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# Design of intelligent mechatronic greenhouse with portability by spacecraft for the plans of future of Space

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***Abstract*—** Today, modern technology has caused many human dreams become a reality. In recent years many organizations and spatial institutions have been focused on the possibility of cultivation of agricultural crops on other planets and asteroid. In this article, some basic parameters for setting up such farms as itinerant greenhouses has been reviewed. The results of designs and investigates showed that by the use of new energy systems, intelligent systems and nanotechnology, base of the construction and operation of these greenhouses will be provided.

***Keywords*—** Spatial plans, Modern agriculture, Mechatronic greenhouse, Intelligent Greenhouse.

## I. INTRODUCTION

PERHAPS the first time human traveled to the moon, did not think to the cultivation and agricultural labor on the moon, But now one of the future plans of spatial organizations is the possibility of making agricultural fields in space. Purdue University scientists have found a species of strawberry that after being planted requires less maintenance and energy. Features that can ready this fruit to be one of the space crops. Researchers tested on various species of a kind of plant found that this plant has the ability to grow in space. The main purpose of this study is to determine the feasibility of growing plants in space with minimal elements needed to produce, and this strawberries need shorter photoperiods to grow and finally amount of obtained fruit is equal to the other strawberry plants. Researchers also are researching on the genes within small, fast-growing plant. In a year and a half to two years, they hope that they have plants with two copies of the new gene. When it is possible to investigate gene function, genes that make the plants resistant to drought, cold, low air pressure. But all the efforts of the scientists is realized when necessary bases to achieve such goals be prepared. In this article, some basic parameters for setting up such farms as itinerant greenhouses has been reviewed [1, 2].

## II. NASA GREENHOUSE PROJECT

As the first step, NASA researchers in a new project want to cultivate turnips, watercress and basil on the surface of the moon. The aim of this project in addition to investigate the possibility of agriculture on the moon is to create psychological comfort to the astronauts in the International space station and researchers who are stationed in Antarctica. Researchers in this project are faced with serious challenges, as an example of these challenges we can point lack of atmosphere and high levels of solar and space radiation that constantly affect the surface of the moon. To resolve this problem, NASA is building a special container that is capable of storing air for 5 days. For plant cultivation in container, seeds are placed on a paper filter which provides all the necessary minerals and water for it. The process of plant growth and its response to the radiation in an interval of 10 days is recorded by video cameras, obtained film will be held at various universities to experiment concurrently by many researchers to be analyzed. Researchers know the building of these small greenhouse as the first step of a massive project that make the way easier to more extensive tests on the effects of radiation on the moon on the plant symbiotic microorganisms. Part of this project is shown in Figure 1.

## III. REQUIREMENTS FOR THE CONSTRUCTION OF A SPATIAL GREENHOUSE BASED ON MECHATRONICS

By using a mechatronic design we can make all stimulus, sensors and total greenhouse space into an integrated design and construction administration. Due to the special requirements and restrictions on other planets, design of greenhouse must consider the following conditions:

1- Careful selection of used plants.

2- Accurate measurement of moisture, and biological parameters by Nano-sensors and Nano-bio sensors and precision water injection.

3- The use of new methods of energy production, for example solar cells.

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4- Intelligent management of individual plants, soil and greenhouse space with the latest achievements of information technology.

5- Energy storage via batteries with long life and high efficiency.

Above conditions are the minimum requirements for setting up an active greenhouse on the space, except the first one other cases listed are related to structure of the greenhouse that they are discussed in the following.

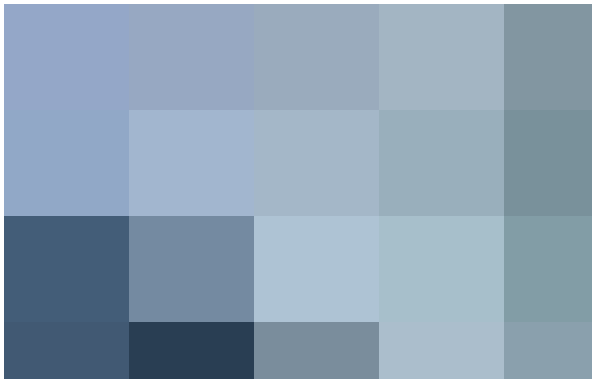

Fig. 1 NASA greenhouse project

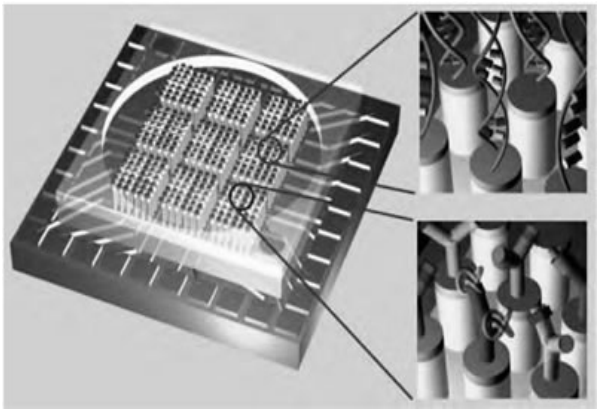

Fig. 2 An example of Nano-sensors

## IV. Assessment and Water Injection Systems for Greenhouses

In a super mechanized irrigation system for a spatial greenhouse expected sharp reduction in water use and avoiding degradation of efficiency. But a mechanized irrigation system which is highly sensitive without having very detailed sensor, online and timely monitoring does not have required performance. Intelligent Controller systems and meeker solenoid valves do this with greater precision and without human errors and also with the minimum fee for irrigation system of greenhouse.

In addition to the irrigation system with respect to the protection of plants in space, biological parameters need to be observed online. All of these measurements should be done by Nano-sensors and sensors that typically are a combines of biomolecule and converters. Precise measurements of parameters in very small scale (Nano), such as physical changes or the presence of chemical species requires the use of sensors in Nano scale. Nano-sensors use Nano-scale sensing elements, the sensitivity of these Nano materials are sufficiently high.

Also materials which are made of Nano sensors must have high strength and good electrical properties. With the advancement of science in the world and the appearance of electronic equipment and enormous changes that occurred during the last decades of the twentieth century, need of building more accurate sensors, smaller and with more features was felt more.

Sensors that are used today, have high sensitivity so that they are sensitive to a small amount of gas, heat, or radiation. Enhance the sensitivity, efficiency and accuracy of these sensors need to explore new materials and tools. Depending on the purpose of analysis, there are a variety of biological and chemical sensors. In figure 2 an example of this sensor is shown [3, 4].


Fig. 3 The use of solar energy for powering aircraft movement

## V. Powering System of Greenhouse

One of these methods over the last 20 years that people are using it, is using solar cells. The sun is transferring about 1000 joules of energy per second per square meter of ground, by collecting this energy we can provide energy for different tasks. The best way to powering the studied greenhouse is using solar cells that its performance has been confirmed repeatedly by scientists. Solar cells made from silicon wafers, are very useful [5]. Single cells are used to provide power for smaller devices such as electronic calculators. Photovoltaic arrays produce recycling electricity, which is used in absence of electrical distribution and transmission systems. For example, inaccessible areas, orbiting satellites, space probes and inaccessible telecom buildings. In addition, this type of energy today exists in places that have distribution networks. Figure 3 is an example of the use of solar cells for powering motor of an aircraft [6]. To store the generated energy new Nano batteries must be used. Nanotubes are considered as an

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appropriate replacement for conventional graphite in the structure of graphite-Lithium electrode. Because of having small structure in nanotubes they have more contact with lithium in comparison to conventional graphite. So that the capacity of a nanotube layer at the lab has reached 640 Ah. By the use of Nano technology in the batteries manufacturing, recharge rate was tenfold. Now, with the development of this technology today's batteries are rechargeable up to 100 times more in comparison to the previous battery (without using nanotechnology).

## VI. INTELLIGENT MANAGEMENT OF GREENHOUSE

For managing sensors and stimulus in greenhouse, an expert system is used [7, 9].

Expert systems refers to a specific software which are used to assist technicians and experts in the fields of human or partial replacement of them in some specialized fields. Such systems, in fact, are the examples of elementary and simpler samples of advanced technology systems that are knowledge-based [10]. These systems usually store information as facts and rules in the knowledge base in the form of structured, then by using special techniques derived from these data, required results are achieved[11,12].

Advantages of expert systems can be classified as:

1- Increase availability: Many experiences are provided through a computer and we can say easier that an expert system is a producer of experiences.

