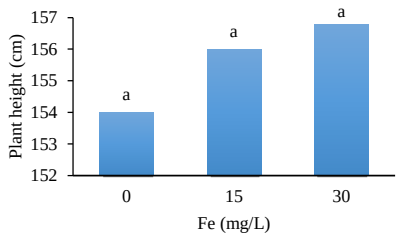

Figure 2. Effect of different levels of Fe on plant height.

B. Stem diameter

According to the variance analysis different tillage methods, different levels of Fe and interaction between tillage and Fe did not significant effect on stem diameter (Table 3). Between different tillage methods the maximum stem diameter was at disk and plow tillage (Figure 3) and between different levels of Fe the maximum stem diameter was at control treatment (Figure 4). The mean comparisons showed that the highest stem diameter was obtained at minimum tillage without Fe (Table 4).

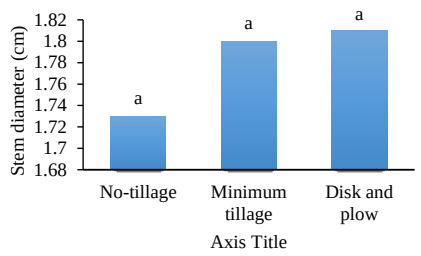

Figure 3. Effect of different tillage methods on stem diameter.

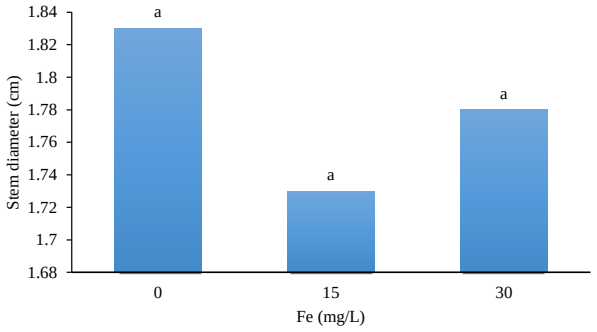

Figure 4. Effect of different levels of Fe on stem diameter.

C. Leaf length

Variance analysis indicated that different tillage methods, different levels of Fe and interaction between tillage and Fe did not significantly affected leaf length (Table 3). The maximum leaf length in different tillage methods was observed at disk and plow tillage (69 cm) (Figure 5) and the maximum of that in different levels of Fe was obtained at 15 mg/L Fe (Figure 6). Mean comparisons of interaction between tillage methods and Fe showed that the highest leaf length was 69.67 cm at disk and plow tillage with 15 mg/L Fe (Table 4).

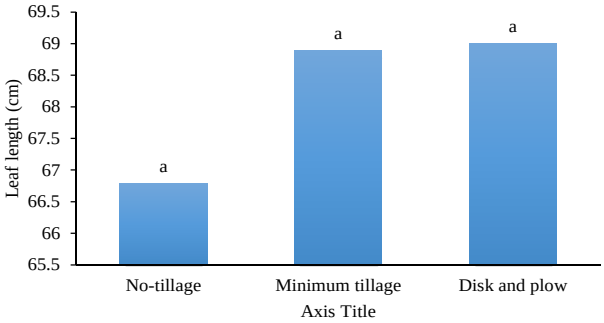

Figure 5. Effect of different tillage methods on leaf length.

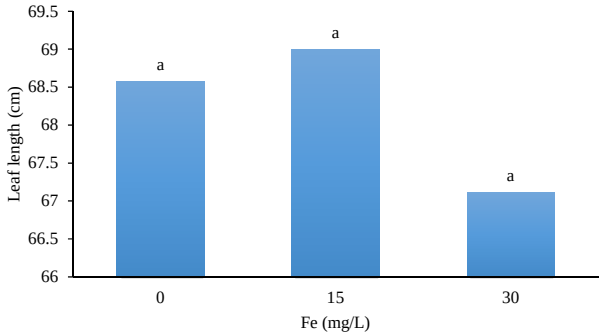

Figure 6. Effect of different levels of Fe on leaf length.

D. Leaf area index

The results showed that different tillage methods and interactions between tillage methods and Fe significantly affected ($P<0.01$) leaf area index, but different levels of Fe did not significantly affected leaf area index (Table 3). Tillage has increased leaf area index, so that the maximum leaf area index was 3.47 at minimum tillage and the minimum leaf area index was 2.77 at no-tillage conditions (Figure 7). The different levels of Fe did not significant effect on leaf area index. The maximum leaf are index in different levels of Fe was 3.1 at 30 mg/L Fe (Figure 8). According to the results leaf area index influenced by

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tillage methods and Fe, the highest leaf area index (3.76) was obtained at minimum tillage with 30 mg/L Fe and the lowest of that was observed at no-tillage with 30 mg/L Fe application (Table 4).

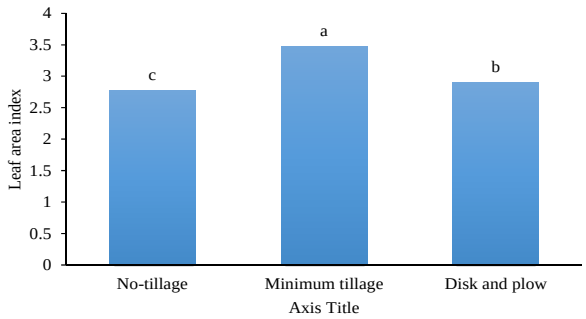

Figure 7. Effect of different tillage methods on leaf area index.

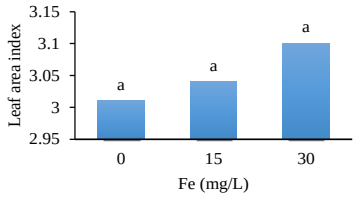

Figure 8. Effect of different levels of Fe on leaf area index.

E. Forage yield

According to the variance analysis results different tillage methods has significant effect (P<0.01) effect on forage yield, but different levels of Fe and its interactions with tillage has not significant effect on this index (Table 3). It was found that tillage can increase forage yields, so that, the highest forage yields was 37546.91 kg/ha at disk and plow tillage (Figure 9). Based on the results, there is no statistically significant difference between different levels of Fe at forage yield (Figure 10). The mean comparisons of interactions between tillage methods and Fe levels showed that the highest forage yield was obtained at minimum tillage with 30 mg/L Fe and disk and plow tillage without Fe and the lowest amount of that observed at no-tillage without Fe conditions (Table 4).

