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INVESTIGATION OF CAUSES AND THE DUST PHENOMENON, COUNTERMEASURE STRATEGIES AND ITS CONSEQUENCES IN AGRICULTURE SECTOR

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ABSTRACT

Today's needs and greed of human societies, made pressure on all types of natural, renewable and perishable resources to such a high extent that exceeds the tolerance and sometimes has created the ground for regression. However, in the last century the phenomena of soil erosion and its consequences are considered as a major obstacle against the development of human society. Given that Iran is one of the centers affected from haze and the damages caused by this phenomenon has gripped this country, causing great human and environmental damage annually. The subject of increased haze must be given considerable attention by the fact that the phenomenon of dust has intensified in recent years, has imposed damage to different sectors, including agriculture so that this phenomenon, based on estimates has inflicted damages upon 40 to 50 percent of the crops. In fact, settlement of dust on leaves reduces the amount of light absorption and photosynthesis of crops and thereby, the crop growth and production will witness a sharp drop. Accordingly, given that the origin of this phenomenon is external to this country, thus in order to deal or cope with it, there is the need for national unity, such that while identifying the precise origin of the dust particles, effective measures to reduce consequences of dust, especially in the agricultural sector must be undertaken.

Keywords: *Haze, Dust, Wind Erosion Control, Crops*

INTRODUCTION

Rapid population growth, brought about increased demand for food supply through agricultural products, particularly extension of the under cultivation land area. In other words, Today's needs and greed of human societies, made pressure on all types of natural, renewable and perishable resources to such a high extent that exceeds the tolerance and sometimes has created the ground for regression. However, in the last century the phenomena of soil erosion and its consequences are considered as a major obstacle against the development of human society. Desertification, as defined by international convention on desertification, is land degradation in arid and semi-arid and dry sub-humid areas by the factors such as human factors and natural factors and after two challenges of climate change and scarcity of fresh water is regarded as the third most important challenge for the global community in the twenty-first century (Ahmadian *et al.*, 2011). The fine particles movements in the air that cause air pollution are called dust. These particles are able to move hundreds of miles in the atmosphere, causing a lot of losses. These fine particles can cause great environmental damage as well as harm to human health. Among the other adverse effects of Haze, one could mention damages to plants, reduced quantity and quality of agricultural products, economics and irreparable damages to the communities affected by this phenomenon, and these factors reveals the need to deal with these challenges. The objective of this study is to provide appropriate and practical solutions to reduce the devastating effects of this hazardous phenomenon. (Kelarlou, 2011).

Causes and Origin of the Dust Phenomenon

The occurrence of dust phenomenon in recent years in some provinces has resulted in many problems for residents and sometimes impossible due to high concentrations of dust in the atmosphere caused impossibility to presence outside of buildings and closure of schools and businesses (Sarabyan, 1389). The main cause of the phenomenon of dust, vegetation degradation and destruction of natural areas, including forests and rangelands, and desertification in Iran and in neighboring countries, especially Iraq.

Research Article

Large areas of Iran is consists of arid and semi arid lands and there is 32 million acres desert lands in this country, also 40 million hectares of Iran regions are being affected of desert lands. Non-systematic and indiscriminate exploitation of natural resources and climate change is a major cause of desertification in the world, as well as the excessive entrance of livestock to pastures is another reason of destruction of the natural areas and the expansion of the desert lands. excessive use of groundwater in Neighbor nations has resulted in drought and desertification and thereby dust phenomena which this reflects ignorance of neighboring countries such as Iraq, Saudi Arabia, Afghanistan and UAE about environment and desertification, so the reason for Dust phenomenon in Khuzestan Province is deserts of Iraq, Saudi Arabia, Jordan and Syria countries. (Ahmadian *et al.*, 2011). The Countries Iraq and Syria, particularly Iraq, are of most important centers of the dust given that much surface of the lands constitutes the main centers in the country. In fact, the main sources entrance of dusts to the West of Iran, desert regions relatively close to the region such as the desert of Syria, Iraq and the deserts occurring in the north of Arabian Peninsula. About 70% of dust events in Iran, results from the country of Iraq. (Engelstaedter, 2006) (Figure 1 and 2). Altogether, there are several factors which involve in causing dust phenomena, however among the most important ones, one could mention drastic changes in the air pressure at deserts of the neighboring countries at East and North-East of Iraq, West of Syria and South of Turkey, transverse acceleration force (Coriolis) resulted from orbital motions, impacts of the uncertainty line in deserts of neighboring countries, vegetation deficiency, severe drought and conflict in the region. Such that it resulted in release of dust particles from Iraq and Syria to the West, South-West and North-west regions of Iran and in some extents, its central parts.