2- Cost reduction: The cost for the user much more reduced.

3- Risk reduction: Expert systems can also work in difficult and dangerous environments that may be dangerous to humans.

4- Permanent: Expert systems are permanent, In other words, they do not die like humans.

5- Multiple experiences: An expert system can be a total experience and knowledge of several experts.

6- Increase the reliability: Expert systems never get tired and do not get sick, do not strike or not to plot against the boss but such situations arise often in experts.

7- Explanatory power: An expert system can explain the reasoning way which going to the conclusion.

8- Quick responses: Expert systems quickly respond.

9- Responding in all cases: in an emergency case, an expert due to stress or other factors, may not make the correct decision, but expert systems do not have these disadvantages.

10- Database of experience: An expert system can perform as a database of experience.

11- User training: Expert system can act as a self-trainer. We give examples to expert systems and we want argue.

12- Ease of the transfer of knowledge: One of the main advantages of expert system is ease of transfer to different geographical locations. This is important for developing of those country that they cannot buy knowledge of experts.

## VII. CONCLUSIONS

According to the human future plans for growing plants in space and extensive researches by scientists, in this article, design and building an itinerant greenhouses that was capable of transferring to space has been reviewed. This greenhouse system for providing needs of spatial organizations must have highest productivity with a minimum dimension and with the least expenditure of energy, needed gas, and water. In this article, we discussed the important elements of such a system. The results of these studies showed that by the integrated system design based on mechatronics, such a system can be used for future research programs in the space.

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# An Analysis of Land Use Instability in Urban Settlements in Southwestern Tehran Metropolis

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**Abstract:**
**Tehran metropolis, due to various factors such as concentration of capital, enjoyment of infrastructures and employment opportunities, has turned to the most important hub for attraction of population in Iran. On the other hand, factors such as implementation of some improper spatial policies in Tehran city and district and increase in land and property prices, low-income immigrants' being pushed to suburban rural settlements and finally unsystematic physical expansion of such settlements all have led to the appearance of urban self-growing settlements around Tehran metropolis. Such local-spatial conditions are more prevalent in urban districts of southweastern Tehran which surround Saveh Road. Appearance of such districts was triggered by development of Islamshahr through spatial-functional annexation of rural settlements and change of agricultural lands and it was aggravated by farther structural expansion and emergence of new cities due to the increase in immigration to this district. Currently, this trend is still in full swing with the decreasing attraction of the original districts of these immigrants.**
**With view of the role that these suburban districts play in the stability of settlement system of the wider districts and also having in mind the emphasis of other studies done in this regard on the social and cultural aspects of this issue, in the current study, employing statistical data and documentary and field studies, it is tried to yield a spatial analysis of instability of the land use pattern in urban districts around Saveh Road. Analysis of spatial-local distribution of land use indicates severe shortage and scantiness of per capita urban land use and this trend becomes even more severe in the cities which reach out to more suburban areas which are further away from Islamshahr. by considering these districts as an undeniable reality, Therefore, reforming and systematization of the current land use to initiate active and functional involvement of these settlements in stabilizing the zonal system and their residents' enjoyment of better living conditions should be in order. By identifying and analyzing the roots and reasons of centralism in Tehran and reforming the land use systems, a sustainable spatial pattern for other condensed urban settlements in other similar geographical areas in developing countries becomes feasible.**

**Key Words: instability of land use, physical planning in suburban settlements, Tehran metropolis**

## Introduction:

Rapid urbanism coupled with economical and industrial development in recent decades has led to enormous expansion in metropolises particularly the ones in developing countries and also it has imposed particular spatial-local developments in their rural suburban settlements; developments which are not much compatible with the local and historical realities of such settlements and which have not been uniform in different countries (Goetz, 2013; Dutta, 2012; Cohen, 2006). In Tehran metropolis, urban districts of Islamshahr, as opposed to the old cities of Iran which were formed in accordance with proper local and geographical conditions and in direct relation with their Surrounding villages, have been formed as a result of various demographic and economical attractions of Tehran. Owing to various factors such as accumulation of economical surplus obtained from selling oil and consequently centralization of capital, infrastructures, and employment opportunities and various urban attractions, Tehran city turned into the biggest hub to attract population in Iran (Tabatabayi, 1988, p. 52), in such a manner that its population grew from 200 thousand people in 1900 to seven million people in 2011 (United Nations, 2012). Manifestation of such centralization was evident in the unprecedented spatial expansion of Tehran metropolis. In the early years, this expansion happened mostly around the center of the city, but spatial limitations brought about by implementation of regulations of the master plan and the increase in land and property prices pushed some of the low-income immigrants of this city towards the suburban rural districts and caused the non-standard expansion of these districts and formation of self-growing cities around this city (Shafi'I Sabet, 2006, p. 189). Southwestern urban districts in Tehran are among such districts which appeared with the formation of Islamshahr around Saveh Road through the expansion of the rural nuclei and their focalization with added effect of land use change in the

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rural agricultural fields. Continuation of immigration to this district and also spatial limitations of Islamshahr led to further and more suburban expansion and birth of new cities (Tehran Urban Master Plan, 1999, p. 41). Currently, 800 thousand people live in these districts. With accepting these districts as an undeniable reality which are caused by the circumstances of the world system which entails general global spatial-functional pattern change in cities (Naryana: 2010, p. 92) and also, with accepting a dependent development pattern and the role of these cities in accommodating population surplus of the metropolises (Habibi, 1992, p. 404), directing attention to the indices of sustainable urban development and fostering the optimal conditions to accommodate the people of such districts seems vital (Rana, 2011, p. 238). In 2000, around 20 percent of the city dwellers of the less developed countries lived in suburban cities (James, 2008, p. 6). In a similar vein, there have been numerous studies carried out on this issue which name this phenomenon as informal settlements, ghetto-dwelling, self-growing settlements etc.

Since, such studies in Iran have mainly emphasized the social, cultural and environmental factors (Khatam: 1995, p. 65; Rahnamayi, 1990, p. 41; Piran: 1995, p. 125) and less consideration have been given to the physical dimension, particularly the urban land use and local-spatial distribution, in the current study, urban land use in urban districts of Islamshahr, Nasimshahr, Golestan, Salehabad and Nasirabad has been analyzed using documentary and field studies, also, some solutions have been proposed to systematize them. It is hoped that the findings of the research will help urban and regional policy makers and planners to better understand the characteristics of land use and to adopt proper measures for the attainment of more sustainable urban conditions.

**Methodology:**

This study has been conducted through a descriptive and analytical method utilizing documentary and field studies. Demographics of Iranian Statistical Center and land use information of urban institutions (City Council and Housing and Urban Development) and field surveys were collected and were digitized and analyzed using geographic information system (GIS). Different land uses were analyzed quantitatively and qualitatively to draw a comparison between per capita use and the standard per capita use proposed by the Department of Housing and Urban Development; additionally, the spatial features of the land uses were investigated in terms of their compatibility with each other.

**basic features of the study area:**

The studied area is located in South West Tehran including the service areas of urban districts of Islamshahr, Nasimshahr, Golestan, Salehabad and Nasirabad. According to Table 1, which shows the demographic changes in urban settlements in the area in recent decades, Islamshahr, as the largest district in this area, had some rural settlements close to each other before 1966. The population of this settlement was 1006 people in 1996; but its population, with an increase in rural-urban immigrations and a general tendency for immigration to Tehran and its suburban cities, drastically increased. Initially, this increase had a 47.9 % annual growth rate in 1966-1967, but this then decreased to an annual growth of 3% in 1996-2006 making the population reach 357,389 people in 2006.