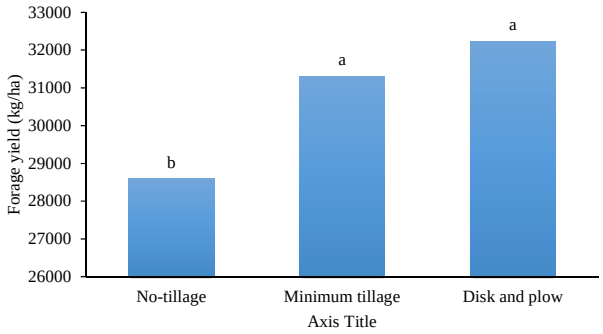

Figure 9. Effect of different tillage methods on forage yield.

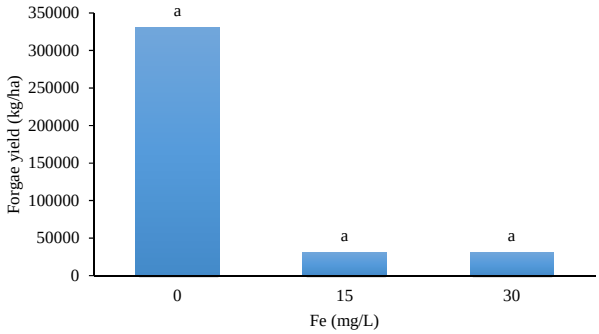

Figure 10. Effect of different levels of Fe on forage yield.

F. Dried forage yield

The results indicated that different tillage methods significantly (P<0.01) affected dried forage yield, but different levels of Fe and interactions of that with different tillage methods did not significantly affected dried forage yield (Table 3). Dried forage yield increases by tillage application, but the results showed that there is no significant difference between minimum tillage and disk and plow tillage (Figure 11). The comparisons of different levels of Fe indicated that the highest dried yield was 11322.42 kg/ha at 30 mg/L Fe (Figure 12). The highest dried forage yield was obtained at minimum tillage with 30 mg/L Fe and disk and plow tillage with different levels of Fe and the lowest amount of that was observed at no-tillage with 15 mg/L Fe and no-tillage without Fe (Table 4).

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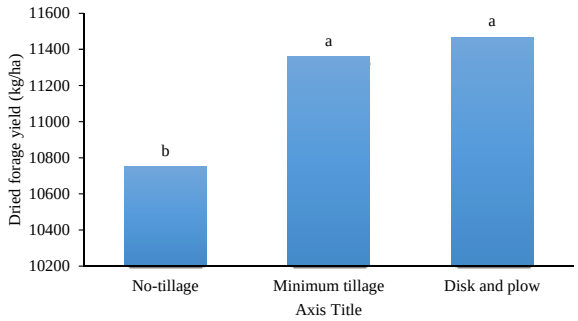

Figure 11. Effect of different tillage methods on dried forage yield.

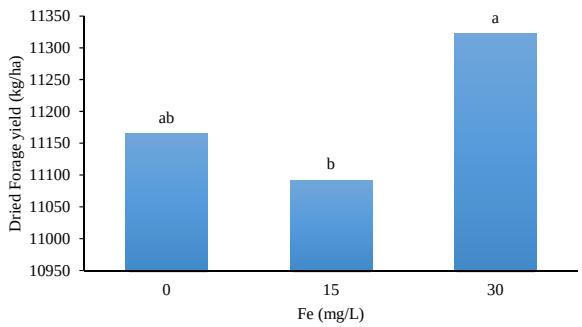

Figure 12. Effect of different levels of Fe on dried forage yield.

IV. Discussion

In no-tillage and minimum tillage systems water infiltration is increases by pores formed by soil organisms. In no-tillage and minimum tillage lands forming of deep rifts in the soil help to increases of soil moisture [14]. Wright and Hons (2005) reported that using of no-tillage system cause to significant increase of aggregates, organic carbon and organic nitrogen of soil [15]. Ismail et al (1994) reported that implementation of minimum tillage system improves the soil structure and increases the soil organic matter and crop yield [16].

Cox et al (1990) observed that the no-tillage and minimum tillage systems increases of soil moisture [17]. The experiments results showed that with using of minimum tillage, field Corn yield in no-rainy years is higher than rainy years. This results are related to improvement of soil physical properties, less resistivity of soil to water penetration and less soil compaction. Its indirect effects are include fewer weeds, roots growth and vegetative growth [18].

According to the Ossible et al. (1992) showed that in no-tillage system, soil compression at lower layer and thicker and shorter root system cause to decreases of seed and straw yield [19]. In one study the effects of different tillage methods on Corn growth were evaluated [20]. Fe has an important role in cytochrome structure, Fe as an electron transporter has a role in photosynthetic systems and involved in the chlorophyll redox and its production [13]. Selisepour (2007) concluded that the using of Fe fertilizers increases yield [21]. Hementaranjan and Garg (1988) reported that application of Fe is significantly increases the yield. He said the increases of yield and yield components due to the effect of Fe on chlorophyll and indole acetic concentration [22].

Increases of chlorophyll by increasing of photosynthesis cause to increases of dry matter yield. Improvement of nutritional status and Fe application affected photosynthesis and light photosystems and cause to increases of growth indices such as stem diameter [13]. Brown et al. (1993) concluded that using of Fe cause to increases of total carbohydrates, starch, protein of seeds and yield [23].

Table 3. Analysis of variance the effect of different type of tillage and different levels of Fe on yield and yield components of *Z. mays* L. single cross 704 cultivar.

S.O.V	df	Mean of square					
		Plant height	Stem diameter	Leaf length	Leaf area index	Forage yield	Dried forage yield
Block	2	16.26^{ns}	0.04^{ns}	0.31^{ns}	0.001^{ns}	$1236467.13.50^{ns}$	21741.86^{ns}
Tillage	2	39.59^{**}	0.02^{ns}	13.97^{ns}	1.25^{**}	32148191.39^{**}	1340390.99^{**}
Fe	2	18.48^{ns}	0.02^{ns}	8.81^{ns}	0.02^{ns}	268879.56^{ns}	125334.67^{ns}
Tillage×Fe	4	10.59^{ns}	0.02^{ns}	7.27^{ns}	0.11^{**}	1142880.66^{ns}	7041.24^{ns}
Error	16	7.09	0.03	4.59	0.001	1485450.73	40566.44
CV (%)		1.71	9.23	3.14	2.74	3.99	1.80

ns: not significant, ** and * are significantly at 1% and 5% respectively.

