



## Studying and comparing the efficiency of different types of trees to mitigate the problem of dust pollution

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### To cite this article:

Ibtihaj Abdulwahhab Abdulrazzak; Studying and Comparing the Efficiency of Different Types of Trees to Mitigate the Problem of Dust Pollution . *Mesop. environ. j.*, 2018, Vol. 4, No.2, pp. 1-7.

Received date: 7/8/2017

accepted date: 12/12/2017

published date: 15/3/2018

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### Abstract

Trees play a very important role in filter out the dust pollution, and other fine particles present in air by absorption or accumulation process. The tree species possessing higher dust escaping capacity has higher chances of survival in the polluted areas. This study indicates that evergreen plants with simple, rough, and fast growing trees are good dust arrestors. The study suggested a systematic way of selecting plant species on the basis of their efficiency in dust control (*Callistemon* , *Casuarina equisetifolia*, *Ziziphus Lotus*, and *Eucalyptus Globu*) .

The objective of the present study is to estimate the amount of deposition of particulate on the leaves surface of various species, and estimate the efficiency of four types of trees and to suggest the most suitable plant species for plantation in dusty area.

The results shown that the highest amount of dust deposited on the leaves of *Casuarina equisetifolia* (8.336 grams), then *Callistemon* tree (4.635 grams), while the *Ziziphus Lotus* tree was (2.291 grams), and the smallest amount of dust deposited on the *Eucalyptus Globu* tree (1.320 grams).

The highest dust deposited on the all types of plants were in June, While the smallest amount of dust deposited in September.

Keywords: Dust pollution , dust mitigation by trees.

## **Introduction**

A dust storm is a meteorological phenomenon common in dry and semi-dry regions [1]. Dust storms arise when a tempest front or other strong wind blows loose sand and suspend solids from a dry surface. Small particles are transported by suspension, a process that moves soil particles from one place and deposits them in another place [2].

When the velocity of wind passing over freely held particles increases, small particles of sand first start to oscillate, then to move ("leaps"). As they frequently hit the ground, they unbend and breach off smaller particles of dust which then begin to depart in suspension [3]. At windy condition rapidly more than that which causes the suspended particles, there will be a inhabitation of dust particles moving by a range of technicality: suspension, leaping and crawl [4].

## **Dust Storms Impacts**

### **Economic impact**

Dust storms cause soil loss from dry soil, and worst, they actually remove organic matter and the nutritious-rich sprightly particles, that way decrease agricultural productivity [5]. Also the direct effect of the storm losses young harvest implant. Dust storms also decrease visibility simulating airplane and road transmission. In addition of that, the dust storms also make many problems due to complexity of respiration in dust [6].

There are many plants and trees that role very well as a windbreak. To choose the best implant or trees for windbreak, consider the gravity of the necessity as well as the area have ready and any decorative qualities influence [7]. This well help to locate which types of plants are most suitable for possession.

The function of trees in controlling ambient heat and rainfall has protracted been comprehend. The difference of dust deposition in various plants is due to the truth that various plants have gained various morphological countenance apart from those agents like leaves shapes, plant rise, leaves structure, existence or absence of furriness, stomatal recurrence are also concerning to the ability of dust collecting staffing of plants [8] have shown that not only the top surface but the low surface of the leaves also collect important amount of dust particle

### **Health Impact**

Dust particles differ in size from visible to invisible. The minimal particle Longley remains in the air and the moreover can travel for long distances.

Big dust particles collapse out of the air comparatively relative to where they are formed [9]. Big dust particles resort to be intercepted in the nose and mouth when you respirator them in and can be easily breathed out or swooped harmlessly

Finer or Smaller dust particles are unseen. Fine dust particles are more likely to permeate deeply into the lungs however ultrafine particles can be soaked up directly into the blood stream [10]. The type and size of a dust particle defines how toxic the dust is. However the potential harm the dust may cause to human health is mostly particular by the amount of dust existing in the air and how long have been exposed to the polluted air[11].

The dust particles which are fine enough to be inhaled may cause: (coughing, irritation of the eyes, sneezing, and asthma attacks).

People who suffered respiratory disease like asthma, chronic obstructive airways disease (COAD) or emphysema even small increases in dust concentration can make their symptoms worst [12].

Actually there is no hard directory that dust causes asthma, however respiration in high concentrations of dust over long period of time (many years) is concept to decrease lung function in the long term and participate to troubles like chronic bronchitis and heart and lung troubles [13].