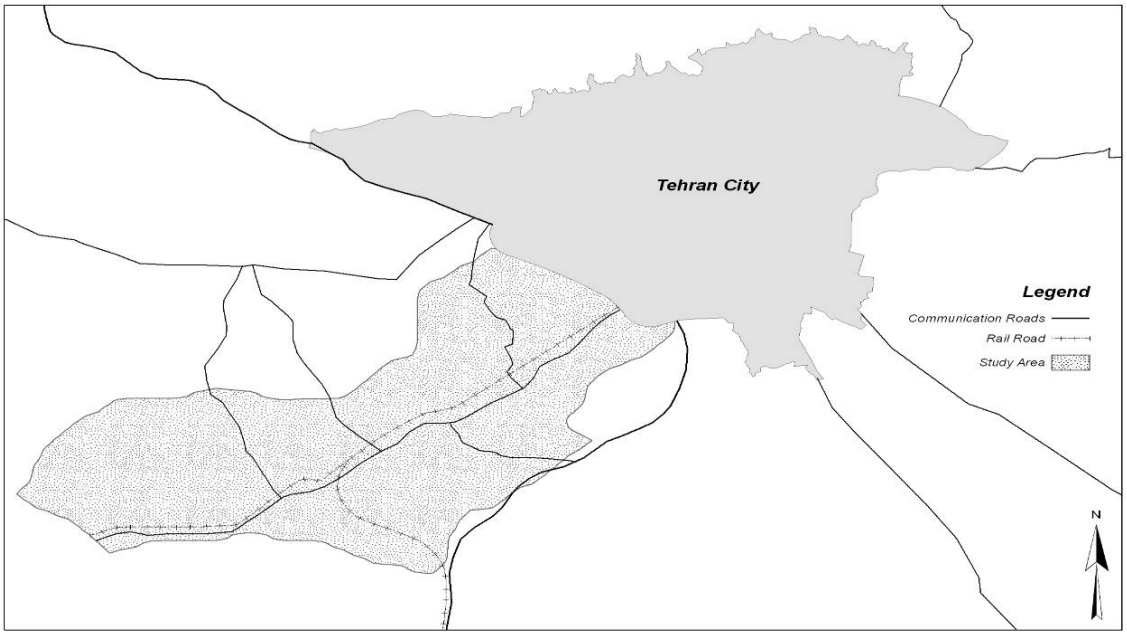

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Figure 1: Tehran City, Communication System and the Location of the Study Area.

A dramatic increase in population growth rate occurred in other urban settlements as well. However, this increase did not occur at the same time. About a decade after Islamshahr's population increase, a strong population growth in cities Nasimshahr and Golestan is noticeable and until 2006 the average annual growth had been high in the two settlements. Akbarabad, which in the early years after the revolution emerged around the lands between Vajhabad and Kalame, at first gradually and then rapidly grew in population, reaching from a population of less than 100 people in 1986 to 14,000 in 1976 and then to 85000 people in 1996. It was renamed in 1999 to Nasimshahr and in addition to Ismailabad village, Vajhabad and villages Hessarak, Hamedanak, Kheirabad and Saeedabad were added to the area and its population rose to 150,000 people. Soltanabad's rapid growth was almost concurrent with Akbarabad's. Its growth centered around a namesake village, beginning along Saveh road and then quickly spreading on its bordering farm lands. Soltanabad, which has reached from 778 people in 1976 to 8,500 in 1986, continued its population growth more quickly and in 1996 reached about 85,000 people. With the annexation of Golestan, Sabzdasht, Riye, Kalame, Ghalemir, Meimoonabad and the expansion of the settlements on surrounding lands, its population has currently reached about 189,000 people. In the next stage, growth in surrounding settlements, i.e. Salehabad and Nasirabad, has been high and still due to the lower cost of land and housing and poor urban development regulations population growth is high in these areas. Spatial pattern of the settlement system has hierarchically been influenced by the distance from Tehran metropolis and then the arterial Saveh Road in the region. This system of spatial establishment initially begins with Islamshahr, the nearest settlement to Tehran city, and continues along Saveh Road and then further away from Tehran to the cities of Akbarabad and Nasimshahr and eventually to more suburban settlements like Salehabad and Nasirabad.

Table 1: Population change in urban settlements within the study area

| City / Year | Population absolute | | | | | Average annual growth | | | | Density (Ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1966 | 1976 | 1986 | 1996 | 2006 | 1966-76 | 1976-86 | 1986-96 | 1996-2006 | 2006 |
| Islamshahr | 1006 | 50292 | 215129 | 265450 | 357389 | 47.9 | 15.64 | 2.12 | 3.01 | 128 |
| Nasimshahr | - | 202 | 13750 | 85124 | 135846 | - | 52.5 | 20 | 4.8 | 191.6 |
| Golestan | - | 158 | 10717 | 87242 | 231905 | - | 52.5 | 23.3 | 10.3 | 210 |
| Salehabad | - | - | 1321 | 14952 | 54228 | - | - | 27.46 | 13.75 | 70 |
| Nasirabad | - | 589 | 1147 | 9490 | 23802 | - | 6.9 | 23.5 | 9.6 | 20 |

Sources: Selected Demographic Studies of Tehran city, 2003, Iran's Centre for Research and Studies of Urban Development and Architecture.

Detailed Results of Iranian Statistical Center's Population and Housing National Census, 2006.

**Results:**

Results of spatial analysis of the study area consistently shows that in Islamshahr, residential land use has been, as the most fundamental factor in occupying lands. In terms of level, this type of land use covers an area of over 1132.27 hectares comprising 41.48 percent of the total urban space. This area consists mainly of small residential housing units; flowingly, 10.8 percent of the residential units have an area of less than 50 square meters, 51.8 percent an area less than 75 square meters, 64.3 percent an area less than 80 square meters, and 86.9 percent an area less than 100 square meters. By comparison, 61.42 percent of the residential units in Iran's cities are less than 100 meters in area and this number in urban areas of Tehran province equals to 57.2 percent. As it can be seen, residential units in Islamshahr are smaller in comparison with the country and the urban areas of Tehran province. Based on the proposed standards, 40 to 50 percent of the city's space should be allocated to residential land use with a 40 to 50 square meters per capita space (Hosseini, 1992, p. 42); however, this per capita space has fallen to 31.7 square meters because of the smallness of residential units.

The case of area of residential units in other urban areas is more serious. 88.8 percent of residential units in Nasimshahr and 90.8 percent in Golestan and 93.6 percent in Nasirabad have an area less than 100 meters and their per capita residential area is respectively 18.6,

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18 and 14.8 meters (Table 2). In this region, the area of a sizeable proportion of the residences is less than 50 square meters. Flowingly, in Nasimshahr, 32.6 percent and in Golestan 35 percent and in Salehabad about 37 percent of the residences have an area less than 50 square meters. Analysis of the above data suggests that the more we move towards the surrounding cities, the smaller per capita of residential land and the poorer immigrants. This condition is better to be analyzable through the investigation of the immigration trends in the region in the last few decades.

Traffic factor, In terms of level, has second highest level after residential land use in Islamshahr. This land use, with an area of 730.38 hectares, has occupied 27.8 percent of the city's space which is equivalent to a per capita of 20.44 square meters. In Islamshahr, due to the proximity to Tehran, as the hub of industrial activity and an important center for consumption of goods, and due to being located in areas which surround Tehran-Saveh road and Tehran-Qom railroad, compared to other cities and other urban land uses, a considerable amount of lands has been allotted to transportation facilities and warehouses.

Table 2: Per Capita Land in Urban Settlements Islamshahr Area Based on 1385 Population

| Per Capita Land Use | Islamshahr | Golestan | Nasimshahr | Salehabad | Nasirabad |
|---|---|---|---|---|---|
| Residential | 31.68 | 17.95 | 18.6 | 25.83 | 14.78 |
| Educational | 2.17 | 0.67 | 0.94 | 0.81 | 0.44 |
| Healthcare | 0.34 | 0.12 | 0.1 | 0.05 | 0.002 |
| Religious | 0.36 | 0.12 | .035 | 0.1 | 0.23 |
| Cultural | 0.05 | 0.06 | 0.06 | 0.02 | 2.65 |
| Sports | 0.57 | 0.21 | 0.54 | 0.04 | 3.62 |
| Green Fields and Recreational | 4.7 | 0.89 | 0.53 | 0.24 | 7.83 |
| Urban Facilities and Equipments | 0.8 | 0.23 | 0.35 | 0.17 | 0.13 |
| Transport and Communications | 20.44 | 9.12 | 11.95 | 10.3 | 33.88 |
| Military | 0.44 | 0.06 | 0.004 | 0.016 | 0.04 |
| Industrial | 0.85 | 4.25 | 0.043 | 1.08 | 30.2 |
| Agricultural | 4.17 | 0.94 | 7.9 | 66.52 | 55.91 |
| Vacant Land | 5.91 | 9.29 | 6.38 | 43.7 | 81.70 |
| Business and Administration | 2.71 | 1.93 | 2.19 | 1.5 | 1.56 |

Source: Municipality and the Housing and Urban Development Organization of Islamshahr, Golestan, Nasimshahr, Salehabad and Nasirabad

These warehouses are nearly 181 hectares vast and have occupied about 6.7 percent of the city's space. In recent years, these types of land uses have occupied fewer lands due to immigration and expansion of residential land use. In 1986, about 13 percent of the city's space was occupied by them. Ttransport and communications land uses have occupied 19.2 percent of city's space with a 9.1 square meters per capita in Golestan, 23.4% in Nasimshahr with an 11.9 square meters per capita and 6.68 percent in Salehabad with a 10.3 square meters per capita. The standard per capita in this type of land use is 20 to 25 square meters (Pour-Mohammadi, 2008, p. 44) and it is mainly devoted to communication roads, but in this area a large portion has been taken away by warehouses and the traffic network is not in proportion to settlement centers and need to be expanded. Additionally, increasing the number of stories of renovated buildings, being a result of the increase in land price, without increasing the width of roads has caused numerous traffic problems for a motor vehicles and continuation of this will cause other difficulties in the near future. In Islamshahr, due to lack of interdependence between urban centers and their direct connection to Tehran, there is no road besides Saveh road to secondarily connect the centers and access roads to Saveh Road and to Tehran are mainly perpendicular to Saveh Road (Figure 2).