Table 4. Mean comparisons of the effect of different tillage methods and different levels of Fe on yield and yield component of *Z. mays* L. single cross 704 cultivar.

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Tillage	Fe (mg/L)	Plant height (cm)	Stem diameter (cm)	Leaf length (cm)	Leaf area index	Forage yield (kg/ha)	Dried forage yield (kg/ha)
no-tillage	0	149.67^{ef}	1.79^{a}	68.03^{a}	2.87^{de}	27942.02^{c}	10664.5^{c}
no-tillage	15	148^{f}	1.63^{a}	68.67^{a}	2.76^{ef}	29115.5^{bc}	10661.93^{c}
no-tillage	30	148.67^{ef}	1.77^{a}	63.67^{b}	2.69^{f}	28699.95^{bc}	10928.87^{bc}
Minimum tillage	0	159^{abc}	1.93^{a}	69.00^{a}	3.23^{c}	31618.77^{a}	11370.33^{a}
Minimum tillage	15	162.67^{ab}	1.78^{a}	68.67^{a}	3.44^{b}	30754.31^{ab}	11239.43ab
Minimum tillage	30	164.00^{a}	1.70^{a}	69.00^{a}	3.76^{a}	31523.29^{a}	11467.87^{a}
Disk and plow	0	153.33^{de}	1.78^{a}	68.67^{a}	2.93^{d}	32085.9^{a}	11460.17^{a}
Disk and plow	15	157.33^{cd}	1.79^{a}	69.67^{a}	2.94^{d}	32798.66^{a}	11372.90^{a}
Disk and plow	30	157.67^{bcd}	1.87^{a}	68.67^{a}	2.84^{de}	31780.72^{a}	11570.53^{a}

Values followed by different letters in each column are significantly different at P≤0.05.

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Carbon sequestration, a stable way to conflict against climate changing in Iran and all around the world

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***Abstract*—**Global warming and climate changing resulted from green house gases such as carbon dioxide has caused some concerns. This concern has ended up to considerable attention to soils and its reliability for carbon sequestration permanently. The natural method is the simplest and the most cost effective way to decreasing carbon dioxide. Carbon sequestration can be considered an approach to sustainable development because it involves advantages such as improving some aspect of global warming and climate changing phenomena, desertification, rural development, decreasing poverty, employment, developing new energy, expanding the forest and ranch and so on.

***Keywords*—** Carbon dioxide, global warming, climate change, carbon sequestration, sustainable development

I. INTRODUCTION

GLOBAL warming and the climate change caused by human activities is one of the major environmental problems which scientific and political circles have attracted it in the recent decades. Global warming caused by the increased greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), nitrogen oxides (NO_X), chlorofluorocarbons (CFCs), sulfur hexafluoride (SF_6), ozone (O_3) and water vapor (H2O) in the atmosphere. Also increasing consumption of fossil fuels, deforestation, irregular grazing pastures, changing the land-use and some human activities may lead to the global warming[1]. CO_2 is the most important greenhouse gas which its concentrations have been raising faster than 1.5 ppm in the atmosphere. It is increasing in critical boundary near 450 ppm.

Increasing concerns about global warming and climate change caused to attention to soil and its reliability in carbon sequestration.[1] Carbon sequestration by vegetation is the easiest and most economical feasible solution to deal with the crisis of climate change. Known options to reduce atmospheric carbon and improving the consequences of climate change, including industrial, natural or land-based carbon sequestration[2,3].

II. TYPES OF CARBON SEQUESTRATION

In this method, carbon produced by industries and generating energy facilities compressed in liquid form through industrial and technological approaches. Then they injected to fossil fuels reservoirs and coal ores, deep saline aquifers and deep ocean. Industry generating energy from fossil fuels, cement industry and purification refinery of natural gas are their target industries to obtain carbon dioxide and compressing it. The process of industrial carbon sequestration was performed in three phases including obtaining, transmission and injection of CO_2 into the reservoir that it called carbon capture and storage (CCS). There are many ways to capture or absorb CO^2 in production industries which application of Ammonia compounds in order to absorb carbon dioxide is the most famous one. Although sequestrating carbon dioxide is the first phase and its transmission and storage are the next phases.

In general, industrial carbon sequestration including geologic, oceanic and mineral methods. However, these techniques only are able to reduce greenhouse gases and they are unable to absorb the carbon source and improving the climate changing. In addition, the predicted and unpredicted risks of weather and Environmental effect due to the leakage of these substances in natural areas, abundant cost and non sustainability are the lack of these approaches. However, today some techniques such as artificial tree and fiber bioreactors are manufacturing and developing aimed at absorbing atmospheric CO_2 and compresses it[3].

A. Terrestrial / natural carbon sequestration

Carbon sequestration in terrestrial ecosystems was performed by land resources such as forests, pastures and soils in the biosphere and pedosphere. This process can be considered in the soils and plants. These two areas chase each other to sequestrating carbon in a continuous process which resulted to soil carbon stocks and growing resource[3].

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According to Brooks (1998), Carbon sequestration involves changes in atmospheric carbon dioxide into organic carbon compounds by plants and capturing it for a certain period. Plants sequestrating the carbon by absorption of water, minerals and carbon dioxide as well as control light energy emitted from the sun during photosynthesis process. Then carbon dioxide is converted into carbohydrate. This process requires the participation of three chloroplast organelle, mitochondrion and the peroxisome. Carbon sequestrating in photosynthesis convert into two main carbohydrate products including starch and Sucrose[4].

Carbon sequestration potential differs by plant species, location and management practices. So by knowing the species that has a greater potential for carbon sequestration and considering the management factors which influence the sequestrating carbon process, it can be performed the land reform and pursued in terms of carbon sequestration. It would be a systemic approach to reform and improving the environment. Because in addition to keep the soil quality and quantity, it can be an effective strategies to combat air pollution and climate change crisis and eventually it can be considered a sustainable development[5].