### **Some types of trees used to filtering the dusty air**

There are many types of plant that used to filtering the dusty air, in this study four types of trees are used, below the names of these types with some characteristics of them:

#### **Bottlebrushes (*Callistemon*)**

*Callistemon* trees have commonly been indicate to as bottlebrushes that is because of their cylindrical, and brush like flowers look alike a conventional bottle brush [14]. They are generally found in the more moderate regions of Australia, especially along the east beach and typically more moist conditions thus when implanted in gardens succeed on orderly watering. At least several species are dryness-resistant and other are used in decorative landscaping in some places in the world [15].

Growing Bottlebrush plants, get their name from the shape of flowers that blossom at the ends of the shanks, firmness a strong similarity to a bottle brush [16]. The plant grow as bush or small trees that develop in length up to 15 feet. Most bottlebrush diversity blossom over a long summer season in spectrums of red or carmine. It needs a very moderate climate [17]. The stem of plant will expand as 6 to 8 inches in diameter. So if it let to grow, it'll need a large area [18].

#### **Casuarina (*Casuarina equisetifolia*)**

*Casuarina equisetifolia* is a type of many tree species in the family of "Casuarinaceae", local to Australia, southeast Asia, the Indian Subcontinent, and islands of the western Pacific Ocean [19].

This type of trees are evergreen shrubs and trees growing to 35 m tall. The leaves consists of slim, multi-branched green to grey-green limbs bearing climb-leaf in whorls of 5–20. The flowers are created in small catkin-like inflorescences; the flowers are simple. Most types are dioecious, while a few are monoecious. The fruits of these trees are woody, elliptical structure ostensibly look alike a conifer cone made up of many carpels each consisting a single sperm with a small wing. The general name is derived from the Malay word for the cassowary, kasuari, reference to the correspondence between the plant's foliage and the bird's feathers [20]. Casuarina types are a food source of the slug of hepialid butterfly; members of the type Aenetus [21].

#### **Jujube (*Ziziphus Lotus*)**

*Ziziphus lotus* (jujube) is a deciduous bush in the buckthorn family Rhamnaceae, local to the Mediterranean province, inclusive the Sahara in Morocco. It is widely concerning to *Ziziphus jujuba* (jujube) [22].

*Ziziphus lotus* can accomplish a height of 2–5 metres (6.6–16.4 ft), with shiny green leaf which is about 5 cm long. The eaten fruit is a globose with a color of drupe is dark yellow, and 1–1.5 cm diameter [23]

#### **Eucalyptus (*Eucalyptus Globu*)**

*Eucalyptus Globu* is a various type of flowering trees and bushes in the myrtle family, Myrtaceae. Members of the type command the tree plant of Australia. There are many species of eucalyptus and

most are local to Australia; while some of them found in neighboring areas of Indonesia and New Guinea [24].

*Eucalyptus Globu* is one of three comparable type that are commonly reference to as "eucalypts", the others being *Corymbia* and *Angophora*. Many types, although by no means all, are recognized as gum trees that is due to the exude abundant kino from any fracture in the bast(e.g., scribbly gum) [25].

Some types of eucalyptus trees have attracted interest from horticulturists, international evolution researchers, and environmentalists that is because of eligible features such a very important sources of wood because it's fast growing [26].

## **Materials and Methods** [27]

### **Instruments**

- 1- Electronic balance (Model: SARTORIUS BL210S).
- 2- Heater plate (Model: Heidolph)
- 3- Electrical oven (Model: HAMILTON).

### **Method**

- 300 grams of leaves from four different trees species (*Callistemon* , *Casuarina equisetifolia*, *Ziziphus Lotus*, and *Eucalyptus Globu*) were collected (monthly) from the same place, height and age.

- The leaves were collected in a polythene bags and washed with 500ml of distilled water and polythene bags were also washed with 50ml of distilled water to wash out the dust remaining inside the polythene bags .

- Water and dust sample is dried on the heater plate at 150 ° C .

- The sample is placed inside the oven temperature of 105 ° C for three hours.

- The sample was dried in the glass drier for one hour till it completely dried.

- dried dust was weight.

## **Results and Discussion**

The results in (table 1) showed that the highest amount of dust deposited on the leaves of *Casuarina equisetifolia* tree where average weight of dust deposition rate during the study period for every 300 g of leaves was 8.336 g. Then followed by a *Callistemon* tree where average weight of dust deposition rate was 4.635 g.