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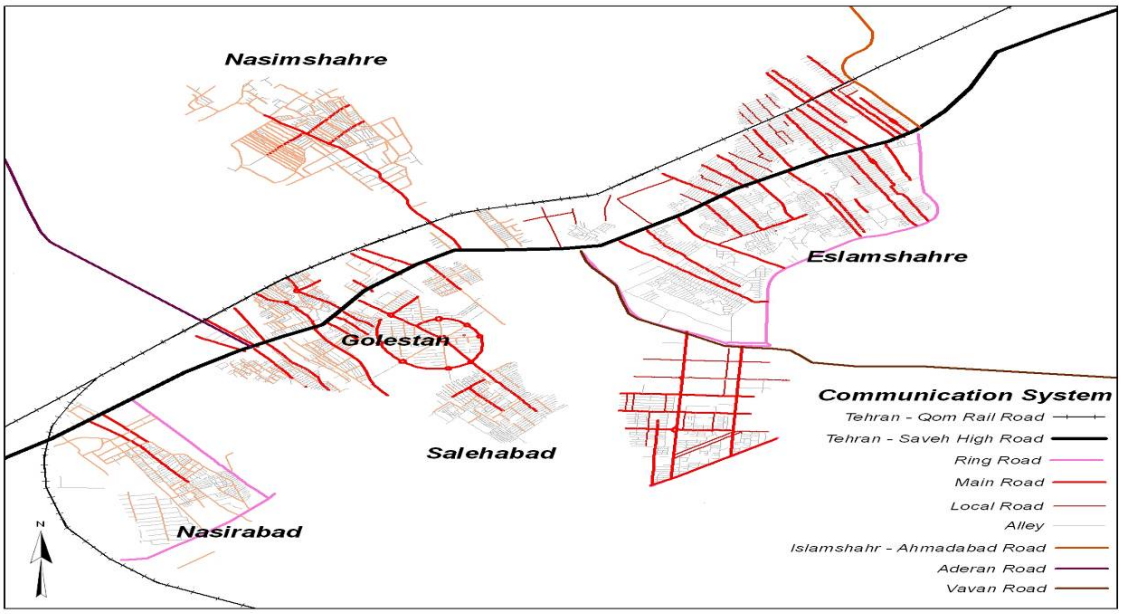


Figure 2: The Condition of the Access Network in Local-Spatial Linking of the Urban Settlements in the South West of Tehran

Land use for industrial activities in Islamshahr, Nasimshahr, Golestan, Salehabad, Nasimshahr is respectively 30.41, 0.4, 98.49, 5.84 and 151.1 hectares (table 2). As is evident from above data, in cities that are closer to the Saveh Road more space is dedicated to industrial use, and also the further cities are from the center, the more such land use, as can be seen in the case of Islamshahr and Nasirabad. Except Nasirabad which has an industrial town, the per capita of this type of land use is less than the national standard of 30 to 40 square meters per person (Shi'a, 2007, p. 163 and Livarjani, 1999, p. 106). Industrial land use in Islamshahr consists mainly of workshop and repair industrial applications, which chiefly fulfills Tehran's needs.

In Islamshahr, per capita educational land use is not much lower than the national standard of 3 to 5 meters due to existence of Azad and Payame-Noor universities per capita standard is in other cities in the area, however, in other cities of this region, the condition is not very satisfactory and the per capita is much less than standard. Per capita for healthcare land use in all lower urban areas and in cities Salehabad and Nasirabad is much below the standard. This per capita in the city of Nasirabad is 0.002 square meter per person, whereas the proposed standard is from 0.75 to 1.5 square meters per person. Urban facilities and equipments and other cultural, sporting, recreational, commercial and administration land uses in urban areas have a poor condition and are far from national standards. Thus, with the increase in distance between the center of the region and suburban cities, the condition becomes more serious in terms of per capita urban land use.

As to commercial land uses, there has not been any chief business center formed because of the uneven and sparse growth of urban centers in the inner space of these cities. In different parts of the city, small commercial land uses have been scattered in all main and side streets and in intersections and urban squares in a linear form within neighborhoods to meet the everyday needs of citizens. In these cities, the population density and distribution of commercial centers depends on the population of neighborhoods and adjacency to the Saveh Road. Spatial distribution of the warehouses and cold storages, which is affected by the railway station and Saveh Road, is mostly concentrated in the North West and West of the city of Islamshahr, along railway station and Saveh Road to the bed of Karaj River and the surrounding neighborhood of Salour. Existence of multiple manufacturing sites around Saveh Road the fact that the cities in the region are access cities have made a part of various guild activities be devoted to small and large repair businesses which are scattered on both sides of Saveh Road and within other business units in a linear way.

In addition to severe spatial shortage of health care, sports and recreation and administration uses, distribution of the uses has not been done in a proper manner and the land uses lack a functional hierarchy or have a defective functional hierarchy in the region and settlements. Many urban areas lack some types of land uses and in some residential areas, because of the location and proximity to Saveh Road, there is a congestion of land uses. Due to

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the large number of industry-focused workshops along Saveh Road in the West and the East of Islamshahr within the city limits of Golestan to Nasirabad, various environmental problems such as noise, air and soil pollution have been caused in the vicinity of residential and commercial units.

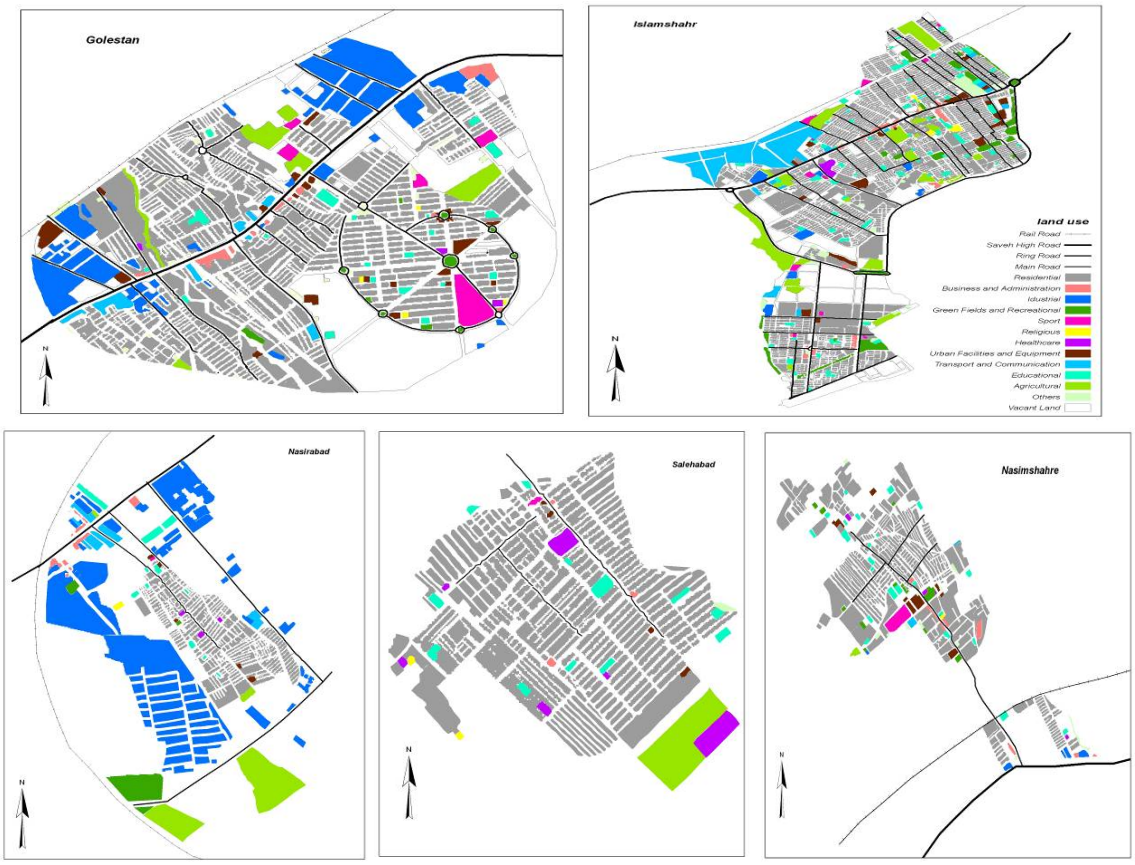


Figure 3: Land Use in Urban Settlements of Islamshahr, Golestan, Nasimshahr, Salehabad, and Nasirabad