Terrestrial carbon sequestration is a natural approach and a method consistent with the principles of sustainable development and has no side effects listed in carbon sequestration. Environmental protection and restoration of natural areas, helping to improve the consequences of climate change and global warming, with a minimum cost is another feature of this low-cost and profitable technology[3].

B. Effective ecosystems on carbon sequestration

Agricultural, pasture and forest ecosystems are the active environment for carbon sequestration or degradation in the country. Today, carbon sequestration known as the value-added aside commercial use of forest, pasture and natural resources as feed, medicinal plants, subsidiary products, grazing and wildlife, biodiversity and recreational uses[3].

C. Carbon sequestration in pastures

Iranian pasture with 90 million hectares surrounded the 54% of the critical area including 14 million acres of meadow, 16 million acres of desert and desert shrubbery and 60 million acres of pasture[17]. Posture in dry and semi dry is an option for carbon sequestration. Although the total amount of carbon is less than some forest ecosystem, but due to the large extent, carbon sequestration potential is higher than forest land. So, increasing the wood plants biomass has numerous advantages in these areas due to lower cost of carbon dioxide sequestration[6].

According to the United Nations Development Program (UNDP), Iranian pastures able to store one billion tons of organic carbon that it equals 20 million ton of oil.

Deputy of Planning and Statistics of Forest organization estimated the annual ability of forest to sequestrate carbon which its result presented in Table 3.

Table 1 Annual ability of forests and pastures in carbon sequestration in growing regions[7]

number	Habitat	Area (Million Ha)	Carbon sequestration (tons)		CO2 absorption (tonnes)	
			In hectare	total	In hectare	total
1	Hirkani	1.92	55.5	105600000	2.37	391600000
2	Zagros	5.05	6.9	34800000	25.3	127900000
3	Iran- Touranian	3.20	4.1	13100000	15.1	48100000
4	Gulf of Oman	2.1	3.3	6960000	12.1	25500000
5	Arsbarany	0.15	18.6	2790000	68.3	10200000
6	Planting trees	2	8	16000000	29.4	58700000
total		14.42	12.51	180350000	45.91	66200000

D. Carbon sequestration in forest ecosystems

In many countries and environmental organizations in the world, increasing the forest area through afforestation is considered as a solution to decreasing the land warming effect[8]. The forest is the most dry ecosystem that it has a major role in the flow of energy and matter and the conversion them between the land and atmosphere. It includes about 75% carbon storage[15].

Improving soil conditions and appropriate management activities in forested areas is difficult action in order to increasing absorption and soil fertility. Although previous studies about the effects of forest on carbon sequestration show that extending the forest resulted to increase carbon absorption. In addition, it is demonstrated that species composition of forests in the upper epoch has the large effect on carbon input into soil and it changes the amount of soil carbon[8].

More than other types of land uses, the forest ecosystems can capture carbon. Also, sequestration of carbon in forest soil and organic carbon of the atmosphere plays an important role in the carbon cycle[16]. Amount of carbon dioxide in the cycle of nature equals 200 billion ton per year which it received by plants and oceans. This resulted to equivalent of organic gas in the nature.

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Forest ecosystems all around the world play role to absorb carbon dioxide and it prepare a proper condition for turning carbon and storing it in the soil[8]. Forest soil carbon is the result of a balance between input (carcass) and output (microbial disintegration, fire, erosion, and leaching) which is influenced by climate, plant community composition, and microorganisms[9].

About 13 million hectares of forest area were changed to other uses or it wasted due to natural disasters from 2000 to 2010. According to estimates conducted, 850 million hectares of forest in the world are damaged and it needs to rehabilitate and improve the biodiversity for ecosystem services that could eventually play an important role to adaptation and mitigation of climate change.

E. Carbon sequestration in agricultural ecosystems

More studies and research in many countries including Iran demonstrated that agricultural ecosystems mainly act toward the destruction of the land carbon sources. Its main reason is the poor management of the resources of the land.

Impaired development of mechanization and tillage and rotation systems and traditional management in recent decades has been effected on. So, the most of demand for carbon sequestration lies in forest and pasture and their potential. In agriculture, the main approach should be keep the carbon reservation and improving the damaged area. However, given that soil resources involved greater value added in these areas and their managerial structure is complex and diverse, it should be identified the carbon sequestration capacity and its potential within the framework of coherent study to be used for management planning and positioning[3].

Agriculture can reduce atmospheric carbon, since tree and corps require a lot of CO_2 for photosynthesis and they obtained it through air, transmit carbon into soil and store it. Storing Carbon increase soil fertility and it can bring many benefits to farmers. The more organic matter, the degree of porosity and soil water holding capacity improves and performance per unit area increases. The same is true about food of soil and it makes the soil environment a proper bed for microorganisms and beneficial organisms such as earthworms. One of the most effective strategies for stabilizing and storing carbon in the soil is tilled management. Virtually system No-tile farming increases the ability of the soil to hold water and nutrients and thus it produce more products. At the same time, planting cover crops such as alfalfa and other forage that remains in the soil for a long time and not requires plowing are improved soil carbon storage[10].

III- FACTORSAFFECTING THE RATEOF CARBONSEQUESTRATION

Factors affecting the rate of carbon sequestration can be classified into two groups which are environmental and human factors. Soil carbon levels were significantly affected by changes in location, topography, lithology, vegetation type and previous management. Also, at the point view of time, carbon rate varies in growth season and decomposition processes in roots, litter and soil microbial biomass. Carbon sequestration rates per unit of time depend on growth specification of plant species and management practices, changing land use, type of rehabilitation operation, physical and biological conditions of the soil and last soil carbon stocks[7].

Livestock and grazing on natural ecosystems, constantly interacting with each other and as long as the animal population in the ecosystem fits capacity of pasture, it does not damage its valuable resources such as water, soil and plant. Management practices and methods adopting rehabilitation of pastures to enhance pasture production requires adequate knowledge and information about pasture ecosystems[18]. Grazing land is one of the most important and most common types of meadow all around the world and it has the potential to alter carbon stocks in these ecosystems. This fluctuation in soil carbon stocks performs through changes in the biomass and relative contribution of sequestrated organic carbon in biomass of underground shoots, changes in nutrients and water available and the impact on the quality and quantity of input carbon to the ecosystem by changing species composition and diversity of plant communities.