While the average weight of dust deposition rate of the *Ziziphus Lotus* tree was 2.291 g .

The leaves smallest amount of dust deposited on the leaves of *Eucalyptus* tree which is 1.320g.

The outer shape of the tree and the surface area of the leaves as well as the shape and nature of the plant (morphological characteristics) has an effect on the amount of deposited dust

As shown in the figure 1 that the highest proportion of dust deposited on the all types of trees were in June because of blowing dust storms lasted for several days, While the smallest amount of dust deposited in September because of the stability of the weather and there was no dust storms during that month .

Table (1) Monthly weight of dust deposited on the four types of Trees

weight of dust deposited (grams)													Average weight (grams)
Types of Trees	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
<i>Callistemon</i>	2.315	5.307	2.816	4.428	3.254	24.347	3.197	3.759	1.929	1.528	1.498	1.245	4.635
<i>Casuarina equisetifolia</i>	8.341	10.558	6.094	14.153	5.264	31.879	4.917	3.595	2.419	6.095	4.167	2.547	8.336
<i>Ziziphus Lotus</i>	3.015	3.352	3.517	2.854	1.896	7.983	2.013	1.165	0.899	0.217	0.347	0.227	2.291
<i>Eucalyptus Globu</i>	1.132	0.956	1.987	1.673	0.987	4.924	0.926	0.728	0.632	0.761	0.624	0.513	1.320

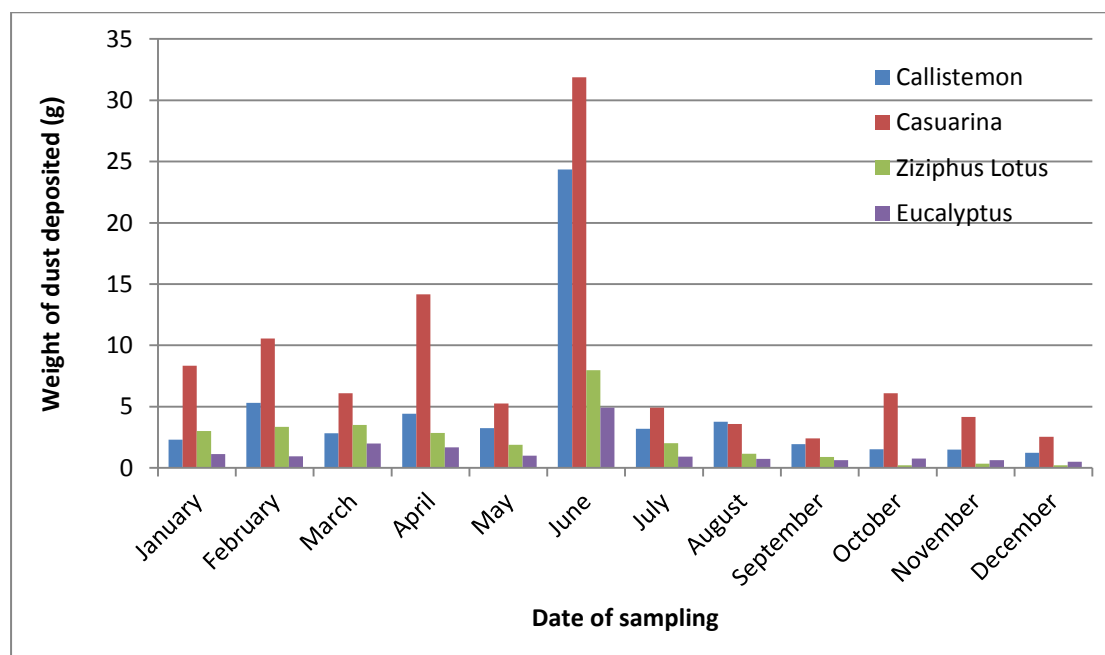


Figure (1) The comparison the weight of dust deposited on the trees during all the months of the year

**Conclusion**

The main conclusion that can be drawn from this study can be summarized as follows:

-In order to mitigate the effect of polluted air by dust and suspended solid four types of trees were selected to compare their ability in dust control and suggest the most suitable plant species for plantation in dusty area, according to the amount of deposition of particulate on the surface of leaves due to the shape of the tree and the nature of the leaves.

-The highest proportion of dust deposited in June because of blowing dust storms lasted for several days, While the smallest amount of dust deposited in September because of the stability of the weather during that month .

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