**Discussion and Conclusion:**

In recent years, in Iran's major cities especially Tehran metropolis, there has been a new and unprecedented phenomenon, which has been formed and expanded in strong and continuous connection with the capital metropolis but through some stages of growth and in parallel to establishment of the needed services and activities, attain some self-reliance and relative autonomy shares some tasks with the capital metropolis and attracts some of the suburban references. Nevertheless, such settlements, even in their final stages of development, suffer from a variety of social and physical abnormalities and have been confronted with numerous theoretical challenges (Sheikh, 2008, p. 96). Previous theoretical approaches have perceived suburban and marginal settlements to be equal to poverty, inequality and various social and personal problems and have diminished the role of urban planning and development in confrontation with these centers to a general surgeon to separate them from the body of the city. The measures to clear and demolish slums and fringes have been successful (Mellor: 1977, 19). However, recent theoretical approaches and the strategies to empower people and help residents to improve their residential conditions have been put on the agenda (Gillbert and et al: 1991, 76; Perlman: 1989, 40; Alsyyad: 1993, 33), because of the following reasons: 1. the properties of settlements in the country have been different from many third world countries due to cultural and economic differences resulting from oil revenue 2. positive functions and the important role of these settlements in accommodating low-income groups 3. spatial partnership with Tehran reduces potential injuries and damages to the capital metropolis (Haughwout, 2009; Khratzebardast, 2000). Accepting these settlements as an undeniable reality, we should pay attention to and expand the solutions which are found from residents' own life and environment without neglecting the social and economic foundations which are involved in the

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formation and development of these settlements. Inattention to the roots of this phenomenon results in multiplication and accumulation of these settlements in a particular place in the country and will disrupt its spatial balance. Within the scope of the current study, among possible solutions to optimize settlement and living conditions in these cities are: land use management, improving land uses, solving the existing deficiencies and incompatibilities, and reduction environmental problems guided through physical planning. Moreover, among approaches to make these settlements more harmonious is the introduction and construction of educational uses, especially higher education, healthcare and recreational uses especially in the cities of Salehabad, Nasairabad, Nsimshah and Golestan and proper distribution of the uses for all urban areas and construction of a functional hierarchy of uses throughout the district and inside the settlements. Land use reform in the region changes daily direct trips from the rural settlements to Tehran and much of the needs of people will be satisfies within region and dependence on the metropolitan area will be reduced. In current conditions, urban and rural settlements in the region are linked to Tehran directly via Saveh Road and there is not a proper link between these settlements. Traffic factor, through adjusting the communicative potential between various activities on the ground, reduces inequalities caused by spatial separation and it is the most powerful tool for forming urban environment and it shapes and leads pattern of activity in city (chi, 2011; Rezazadeh, 2001) Therefore, reforming and systematization of this land use seems vital. Another important priority is to promote the natural environment which is to some extent achievable through organizing the industries, especially obtrusive and workshop industries and transferring them to industrial and workshop towns. Although, land use reform and efforts to enforce urban development regulations will improve the conditions for residents in these areas, inattention to the primary reasons, which contribute to persistent concentration of population in Tehran, will result in transference of the problems of this city to the outskirts and will regenerate new settlements with problems.

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# Intelligent control of condensation generators, construction ground to create artificial rain Based on Fuzzy Systems

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***Abstract*—** One method of artificial fertilization using generators condensation clouds and rain making the ground. These generators are usually installed in areas prone. The main challenges of this equipment control system that should be Tools for fertilization when appropriate, respond to the environment. In this paper, a comprehensive control system based on fuzzy control has been proposed. According to the features and benefits of this control system, it can be used for intelligent control of land for construction condensation generators.

***Keywords*—** artificial rainfall, fertile clouds, fuzzy systems, intelligent control.

## I. INTRODUCTION

THE use of new technologies has led to a natural process in order to optimize service. The process of creating an artificial rainfall and fertile, cloud storage is an artificial form. Fertilization clouds for the first time in 1946 at the General Electric Research Laboratories America by Vincent Schaefer was observed. Her temperature of dry ice crystals 78 - degrees Celsius into artificially generated clouds in a cloud chamber containing cold clouds were drops be seen drops abandoned and cold cloud over the freezing process ice crystals become deposited as snow in a cloud chamber their loss. Laboratory evidence thus obtained Barvrshdn clouds. Concurrent with these studies, doctor Langmuir won the Nobel Prize, a field trial on a cloud cover over the mountains in the East Shnktdy Gryvlak owned by the New York State did. The temperature at the altitude of about 4270 meters from ground level cloud was - 20 Celsius respectively [1-4]. By definition, the rain using artificial Harm stimulation and changes in internal processes Hmrahast cloud, the cloud is called fertilization [5]. Cloud Seeding is usually done by adding certain substances called fecundity agents. Intelligent behavior in Cloud Seeding clouds and cloud systems in order to increase potential rain clouds and precipitation processes in which they are formed and implemented. The main purpose of the reproductive clouds, increasing precipitation , prevent natural disasters such as floods , hail , thunder , rain transfer time and place , May eliminating redundant , adjustment, alteration , producing snow in the mountains and ... 's . Currently, about 40 countries, fertility programs do clouds. Earth's atmosphere contains varying amounts of water vapor. The amount of water vapor is directly related to temperature. With temperatures reaching 12 degrees, the air is saturated with water vapor. If cooling continues, the amount of added vapor Bryan needed to maintain saturation, to become cloud droplets. Best practices for cloud seeding, the increase in cloud condensation nuclei. One way to think of cloud condensation mechanism of land by the generators [6, 7]. Efficient use of land in the fertile clouds generators varies depending on the generator, but the average rainfall will increase by 15% [8]. One of the major challenges in the use of generators due to environmental conditions and climate controls are sophisticated. Figure 1 is an example of how the aerial and ground spraying fertilizer materials show.

## II. CLIMATE MITIGATION TECHNOLOGIES AT GLOBALLY RECOGNIZED ORGANIZATIONS AND ASSOCIATIONS

Given the importance and magnitude of climate mitigation programs in many countries of the world and embrace technology during the past 50 years mainly four leading associations and organizations such as the World Meteorological Organization, America Society of Civil Engineers, Association of America and the Society of climate moderated America weather led many climate mitigation and control activities [9-11]. Some important statements, tips, and articles published are as follows:

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1. Adjustments should the weather be viewed as part of a strategy for the integrated management of water resources.

2. Possible changes in the structure of clouds from region to region, there are extensive. Thus, fertilization results in a geographic area cannot be generalized to other areas.

3. Cloud Seeding unintended consequences such as environmental impact and ecological impacts downstream wind or not fixed, but cannot be ruled out.

4. Ability to influence cloud microstructures through experimental observations, numerical simulation models and physical measurements in some natural systems such as fog, clouds and cumulus clouds layer confirmed.

5. The complexity and variability of clouds, understanding and detecting the effect of artificially modifying the weather has a big problem.

6. Published studies indicate that since silver iodide any significant effect on public health and the environment is not.

7. The energy in the climate system is stressed so much that the cloud systems pluvial, changing wind patterns in order to bring to an area or complete removal of water vapor severe weather phenomena is impossible.