It seems to speed up carbon cycle in grazed ecosystems by grazing process, but the impact of grazing on the ecosystems reserve are irregular and various and its prediction is difficult. However, it is not identified the effect of grazing on sequestrating and stabilizing process of carbon and nitrogen. The result of the study shows the effects of grazing on carbon and nitrogen stocks in grazed and non-grazed lands all around the world. Both of them indicate increasing and decreasing of soil carbon as a result of grazing land. Generally, when the vegetation and production capacity of pastures does not effect by extreme grazing, and animal numbers were in moderate, the amount of organic matter in soil does not change much. However, excessive land grazing resulted toerosion and loss of soil carbon stocks in addition to severe destruction of vegetation. Thisproblemcan be studiedfromtwo aspects. Firstly, the greater part of pastures covers by sagebrush. So, a little change in the carbon sequestration potential on a small scale, may lead to very large and uncontrollable changes at the national level. Secondly, because of the wide distribution of sagebrush lands in the dry and area and due to their fragile ecosystem, damage compensation resulted from loss of carbon and nitrogen in the ecosystem is impossible due to the slow process of carbon sequestration and storage[11].

IV.CARBON SEQUESTRATION IN DIFFERENT COUNTRIES

A. Carbon Sequestration in overseas

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At present, carbon sequestration in different countries such as United States, Canada, Australia, Germany and China often performs industrially. Regardless of their advantages, these ways are in the early stages of development. They may suffer heavy and unpredicted cost and possible unknown effect on environment. For example, ocean carbon sequestrating, despite the reduction of CO_2 can enhance the growth of photosynthetic organisms, and reduce the flow of oxygen, and as result the death of aquatic organisms living there. It can also cause water discoloration, change in photosynthesis, disruption of the life cycle; ocean acidification, warming, and thus it throw into jeopardy the life aquatic ecosystems. Although carbon sequestration by mineral can be considered as an appropriate approach to carbon storage, but requires so much energy and it is not cost effective. The geologic carbon sequestration we will see a stable, solid compounds due to injection of CO_2 into saline formations of basalt. It is considered a positive step for carbon sequestration. Also, CO_2 injection into oil and gas fields resulted to extract more oil as well as these tanks have storage capabilities of CO_2 for a very long time. However it involves unknown risks and heavy cost.

B. carbon sequestration in Iran

Fortunately, carbon sequestration projects in Iran are synchronized with global environmental commitments and programs of the Islamic Republic. Thus, Iran is member of several environmental conventions including the UN Convention on Climate Change (UNFCCC) and United Nations Convention on desertification (UNCCD). Therefore, government has begun wide activities for reduce greenhouse gas and carbon sequestration project in Hosseinabad Ghinab is a sample. Iran currently ranks first win in desertification projects in Asia and the Middle East.

The first international carbon sequestration project in the country has begun since early 2003 with collaboration with the United Nations Development Programm (UNDP) and Global Environment Facilities (GEF) in Hosseinabad of Sarbishe city located in South Khorasan province. It aimed realizing a development priority of the Government of the Islamic Republic for desertification in order to develop models of collaborative management of rangelands in dry areas and semiarid. It resulted to deprivation and increasing soil carbon[12]. Place of project execution is part of 125000 hectares of degraded lands adjacent to Afghanistan and it performed by Afghan refugees in camps of East of the country[13].

The first phase was begun since middle of 2003 and ended in 2009. Because this project concluded successfully, second phase has begun since early 2010 and continued as long as 5 years. Second phase followed sustainability and empowerment of rural development, solving the marketing problems and institutionalization of the participatory model of rural development. After completion of the second phase, the third phase planned and implemented to bring more income for the local community with respect to the provision of adequate income by actions taken.

Overall, this project has three major goals in the following three levels:

1- Global level: the absorption of atmospheric carbon through the restoration of wilderness areas
2- National level: providing a model for increasing productivity arid and semi-arid rangelands and desertification by restoring destructed pasture by public participation.
3- Local level: improving social and economic conditions of local communities, reducing poverty and improving human development indicators[14].

Obtaining the respectful result caused that all success were emphasized in local, state and national authorities, specially about mechanisms for using the local possibility, cooperational management, commercial management based on forming the rural development group.

Successful results of carbon sequestration projects in South Khorasan province make the forest organization and rangeland and Watershed Management to continue this project in area with similar climate, environment and culture. Result will consider again in the areas of natural resources management and re-examined as a national model for future implementation. The project for provinces like Kerman, Alborz, Bushehr, Semnan, Arak, Isfahan and Tehran also are exploring and planning. It was decided that the carbon sequestration projects in Tehran and Kerman provinces will also be enforced. Implementation of the project in the stated provinces will last for three years and now carbon sequestration project is implementing in the region of Kerman province in shahdad.

V. CONCLUSION

Regarding to the impact of carbon dioxide in causing environmental crises such as global warming and climate change, any action concluded to reducing the related gases in atmosphere and moderate pollution can be considered a positive step to survive. It seems that natural and terrestrial carbon sequestration method is the most effective approach for solving the current crisis. Because other methods of carbon sequestration do not moderate the pollution, it also is costly and requires further investigation. In addition, it involves environmental risk. Carbon sequestration in terrestrial ecosystems is an approach naturally, in principle, with no side effects. It doesn’t involve disadvantages listed in industrial carbon sequestration and is in line with sustainable

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development. In this way, in addition to less cost than the industrial methods contains advantages such as desertification, increased levels of meadows and forests, reducing poverty anddeprivation, employment, immigration reduction, rural development, agricultural improvement, helping to improve the consequences of climate change, mitigation of global warming, providing fodder, fuel and ancillary products, medicinal plants, stylized air, supporting wildlife and protecting water and soil. Iran is considered as leading country since conducting the land-based carbon sequestration projects from 10 years ago in Sarbisheh, South Khorasan. In this field in the Middle East is concerned. However, there are several preventive factor such as non facilitate the issuance of visas and work permits for counselor of international agencies, non-specified training courses and periodical visits for similar and successful overseas projects for local peoples, not allocation of credit and certain single-tier funds for international projects, the lack of proper coordination between relevant agencies, organizations need to develop a business strategy or legal, administrative order to sustain and legal entities composed by people, not educating expert as well as replacing the senior project manager in during implementation of the project. We hope to be able to implement carbon sequestration projects in other parts of the desert in order to solve environmental problems and to step forward a developed country.