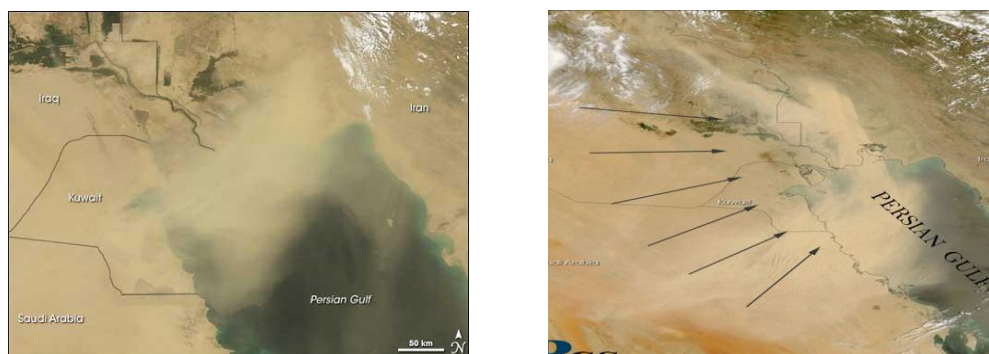


Figure 2.1 Froushani

The Consequences Arisen from the Dust Phenomenon in Agriculture Sector

Dust and haze could increase Air pollution level. Ozone depletion due to air pollution, has long been recognized a threat to human health and the environment. Dust deposition on leaves and high concentration of ozone in the agriculture field leads to produce smaller plants in many crops. Physical Dust deposition on the plants had impacts directly and indirectly, causing the destruction of the plant resources. The Plants orifices block due to dust deposition on the surface of leaves and as a result, the mechanism of air exchange and evaporation and transpiration, photosynthesis and respiration of plants will be difficult and to some extents, plant growth stops. That deposition of dust and existing pollution inside on the soil surface alters its soil texture and reduced climate Permittivity in the soil and activity and numbers of different types of micro-organisms will be affected and in turn they affect the quality of the soil and plant species (Mehravaran, 1989). Dust deposition on pastures plants, reduces the energy stored in plant tissues, which reduces the efficiency of these plants in animal nutrition (Sadeghi, 2009). Laboratory studies using growth chamber which it's roof is open, it was shown that the concentration of ozone by 50ppm, decrease winter wheat yield by 10% and by 8% in rice. Doubling this concentration reduced yield up to 59% and 26%, respectively, (Shobing, 2004). Deposition of pollutants and dust on plant, builds a cover on that reduces direct radiation absorbed by plants, however accumulation of heat on

Research Article

plants surfaces increases and leads to warming plant. In addition, due to acidic mist, the negative consequences of acid rain on the chemical composition of soil and plant tissue will occur. In addition to the direct effects of air pollution on plants, dust has indirectly effects on agricultural production by three ways:

1. The amount of radiation received by the plant decreases. Aerosols increase solar energy reflected back into space and in total increase absorption of radiation in the atmosphere. Absorption and distribution of solar energy causes a massive reduction in direct light received by the plant.
2. Presence of aerosol form more clouds, these clouds contain fewer droplets and have less chance of rain precipitation therefore decreases rain precipitation. In addition, these clouds are an additional source of light emission solar radiation, decreased rainfall through the clouds formed from aerosol have been reported for an annual average as 5 to 8 percent from 1930 to 1960, thus the frequency of drought is predictable.
3. Finally, the dust leads to regional surface cooling, which impacts on vegetation.