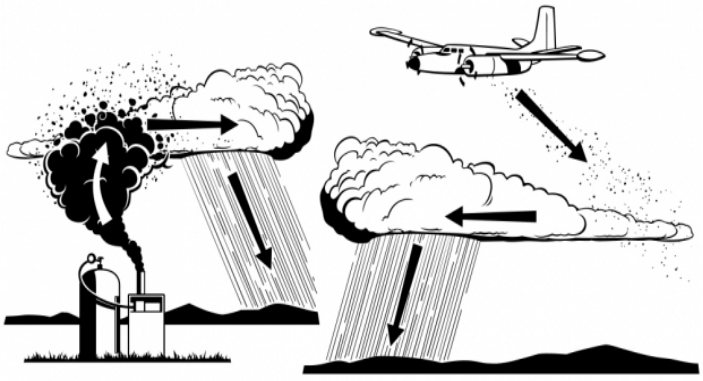

Fig. 1 is an example of how the aerial and ground spraying fertilizer materials

## III. FUZZY SYSTEMS

Fuzzy Logic for the first time in 1960 by Lotfi Zadeh doctor, a computer science professor at UC Berkeley was invented. Classic article by Professor Lotfi Zadeh on fuzzy set was published in 1965, beginning a new direction in science and engineering, and computer systems. Fuzzy systems are knowledge-based systems or rules [12]. Heart of a fuzzy system is a knowledge base of rules if - then phase is formed. If a rule - when a phrase fuzzy if - then that some words are connected by attachment functions. Briefly, the starting point to construct a fuzzy system to obtain a set of rules though - so fuzzy expert knowledge or knowledge areas discussed are the. The next step is to incorporate these rules into a single system. Fuzzy logic provides a method for processing events of uncertain exactly what the nature and everyday life associated with Am. Fuzzy logic and approximate values of uncertain work.

## IV. GENERATORS CONDENSATION MECHANISM

Condensation generators, construction land, fertilizer materials emit clouds in the sky, these generators have different types but all of them are composed of several sensors and disconnect the electric and a tank. Disconnect the electric generators are responsible for working with remote control. These generators are very large dimensions, but some of them must be installed in an area and the state should have a website .it is very complex. After processing the information and determine clarify the generator, the generator must be fertile materials as silver iodide cloud as the sublimation is released into the air .rainfall is. About 20 to 35 minutes is needed to fertilizer materials into clouds to reach maximum performance. These materials into clouds can act as ice nuclei, water droplets in clouds are around the nucleus is Hajm , the

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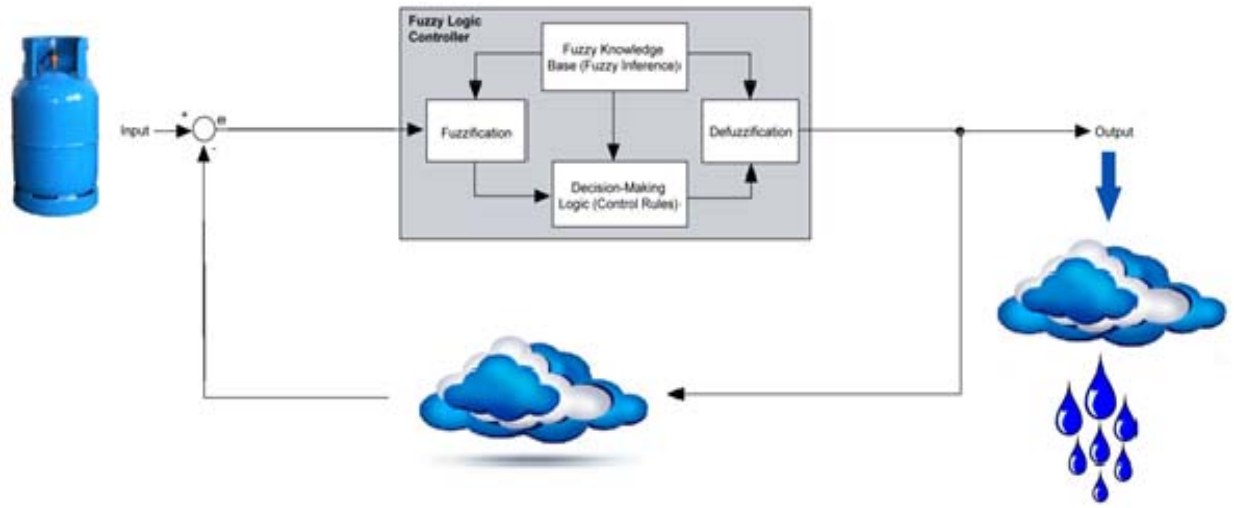


Nuclei grow and eventually will fall and thus may cause increased precipitation.

## I. THE FUZZY CONTROL MECHANISM OF CONDENSATION GENERATORS

Ability to obtain quality signals in a control system based on observable phenomenon is not a main feature of the controller. The research literature on various aspects of fuzzy control are shown. Uncertain reasoning ability of the system to achieve quality work, and how to implement real-time characteristic of the qualitative theory of temperature control system is attractive. The proposed fuzzy system is shown in Figure 2. To properly verified the proposed approach, a trial package of data on the influence of parameters on the Rain clouds were placed on modeling and simulation [13, 14].

This data, which includes the position of the cloud, cloud water content , ambient temperature and wind speed as the input and output as the amount of fertilizer materials , then the normalized fuzzy sets , fuzzy An. The fuzzy sets are shown in Figures 3 to 6. The fuzzy data using the fuzzy inference engine as a software MATLAM software was designed and tested data. The data obtained from this method were compared with the classical methods. Simulation results show that the use of this technique more efficient than the classical methods .offers.

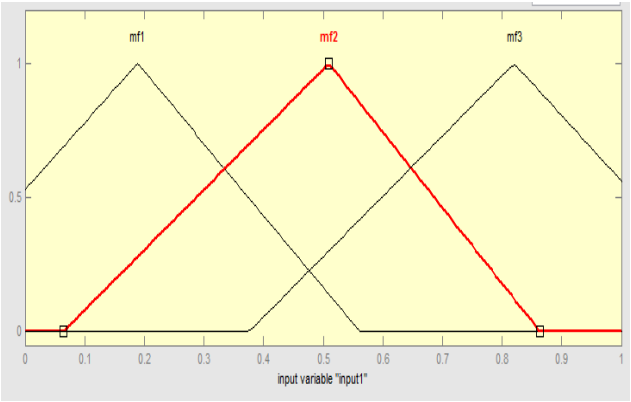


Fig. 3 normalized fuzzy data by cloud status

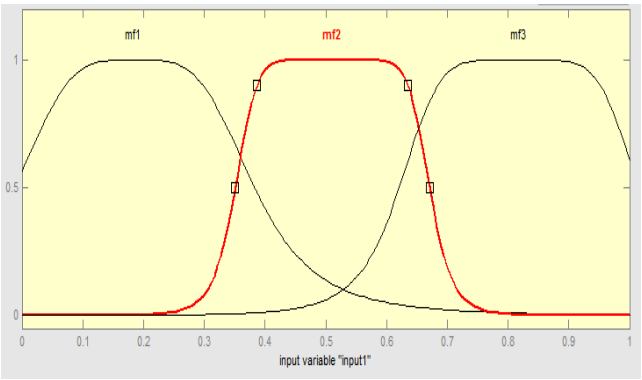


Fig. 4 normalized fuzzy data by cloud water

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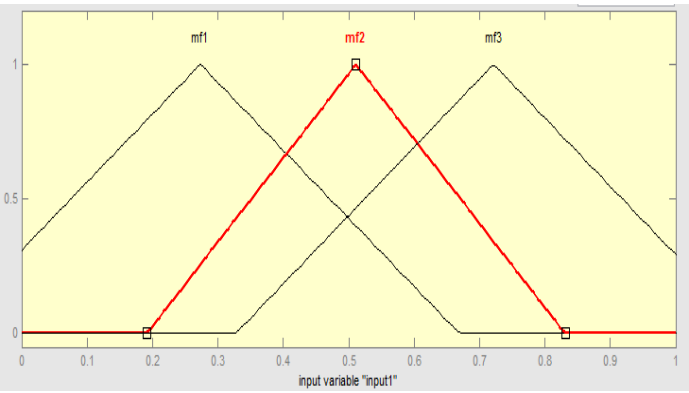