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Laboratory Study on Nematicidal Effect of Methanolic Extract of Two Medicinal Plant from the Family of Solanaceae on Root-Knot Nematode "*Meloidogyne Javanica*"

Maryam Fayaz[1]

Abstract—Root-knot nematodes are an important factor causing damage to agriculture. Recently, much attention has been paid to the use of medicinal plants as an efficient method for pest and pathogen control. This paper attempts to study nematicidal effect of different concentrations of methanolic extract of Datura (Datura stramonium) and Nightshade (Solanum nigrum) on prevention of hatching and mortality of second-instar larvae of root-knot nematode in factorial experimental design in a fully random manner with four repetitions. Statistical data analysis by SAS indicated that the methanolic extract of the aforesaid plants has a significant effect on prevention of hatching and mortality of nematode larvae compared with control treatment (distilled water).

Keywords—Datura, Methanolic Extract, Nightshade, Root-Knot Nematode

I. INTRODUCTION

ROOT-Knot Nematode is one of the most important and most widespread pests causing damage to agriculture. Due to considerable economic losses inflicted by these nematodes, a lot of measures have been taken so far to manage and control them [9]. The activity of root-knot nematode and reaction of host plant results in development of several knots on the root, which interrupts water and food absorption system of the plant [3]. Among popular methods for controlling root-knot nematodes are physical methods (soil solarization and flooding), farming methods (crop rotation, weed removal, contaminated roots removal, fertilization, soil reinforcement, planting time adjustment, and use of resistant varieties), and chemical methods (disinfection with pesticide and foliar spray) [1]. While there are various methods to fight root-knot nematodes, none is perfect because each has its own limitations [10]. The recent years have seen a considerable amount of study on nematode fighting methods, particularly chemical ones [8]. While the use of nematocide is the most important method to control nematodes, the problems caused by excessive use of chemical pesticides have led to a tendency to use natural pest-fighting materials. In line with this objective, the compounds present in medicinal plants have been paid much attention [2]. Mankind has used medicinal plants throughout the history in both direct and indirect ways. Today, medicinal plants have a considerable share of medical products [6]. The nematicidal effect of many plants has been demonstrated and the use of plant products has been considered as a safe method to control root-knot nematode. This method is cheap and easy to use, does not cause environmental pollution, and is able to improve soil in structural and nutritional terms [4]. Organic plants possess a wide range of secondary metabolites such as phenyls, flanoids, coinons, tanons, essences, alkaloids, saponins and sterols. These substances are biodegradable owing to their natural origin and do not pollute the environment [13]. Today, active plant compounds are given much attention because they are less durable and do not have negative impact on mammals and non-target organisms [14]. Plant products including essences and extracts are usually used to control plant diseases [11]. This paper attempts to study the effect of methanolic extract of Datura and Nightshade from the family of Solanaceae on root-knot nematode (M. Javanica).

II. METHOD AND TOOLS

A. Preparation of Nematode Inoculum

In order to prepare the inoculum required for the test, root-knot nematode-contaminated tomato samples were collected from the farms or greenhouses of Chaharmahal Bakhtiari Province (one of the provinces of Iran). To separate and extract eggs and larvae, contaminated roots were chopped into 1-2 cm pieces by the method of Hussey & Jonsen (2002) and were mixed in 10% hypochlorite sodium solution in mixer for one minute. Then the mixture was put in 400-mesh sieve under water current so as to remove hypochlorite sodium. Finally, the eggs were collected in distilled water.

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Furthermore, to prepare sufficient larvae, nematode egg masses were transferred to petri dishes and kept in incubator for 24 hours until the eggs hatched. Finally, the obtained eggs and larvae were used to carry out the test.

B. Preparation of Extract

Preparation of plants: The dried seeds of Datura and Nightshade were obtained from market. The seeds were ground by mill and sieved by 20-mesh sieve in order to remove hard and insoluble tissues.

2.2.1 Extract Preparation

To prepare 10% methanolic extract, 10 gram of the ground tissue (seeds) of the plant was mixed with 100 ml of methanol (96%) and put on shaker with 350 rounds per minute in 20 centigrade degree for 24 hours. 75 ml of the solution was transferred to new container and enlarged to 100 ml by adding sterile distilled water. Then, the same amount of hexane was added to it and the mixture was shaken under conditions stated above. To obtain final extract and remove methanolic part through evaporation, the mixture was kept under hood in room temperature for 4 hours. (Abdolmaleki et al., 2007).

2.3 Evaluation of Preventive Effect of Methanolic Extract under Laboratory Conditions

2.3.1 Concentrations Used

Concentrations of 0 (control), 1%, 5% and 10% of the extract were used to carry out the test. To prepare other concentrations, 10% extract was used. To prepare concentrations of 1% and 5%, each ml of 10% extract was thinned by 9 and 2 ml of 45% methanol respectively.

2.4 Investigation of Nematicidal Activity of the Plants in Laboratory

The effects of methanolic extract of the plants on mortality of second-instar larvae and prevention of hatching were separately studied. To carry out the test, sufficient amount of methanolic extract of the plants and root-knot nematode egg and larvae were prepared and then 1 ml of water containing 100 eggs and 100 second-instar larvae was separately transferred to sterile petri dishes. Next, 3 ml of different concentrations of the extract was added to petri dishes. This test was carried out in factorial way under laboratory conditions in a fully random manner with four repetitions. Non-hatched eggs and dead larvae were counted after 72 hours following treatment application and the data was analyzed by SAS.

III. Discussion and Results

ANOVA results demonstrated that the use of methanolic extract of Datura and Nightshade had a significant effect on prevention of hatching and mortality of root-knot nematode larvae (Tables 1 & 2). The comparison of treatments (Tables 3 & 4) indicated an increasing nematicidal effect of concentrations of methanolic extract on prevention of hatching and mortality of larvae. In two plants under study (Datura and Nightshade), the highest mortality occurred in concentration of 10% and the lowest mortality occurred in concentration of 1% compared with control treatment (zero concentration).