Estimated data showed that an average reduction of production (agricultural and horticultural) for the provinces of Khuzestan, Kermanshah, Ilam, Bushehr, Fars, Lorestan, Kurdistan, was between 20 and 40 percent for other involved provinces was 5 to 20%, (Tables1 and 2) (Srabyan, 2010).

Table 1: Estimates of damage to productions agricultural products with less vulnerability

Province Name	Total production (tons)	decreased production by 5% (tons)	decreased production by 20% (tons)
Eastern-Azerbaijan	3863163	193185.15	772632.6
Western- Azerbaijan	3978886	198944.3	795777.2
Esfahan	4793633	239681.65	958726.6
Tehran	4563344	228167.2	912668.8
Zanjan	1427904	71395.2	285580.8
Systan - blochestan	1816012	90800.6	363202.4
Ghazvin	2696890	134844.5	539378
Quam	407735	20386.75	81547
Kerman	4863101	243155.3	927621.2
Kohgolieh-boir ahmad	568434	28421.7	113686.8
Markazi	1649212	82460.6	329842.4
Hormozgan	1676736	83836.8	335347.2
Hamadan	3440444	172022.2	688088.8
Yazd	789220	39461	157844
total	36534719	1826735.95	7306943.8

Table 2: Estimates of damages to agricultural and horticultural production in the provinces with greater vulnerability

Province Name	Total production (tons)	decreased production by 20% (tons)	decreased production by 20% (tons)
Ilam	708373	141674.6	283349.2
bushehr	793962	158792.4	317584.8
Khuzestan	10684042	2136808.4	427361.8
Fars	7301542	1460308.4	2920616.8
kurdstan	1510896	302179.2	604358.4
Kermanshah	2255609	451121.8	902234.6
Lorestan	1170685	354137	708274
total	25025109	5005021.8	10010043.6

Research Article

Providing Strategies to Prevent and Counter the Dust Phenomenon

Firstly, one could reduce the wind speed and not to let the erosion reaches to threshold extent (with using a variety of windbreaks).

Secondly, making resistant the surface exposed erosion against wind erosion (using a variety of mulches and soil covers).

The techniques to control wind erosion stage by stage is as follows:

1. Provision of identification Plan, determine the approximate range of studies (the harvest, transport, and deposition regions) with the help of basic research.
2. to Separate types of land use (residential, urban, municipal, non-use, arable land)
3. to Assess the extent of damage to the biological and economic resources in each of the erosion zones and land uses and compare and prioritize them in national and regional level (provinces and countries) and the introduction of critical and the justifiable areas
4. To prepare a proper feasibility study (Study and select the appropriate administrative, biological, non-biological options) for each of the erosion zones and land uses regarding to the limitations and potentials of existing facilities in the area
5. To Prepare an action plan in justified limits

Methods of Reduction and Control wind Erosion can be categorized into the Following Four Categories:

1. Soil management practices (grazing or conservation, tillage appropriate practices)
2. Biological Operations (crop management and cultivation, creating tree windbreaks)
3. Non-Biological Operations (Mechanical (non-living windbreaks), physical (gravel mulch), chemical (petroleum mulch)
4. Consolidated Operations (Managerial, Biological- mechanical, biological).