Fig. 5 fuzzy data of normalized wind speed

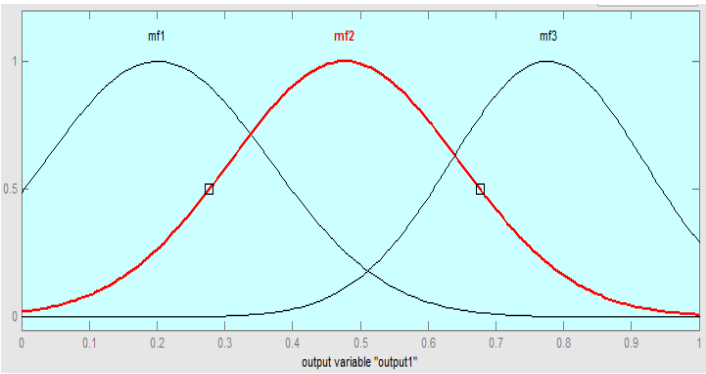


Fig. 6 normalized fuzzy data by spreading the amount of fertile material

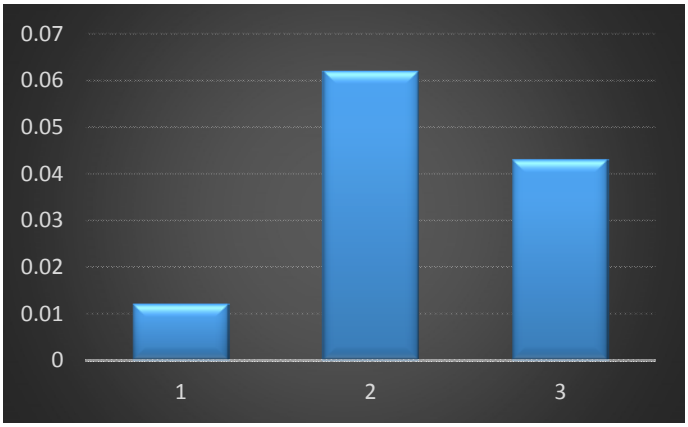


Fig. 7 normalized fuzzy data by spreading the amount of fertile material

## II. Conclusions

In this article, we use the intelligent control system of generators condensation of clouds to create fertile ground for construction of artificial precipitation was studied based on fuzzy systems. Because of the complexity of such a control system for such generators is that such systems are involved with it because the clouds of material ¬ fertilizer should be sprinkled on them quite efficiently .the collapse of the cloud. What is important here, condensation mechanism of multiple generators in an area thereby increasing the amount of information to be processed. The results showed that using this method for a packet to a good cause is to optimize the control system in such a generator.

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# Evaluation of Different Planting Dates on Some Quantitative Traits of Cotton Cultivars in Dezful

Mostafa Eidi kohnaki[1]

*Abstract*— Optimum planting time is one of the important factors that influence the cotton yield appreciably. In order to harvest the maximum possible performance of a variety it is necessary to having information about the proper planting time for each variety in each region. In this regard this study was carried out in split plot in randomized complete block design with four replications at Dezful research station-safiabad (Khuzestan province, Dezful) . The factor of sowing dates were used as the main factor which has four levels include 20th March, 5th April, 20th April and 5th May and, three cotton cultivars Cyland (V1), Termez 14 (V2) and Dr.Omomi (V3). Analysis of variance showed that the effect of sowing date and its interaction with cultivars on number of green bolls are not significant but there were significant differences in the level of 1% among cultivars studied. Mean comparison of planting date and cultivars interaction on total bolls production show that this interaction is affected by flowering potential of varieties. due to the more flowering, The best planting date for crops in Dezful region and areas with similar climate conditions was the second planting date and among the cultivars the Cyland cultivar had the best conditions. The early and late planting dates can significant reduction in yeild. In aggregate Planting at inappropriate time may cause drastic reduction in cotton yeild.

***Keywords***—Planting date, Cultivar, quantitative traits, Cotton.

## I. INTRODUCTION

Cotton is an important fibre crop of global importance which is grown in tropical and subtropical regions of more than 60 countries of the world [7]. Currently, more than 180 million people worldwide are directly or indirectly dependent on cotton and its derivatives. In recent years, extensive research was done in the field of breeding crops and high yielding varieties that have been introduced adapted to each area. One of the main problems in order to achieve the maximum possible product is the lack of suitable varieties. In this regard, most important agronomic considerations for growers to optimise yield and quality is to select an appropriate sowing time for cotton crop. Optimum planting time is one of the important factors that influences the cotton yield appreciably. Planting at inappropriate time may cause drastic reduction in cotton yield. Another important issue that must be considered is the choice of cultivar that is very important component in any cropping system even more critical than sowing date for cotton production. Khan *et al*. (1981) reported that seed cotton yield of different cotton varieties is significantly influenced by the seasonal variation. They concluded that best planting period of cotton is the second fortnight of May under the conditions prevailing in Dera Ghazi Khan [5].

Choosing the best time of sowing in a particular region can often be difficult [8]. as it is a decision that must strike a balance between sowing too early and enduring problems associated with cold weather or sowing too late and losing potential yield. Sowing too early when the weather is cold can predominantly slow crop growth, often leading to poor establishment and poor early growth. Furthermore, the crop is exposed to many seedling diseases [6]. Number of studies have indicated significant differences among the different sowing date in various regions. Akhter *et al*. (2002) investigated the effect of sowing dates from May 01 to June 16 with six cotton cultivars and reported that regardless of the cultivars, best results were obtained with the crop planted on May 16 [3].. Kittock *et al*., (1981) showed that seed cotton yield of upland cotton was least affected by sowing dates when compared with pima cotton [1]. rahman *et al*., (2007) used early and late planting time for the induction of heat stress. It was shown that reproductive phase of early sown cotton genotypes coincided with the hottest month of the year, which caused serious short falls inthe yield. Also effect of sowing dates showed that early sowing produced 10% more flowers, 23% more open bolls, 18% more seed cotton yield and 13% more ginning out turn than late sowing [2], [1]. in terms of climatic conditions. The Khuzestan province has significant potential for cotton cultivation hence it is considered as one of the hopes of the future. In this regard considering that the basis of sustainable agriculture is the use of methods to increase the amount of crop production per unit. The objective of this research work was to find out optimum planting date for three varieties of cotton in Dezful region.

## II. MATERIALS AND METHODS

The field experiments were conducted at Dezful research station-safiabad (Khuzestan province, Dezful), IRAN at 32° 16' 0" N and 48° 25' 0" E to determine optimum sowing on some quantitative characteristics of cotton cultivars during two consecutive cotton growing seasons. In order to determine

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the nutrient and soil physical and chemical properties, four points samples of soil were taken from the 0-30 and 30-60 cm depth in the experiment ground. Then the samples from each depth at each replication mixed together for chemical analysis. The data regarding soil characteristics were presented in Table 1.

**Table 1. Physiocochemical analysis of soil in the experimental field**

| Depth (Cm) | Available P (ppm) | Available K (ppm) | Available N (ppm) | OC % | PH | E.C. (ds/m) |
|---|---|---|---|---|---|---|
| 0-30 | 10 | 140 | 795 | 0.75 | 6.3 | 1.59 |
| 30-60 | 8.83 | 118.3 | 783 | 0.7 | 7.7 | 1.43 |

The factor of sowing dates were used as the main factor which has four levels include include 20th March, 5th April, 20th April and 5th May and, three cotton cultivars Cyland (V1), Termez 14 (V2) and Dr.Omomi (V3) is used as a the subplots. The land was prepared in the form of bed-furrows at 75 cm apart and pre-sowing herbicide was applied to control weeds in the field. The furrows were irrigated 48 hours after dibbling the seeds to have successful seed germination and emergence. However, later on a subsequent irrigation was given after a week to fill the gaps where seeds were not germinated. There after wards, the subsequent irrigations were given at 10 days interval up till crop maturity. Fertilizer was applied broadcast at a rate of 250 kg $ha^{-1}$ ammonium phosphate and 150 kg $ha^{-1}$ urea fertilizer prior and after to planting . Weeds were controlled with trifluralin (48% w/v), and other preplant herbicides application and by hand in row and mechanical between row weeding along the growing season. Cotton picking was done from month of September to November. Irrigation to this field was stopped one month before cotton sowing. The experiments was carried out in split plot in randomized complete block design with four replications. Analysis of variance and mean comparison base on Duncan's multiple range test were performed using the MSTATC software and Excel software was used to draw the graphs.