Among the plants under study, Datura and Nightshade had the highest effect on prevention of hatching and mortality of nematode second-instar larvae. The reason may lie in the difference between effective compounds of the plants. This study demonstrated that concentration of 10% of methanolic extract of Datura has the highest effect on prevention of hatching and mortality of nematode second-instar larvae. Nightshade medicinal plant is in the second rank.

The results of this study corresponds to the results of Cristobal Alejo, J., Tun- Suarez, J.M., Moguel Catzin, S, and Mabana-Mendoza, N(2006) [7]. They studied the effect of alcoholic extract of different parts of 20 native plants of Mexico from the families of Euphorbiaceae, Asteraceae, Meliaceae and Fabaceae on root-knot nematode in laboratory with different concentration and concluded that alcoholic extract of root and leaf of Calea Urticifolia from the family of Asteraceae and extract of stem of Tephrosia Cinerea from the family of Leguminous had the highest nematicidal effect in highest concentration. Also, studies of Ntalli et al (2010) revealed that extract of Melia Azedarach had a preventive effect on root-knot nematode (Ntalli et al., 2010).

Table 1- ANOVA on the effect of methanolic extract of Datura and Nightshade on prevention of root-knot nematode egg from hatching

Change sources	Degree of Freedom	Mean-Square
Plant	1	595.12**
Concentration	3	2415.37**
Plant-concentration	3	94.70**
Error	24	8.22
Change coefficient	6.5	

** Significance of difference in the level of 1%

Table 2- ANOVA on the effect of methanolic extract of Datura and Nightshade on mortality of second-instar larvae of root-knot nematode

Change sources	Degree of Freedom	Mean-Square
Plant	1	364.5**
Concentration	3	3197.8**
Plant-concentration	3	53.5**
Error	24	8.9

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Change coefficient	5.9

** Significance of difference in the level of 1%

Table 3- Comparison of average percentage of non-hatched eggs of root-knot nematode in different concentrations of extract of Datura and Nightshade after 72 hours

Treatment	Datura	Nightshade
0%	22.75[e]	22.75[e]
1%	44.5[c]	33.25[d]
5%	53.25[b]	46.25[c]
10%	72[a]	55.75[b]

Table 4- Comparison of average percentage of mortality of root-knot nematode larvae in different concentrations of methanolic extract of Datura and Nightshade after 72 hours

Treatment	Datura	Nightshade
0%	30.5[g]	30.5[g]
1%	41[e]	35.5[f]
5%	62.5[c]	52.5[d]
10%	80.75[a]	69.25[b]

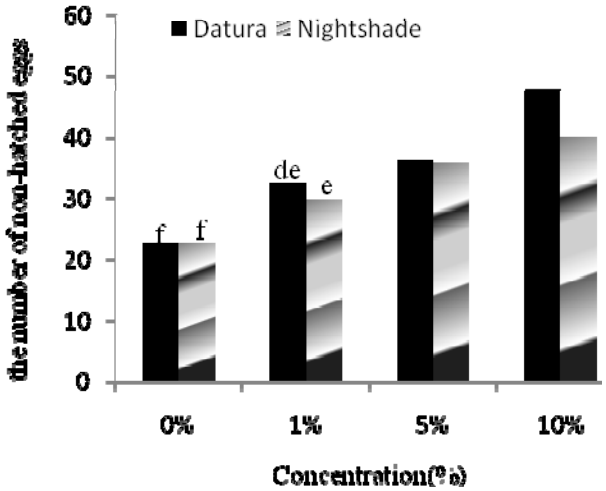

Figure 1- Comparison of the effects of different concentrations of methanolic extracts of Datura and Nightshade on prevention of root-knot nematode egg from hatching after 72 hours

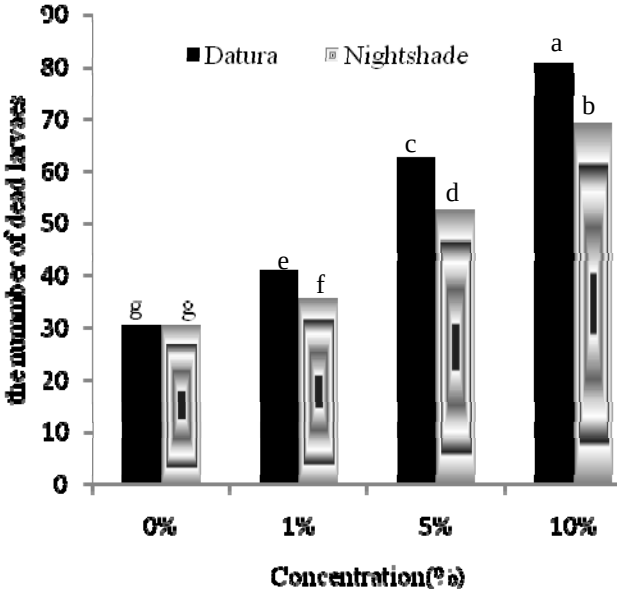

Figure 2- Comparison of the effects of different concentrations of methanolic extracts of Datura and Nightshade on mortality of root-knot nematode larvae after 72 hours

IV. Conclusion

Generally, the results indicated that methanolic extract of the plants under study had a good preventive effect on root-knot nematode "Meloidogyne Javanica". It is recommended to use these plants (especially Datura) in nematode management programs.

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Economic and environmental waste recycling investigation in Khomeini Shahr (Esfahan province)

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Abstract

Waste management is choose a combination of techniques , technologies and management plans to achieve it's goals such as environmental protection and control pollution from these substances on of the most interesting options in waste management is solid waste recycling that has been considered by economic saving and environmental benefits . So , to determine the quality and quantity of waste we sampled and its components were identified . Also , to determine economic – environmental evaluation and graduate studies library and internet resources were used. The results show that per capita waste for each person in Khomeini shahr is 500 g in a day weight of perishable materials 73% , paper 8.2% , plastic 7.3% , glass 5.2% , metals 6.3% were obtained . Amount of energy from burning and bene fits of recycling is respectively 787550 Gj and 4780000 Rials . In addition to economic aspect , it resorting forests and reducing damage to natural resources and environment . According to mentioned percentage in waste of Khomeini shahr , attention to recycling of these material clan fied to us that we can save for economic and environment with proper training and in formational source separation of waste produced .

Keywords— waste – recycling – environmental evaluation – economical evaluation – Khomeini shahr .