Ways to Control and Reduce wind Erosion and Damage Caused on Types of Land use in Harvest Areas:

1. Wind Erosion Control Practices within Limits of Farming Lands

1-1. Soil Management Practices within Limits of Farming Lands

- A) To increase surface soil moisture
- B) To improve soil texture and structure
- C) To increase surface roughness

2-1. Biological and Agronomic Management Operations to Control Wind Erosion on Agricultural Land:

- A) To use crop models consistent with the strong winds seasons
- B) Crop rotation appropriate and according to the climatic conditions and soil of the region
- C) Use of arable crop species close together (accidentally cultivation) or row planting perpendicular to the main wind
- D) To leave crop residues on the soil surface
- F) To establish a arboreal (living) windbreak at the surrounding of fields: Field wind breaks (Green belt)

3-1. Non-Biological Operations (Mechanical, Physical and Chemical) to Control Erosion on Agricultural and Horticultural Lands in Harvest Areas:

- A) To leave stubble straw or crop residues at farm level (plant mulch) (Stubble mulch)
- B) To use physical or chemical mulch
- C) To Use non-living windbreak around farms and gardens

2. Control and Reduce wind Erosion on Bare and Barren Areas Within Harvest Areas:

1-2. Managerial Practices to Control and Reduce Wind Erosion on Bare and Barren Areas:

- A) Avoiding soil disturbance

2-2. Biological Measures to Control and Reduce Wind Erosion on Bare and Barren:

- A) Occurrence of salty gypsies "Hard pan" in gravelly lands and marl hills
- B) A "salty clay" Hard pan in plain clay Kalout and Yardang fields
- C) The conditions of water logging and flooding in sandy beach lands, Sanjay (adjacent to the sea or desert) lands and the dry river bed

Research Article

2-3. Non-Biological Measures (Mechanical, Physical, and Chemical) to Control and Reduce Wind Erosion on Bare and Barren:

A) To use of non-living windbreak (artificial)

The Ways to control and reduce wind erosion and the resulting damages on all the types of land use in transportation areas:

1. Biological measures to reduce damage to the facilities and economic resources in transit area :

A) To establish a green belt of trees (wind break trees) in front of the facilities

2. Non-biologic measures (mechanical, physical, chemical):

A) Construction of non-living windbreak (made from mud, brick, and Branch head)

B) Construction of canal and bulwark along with "chapar kari" on bulwark tip in order to reduce damages of sand transport to facilities

C) To use diving ceilings or roofed gallery or hallway on the roads

Ways to control and reduce wind erosion and its damages in the precipitation regions (sand zones and dunes)

1) Biological measure to control and stabilization of active and semi-active sandy zones and dunes:

A) Biological methods to stabilize moderately active or less active sandy zones

2) Non-biological methods (mechanical-chemical-inclusive) to stabilize active to moderately active sandy zones:

2-1) using cheery (Branch head)- matted windbreak to stabilize the active sandy zones

2-2) using petroleum mulch etc for temporary stabilization very active sandy zones (Vahdati, 2011)

CONCLUSION

Conclusion and Suggestion

The major concern with regard to the phenomenon of dust is that unfortunately their persistence intensity and stability has increased dramatically in recent years. If the intensity and persistence of that dust are plotted in the form of an graph, we would have an ascending path. This phenomenon is considered a serious crisis for the entire the Middle East region, requiring cross region determination. In general, in order to containment dust phenomenon as a pollution source, several strategies such as identifying contamination sources, removal of the source or preventive measures against pollution resources, as well as strategies such as sand-fixing and desertification, optimal management of water resources in upstream source of dust off take, dewatering minimum of wetlands in Iraq territory and soil moisture preservation, Watershed management Operations and Contest against Desertification and alongside use of new and holistic technologies (clouds fertilization so as to reduce the intensity of the storms and Hazes) is a rout that can help to solve the problem permanently. On the other hand, in order to deal with the dust phenomenon, training experts of the region, and development of vegetation in areas where are dust offtake sources meanwhile in the development of vegetation in the right time in Iran, should be done. In addition to special equipments are needed to determine the height of the pollutant concentration as well as the several-days warnings and Prognoses about must be available, regarding that drought has long-term consequences. One must prepare more comprehensive Meteorological applications and maps. (Foroushani, 2011)

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Research Article

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