## III. RESULTS AND DISCUSSION

The analysis of variance revealed that the effect of planting date on flowering is significant at 1% level probability. However, cultivar effect and planting date and cultivar interaction were not significantly (Table 2). On the other hand, the agent of planting date and its interaction with cultivars on the number of mature bolls is significant at the 1% level. Furthermore, there was no significant differences between the cultivars in this regard. Analysis of variance showed that the effect of sowing date and its interaction with cultivars on the number of green bolls are not significant but there were significant differences in the level of 1% among cultivars studied. The main cause different reactions of cultivars in terms of numbers of green bolls were due to different potential in flowering, loss of flowers percentage and different effects of the environment temperature in different planting dates. All varieties in this experiment have produced the highest number of flowers in the first planting date Among the cultivars, Dr.Omomi with 63 flowers per plant and Termez 14 with 63 flowers had the highest and lowest number of flower per plant respectively.

The reaction of three cultivar was different in terms of the number of mature bolls. The main reason for this difference is the potential to produce flowers, their flowering response, sensitivity and influenced by temperature of the environment.

Mean comparison of planting date and cultivars interaction on total bolls production show that this interaction is Affected by flowering potential of varieties. Due to the more flowering the Dr.Omomi cultivar has more number of bolls production and this is also true for the other two cultivars.

The reason of different reaction of cultivars and different sowing dates in terms of the percentage of mature bolls is affected by the number of flowering production and the loss percentage of flowers in different treatment of experiment. The percentage of mature bolls is reduced in the early and late planting dates due to increasing loss of flowes.

**Table 2.** Analysis of variance for some quantitative traits in per plant

| S.O.V. | Df. | Num. Of flower | Num. mature bolls | Num green bolls | Total Num. of bolls | maintaining boll % |
|---|---|---|---|---|---|---|
| **Replication** | 3 | 134.43 $^{n.s}$ | 1.66 $^{n.s}$ | 3.24 $^{n.s}$ | 0.99 $^{n.s}$ | 52.75 $^{n.s}$ |
| **sowing date (A)** | 3 | 410.29** | 102.37* | 3.45 $^{n.s}$ | 92.7* | 176.23$^{n.s}$ |
| **Error (a)** | 9 | 87.35 | 26.45 | 9.95 | 15.703 | 308.00 |
| **Cultivar (B)** | 2 | 198.25 $^{n.s}$ | 34.00 $^{n.s}$ | 97.96** | 191.37** | 144.15 $^{n.s}$ |
| **cultivar×sowing date** | 6 | 76.33 $^{n.s}$ | 49.19* | 0.34 $^{n.s}$ | 48.47 $^{n.s}$ | 143.43 $^{n.s}$ |

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| | | | | | | |
|---|---|---|---|---|---|---|
| **Error (b)** | 24 | 79.47 | 13.99 | 7.57 | 20.75 | 100.88 |
| **C .V. (%)** | | 21.69 | 32.19 | 46.66 | 26 | 34.62 |

*** and **: Significant at the 5% and 1%levels of probability, respectively.**

**ns: Non-significant**

Both of Termez 14 and Cyland cultivars have produced the highest amount of maintaining boll percentage in second planting date while Dr.Omomi cultivar produced highest amount of this character in first planting date (fig.1). The reason of different reaction of cultivars and different sowing dates in terms of the percentage of mature bolls is affected by the number of flowering production and the loss percentage of flowers in different treatment of experiment. The percentage of mature bolls is reduced in the early and late planting dates due to increasing loss of flowes.

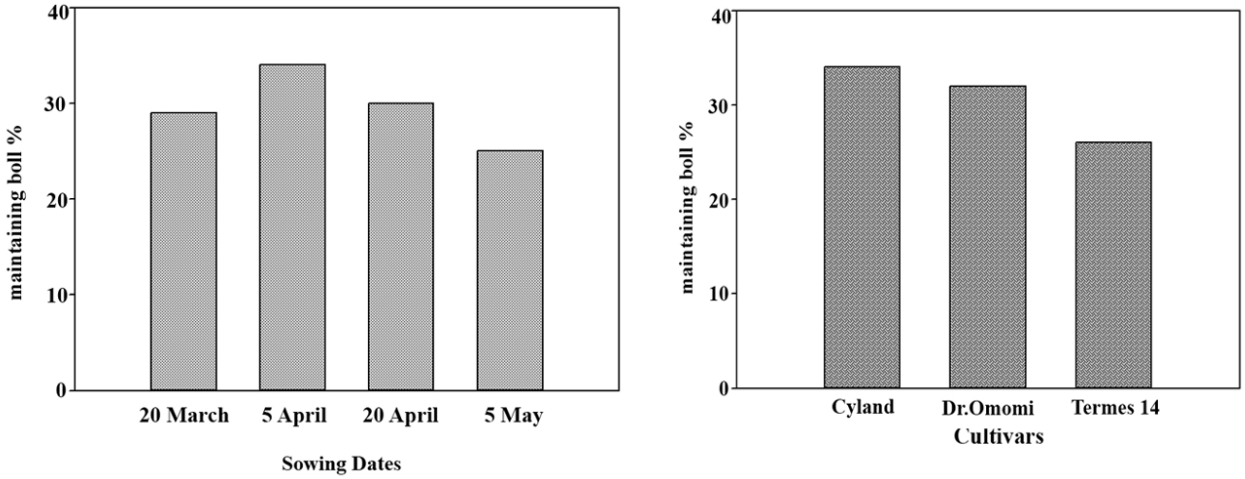


Fig. 1 Mean comparison of maintaining boll percent in different sowing dates and cultivars

In early sowing date due to poor environmental conditions especially temperature Leading to a lack of proper germination. More flowers in this situation begin to fall in beginning of the season. Total number of bolls at the end of the season consist of the sum of mature and green bolls. Analysis of variance for this trait showed that the planting date and cultivar have been effective on total number of bolls per plant at level of 5% and 1% respectively.

The percent of maintaining boll represents the ratio of ripe bolls of total boll production per plant. Analysis of variance showed that the planting date, cultivar and their interaction on percent of maintaining boll is not significant also there was no significant difference observed about mean comparison of planting date and cultivars interaction and their effects of cotton cultivars. ( Table 3 ).

**Table 3.** Mean comparison of planting dates and cultivars Interaction on cotton yield with Duncan method*

| Interaction effect | | Num. Of flower | Num. mature bolls | Num green bolls | Total Num. of bolls | maintaining boll % |
|---|---|---|---|---|---|---|
| **Cyland** | **20 March** | 50.88AB | 10.8BC | 3.1BC | 14BC | 23.17ABC |
| | **5 April** | 34.25D | 13.2BC | 2.1C | 15.1BC | 38.68A |
| | **20 April** | 34.5D | 11.8BC | 3.1BC | 15BC | 37.81AB |
| | **5 May** | 31.98D | 8.47BC | 3.9AB | 12.4C | 26.25ABC |
| **Dr.Omomi** | **20 March** | 63.55A | 21.15A | 8.1A | 29.2A | 34.37ABC |
| | **5 April** | 37.4BCD | 9.3BC | 7.2AB | 16.5BC | 28.37ABC |

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| | | | | | | |
|---|---|---|---|---|---|---|
| | **20 April** | 39.9BCD | 12.2BC | 7.9A | 20.2B | 30.12ADC |
| | **5 May** | 38.63BCD | 10.35BC | 7.8A | 18.1BC | 26.72ABC |
| **Termes14G** | **20 March** | 50.0ABC | 14.2B | 6.8AB | 21B | 28.8ABC |
| | **5 April** | 43.9BCD | 14.1B | 6.02ABC | 20.1B | 33.26ABC |
| | **20 April** | 32.63D | 7.05C | 7.2AB | 14.2BC | 21.23BC |
| | **5 May** | 35.5D | 6.8C | 7.3AB | 14.1BC | 19.39C |

***: Means having the same letter(s) in the same column are not significantly different (p≤0.05).**

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In this experiment, the distance between the first and the last planting dates were 45 days. In late planting dates the number of flowers is decreased due to shortening of the plant growth. One of the main cause of yield loss in late planting dates is the cold of end of the season. Also recent research show that early and late planting in abnormal circumstances may be one of the reduction of yield cotton.

The best planting date for crop cultivars in Dezful region and areas with similar climate conditions was the second planting date and among the cultivars the Cyland cultivar had the best conditions. The early and late planting dates can significant reduction in yeild and in aggregate Planting at inappropriate time may cause drastic reduction in cotton yield.

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