INTRODUCTION

By advance of science and technologies , production and solid waste management are changed one of the most interesting options in solid waste management is recycling that has been considered by economic saving and environmental benefits.(1) In solid waste management system , for decreasing solid waste volume and its recycling , it is necessary to be inform about chemical and physical combination of solid waste for determining of decrease type and recycle process type and accurate investigation of chemical and physical characteristic of waste .(2) Physical and chemical combination and also amount of solid waste production according to different seasons of the year , day of week , culture and tradition , Food habits , income and … is changed significantly. (3),(4),(5) Today more of type and quantities of waste were added as environmental pollutants and this flow up to 2025 will be 4-5 times of current value .

As a result special attention to solid waste management problem and methods adaptation and management which seeks to reduce waste production is necessary and unavoidable and has special priority in human life. So that appropriate management actions at different stages of production , keeping , transportation and final disposal is necessary for environmental and human health and for achieving to this goal prevention policies adaptation and minima zing the negative effect of waste and prevention of water , soil , weather pollution and prevention the distraction of natural landscape , prevention the transmission of diseases and finally prevention the development and production of insects and rodents is essential. (2) one of the most interesting option in waste management is recycling that is considered by economic saving and environmental benefits industrial countries experience about recycling of urban waste indicate that one of the most hygienic and economical methods of urban waste recycleing is segregation of waste at the place of production (separation at source) . (1),(3)inattention to waste collection in today society , for different quality and quantity of material , uncontrolled urban development , limitations for public service in large cities and un proper technologies cause to special problems and removing of them is done by

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coordination of knowledge and experience in correct and appropriate management framework . (3) Today in creasing production of waste such as paper , metals and non – normative disposal to environment lead to recyclable national disinvestment and also distruction of natural resources. (1),(5) This study is for investigation of recyclable waste quantities and economic and environmental value in Khomeini Shahr . In this study after physical analysis of waste and study of separation at source plans we calculate the income and benefits from implementation of recycling plan.

Materials and methods

The final goal of this study is quality , quantity and potential investigation of solid waste recycling in khomeni shahr to solve environmental problems and pay costs waste transmission to place of burial lead to create income by waste recy ding . This study is a field – descriptive study and sampling was over a year and every month for a week . Amount of sample in each unit of sampling was equal to 200 Kg and it's component's were identified Khomeini shahr is in Esfahan province , and it is bated in 12 km North west of Esfahan , between 40 north and 51 and 31 min of fast length . Khomeini shahr waste landfill is in 48 km of city in place of fertilizer production plant . (4) Also for determining of economic – environmental and supplementary studies evaluation , library and internet resources were used.

Findings

The results show that capital of productive waste for each person in the city was 500 g in a day in Khomeini shahr average daily production was 112 tons of waste , so average capita of waste production of each citizen in the city was 500 g in a day. According to physical analysis of city waste weight of perishable material 73% (7 tones) , glass 5% (5 tones) , metals 6.3% (6 tone) were obtained. Amount of energy from burning and benefit of waste recycle is 787550 GJ and 47800000 Rials respectively . That in addition to economic aspect , it resorting forest and reducing damage to natural resources and environment .

Table 1: energy from burning of recycling material in Khomeini shahr)

Total energy of recycling material (Gj)	Gj energy (tone)	Weight (tone)	Percentage	Material
399900	4650	86	73	Perishable material
132000	16500	8	8.2	Paper
4200	700	6	6.3	Metals
228200	32600	7	7.3	Plastic
23250	4650	5	5.2	Glass
787550	59100	95	100	Total

Table 2: profit of waste recycling (daily) in Khomeini shahr

Material	Percentage	Recycling weight	Price to kg (Rial)	Total price of recycling material
Paper	8.2	8	1700	13 600 000
Metals	6.3	6	2200	132000
Plastic	7.3	7	2500	17 500 000
Glass	5.2	5	700	3500000
Total	27	26	-	47 800 000

According to waste recycling in the city , income is the sume of 47800000 RLS daily that it shows the economic importance of waste recycling since just recycling of each tone paper prevent cut down 17 trees (6) ,(7) , so , just with recycle of paper we can prevent the cut down of 136 trees . Also , with daily paper recycling 56 Gallons of water , 369/6 Gallons of oil are saved , and prevented from occupying 24 cubic meters of land fill space and 32.57 Gj energy that yearly saved mentioned resources significantly .

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Table 3: economical and environmental cost decrease by paper recycling in Khomeini Shahr

Index	Recycling efficiency 10%			Feldspar
	Sand	Sodium carbonate	Lime	
Daily	1.35	98.05	98.05	34.2
Yearly	492.75	35952.5	35952.5	12483

Also with glass recycling in Khomeini Shahr about 1.69 pound sand are saved and also lead to many saving in same resource such as sodium carbonate , lime and feldspar using of each tone recycling paper lead to decrease of 3989 g distribution of suspend particle , 2782g Co_2 , and reducing discharge to the atmosphere is approximately 15 grams of H 2S . (8),(9)Can see that paper recycling cause distribution decrease of 31912g suspend particle , and 22256g Co_2 , 120 g H25 to the atmosphere .

Table 4: economical – environmental cost decrease by glass recycling in Khomeini Shahr

Index	tree	Recycling efficiency 10%		Oil (Gallon)	Energy (Gj)
		Water (Gallon)	Land fill space (m^3)		
Daily	136	56	24	369.6	32.57
Yearly	49640	20440	8760	134904	11888.05

Conclusion

According to this point that 73% of total productive waste of Khomeini Shahr are putres cible material , using of organic production system con be considered as proper method for urban solid waste material disposal and lead to decrease of health and environmental problem with paper recycling and reusing of it can lead to resorting of forest and distruction decrease of natural resources weight of paper and plastic percentage after pptrescible material , are biggest amount in domestic waste in Khomeini Shahr and lead to correct recycling of 15 tones paper and plastic . Also among recycling waste material biggest amount of energy and profit is related to plastic . In this city just with daily recycling of paper , we prevent cut down of 136 trees , while even just 50% of papers were recycled , can lead to prevent cat down of 68 trees that is significant . For optimum using of recycling material , we can train to citizen about collecting and segregation of waste from the source , and in from the public through the media , create motivation among citizen for correct segregation of recyclable waste and cooperation of agencies involved in the implementation of the foregoing correctly .

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